TexasHomeLearning



Eleventh Grade
Onceavo grado

Summer At-Home Learning
Aprendizaje de verano en casa

Everything you need to provide summer lessons at home.
Todo lo que necesita para ofrecer clases de verano en casa.

The learning plans included in this document are provided as a resource only. This information is intended to assist in the delivery of educational resources in this time of public crisis.

1701 N. Congress Ave, Austin, TX ● (512) 463-9734 ● info@tea.texas.gov

Texas Education Agency

Descripción general de los recursos en español incluidos
Este paquete proporciona a los estudiantes recursos selectos en el idioma español para apoyar el aprendizaje en el hogar en Artes del Lenguaje y lectura en español e inglés. En el bloque de lectura y escritura, se incluyen textos seleccionados de nivel de grado y sus actividades correspondientes, en inglés y español. Las familias y los estudiantes tienen la flexibilidad de elegir si realizar las actividades en español o inglés todos los días. Tenga en cuenta que no podemos proporcionar recursos impresos en español en otras materias en este momento. Las actividades en español de lectura y escritura están incluidas en los horarios diarios y semanales que comienzan en la página **9**.

Los textos de apoyo en español y las actividades correspondientes se pueden encontrar en la sección de Artes del Idioma Español de este paquete en la página **707**.

Notice and Disclaimer: This Texas Home Learning packet is a temporary, contingency tool intended to support Texas students in staying connected to learning during the summer. These are optional resources intended to assist in this time of public health crisis and permission to use included materials is only available for the duration of the Covid19 crisis.

Given the timeline for development, errors are to be expected. If you find an error, please email us at curriculum@tea.texas.gov. Additionally, any references contrary to the Texas Essential Knowledge and Skills (TEKS) or inconsistent with requirements to deliver the TEKS are incidental. The overall purpose and message of instruction must be based on the TEKS, not any other set of standards or viewpoints. Schools retain the responsibility for providing education to their students and consulting with their legal counsel to comply with legal and constitutional requirements and prohibitions.

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Getting Started

Welcome Texas Families!

The Texas Summer At-Home Learning packet provides four weeks of home learning plans and additional lessons for students. This packet has been designed with flexibility and easy family use in mind to keep students connected to meaningful content during the summer. Although lessons, assignments, and scheduling suggestions are provided, students and families, with support from their schools, may complete the lessons in a way that meets the needs of each individual student.

What's included:

- Introductory guidance to get your student set up to learn
- Four weeks of daily lessons organized by subject
- Additional lessons to extend learning beyond four weeks, if desired
- Curriculum materials for each lesson, including books, articles, worksheets, etc.

To get started, review the **Establishing a Schedule for Learning** and **Learning Goals for Students** sections of this packet. Following a planned schedule with learning objectives makes the learning plan easy to follow.

Packet Overview

The four-week Summer At-Home Learning plan is divided by subject area: English, math, science, and social studies. Students can focus on just a few subjects, like English or math, or on all subjects included in the packet. Schools should help students choose which subject areas to focus on and when.

Each subject area includes sequential lessons with five daily lessons per week beginning with Week 1, Day 1 and ending with Week 4, Day 5, plus a set of additional lessons for students to extend learning up to four more weeks.

Lessons provide detailed instructions and reference the page numbers of materials in this packet, including articles, books, worksheets, and other materials needed to complete the lesson.

First Steps

1. To begin, simply choose a subject and use the table of contents to find that section of the packet.
2. Start with Week 1, Day 1, complete the listed activities, and check off each lesson when finished.
3. Make your way through all lessons in the order presented or as instructed by your school.
4. After completing four weeks of lessons in a specific subject area, continue to the Additional Lessons section for more learning.

For more information, visit TexasHomeLearning.org.

Establishing a Schedule for Learning

It is recommended that students establish a consistent learning schedule that can be followed each day of the four-week learning plan. Having a regular structure can help make daily and weekly activities easier to follow and enhance home learning. For example, a student may start each day off eating breakfast and getting some exercise before beginning the first lesson.

Families are balancing at-home learning with many other priorities so their chosen schedule should help increase student learning while also meeting the needs of the family.

In establishing a consistent routine, families should seek help from schools and consider which subject(s) may require more support for the student while balancing home learning with other family priorities.

The following sample schedules are a starting point. Families should adjust the schedule to meet the needs of the student while accounting for their own availability to help facilitate learning, if needed.

Daily Check-Ins

Connect with your student every day at a time that works well for your household. For example, you may want to check in briefly a few times per day or have just one longer check-in in the morning or evening. The goal of this time is for students to recall and reflect on what they learned during the day.

Use check-in time to spark conversation with questions such as:

- Were you able to complete all the assigned activities?
- What did you learn/practice/read today?
- What was easy or challenging for you?
- Do you have questions for your teacher?

Also use this time to communicate with the student's teachers as needed, send them copies or pictures of student work, or share information about the student's learning progress.

Daily Choice Reading

Thirty minutes of daily choice reading is recommended. The student selects a text of any genre or topic (with approval from caregiver). Students can choose a book from home or consider these titles:

- *Emma* by Jane Austen (fiction)
- *Great Expectations* by Charles Dickens (fiction)
- The Importance of Being Ernest by Oscar Wilde (drama)
- *Little Women* by Louisa May Alcott (fiction)
- *Metamorphosis* by Franz Kafka (fiction)
- *Othello* by William Shakespeare (drama)
- *A Raisin in the Sun* by Lorraine Hansberry (drama)

Caregivers are encouraged to talk with students about what they have read:

- Ask your student: What is something new you learned from the book?
- Ask your student to draw something they learned from the book.
- Ask your student to write about the book or respond to a prompt.
- Ask your student to talk about the book with a family member or friend.

Sample Schedules

Subject areas included in this Summer At-Home Learning packet are highlighted in gray.

Sample Schedule 1: Full Day of Learning

This schedule works best when student: needs access to all subjects; works well independently; has help available throughout the day.

Time	Activity
8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	**English**
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	**Math**
11:15-11:30 p.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	**Science**
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	**Social Studies**
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)
3:30 p.m.	Daily Check-In

Note: May use Monday–Friday, Monday–Thursday, or alternating days (Mon/Wed/Fri).

Sample Schedule 2: Morning Learning with Reading and Math Only

This schedule works best when student: needs to prioritize reading and math; has help available in the morning.

Time	Activity
8:30-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	**English**
10:00-10:30 a.m.	Snack and Break
10:30-11:30 a.m.	**Math**
11:30-11:45 a.m.	Daily Check-In
11:45 a.m.	Lunch

Note: May shift to an afternoon schedule. May use each day of the week, part of the week, or alternating days (Mon/Wed/Fri).

Sample Schedule 3: Reading-Only Option

This schedule works best when student: has limited time; has limited help available.

Time	Activity
5:00-6:00 p.m.	**English**
6:00-6:30 p.m.	Choice Reading
6:30 p.m.	Dinner

Note: May schedule time as family schedule allows.

Learning Goals for Students

This Summer At-Home Learning packet provides daily lessons in each of the main academic subjects. While materials are provided for all of these subjects, a student, family, or school may choose to focus on only some of these content areas based on individual academic and scheduling needs.

English

This packet includes grade-appropriate thematically/topically aligned "text sets" with shorter passages of various genres to build students' background and content knowledge. Students should read, annotate, and write about their reading every day. Printable book options are included in this packet to correspond with the reading lesson plans.

Learning Tips:

- Read and annotate the selected text, deciding to read the passages independently or with a family member.
- Discuss what the passages are about.
- Summarize the passages for yourself to check your understanding.
- Identify text evidence to support your answers when responding to both multiple choice questions and writing prompts.

Math

Students will complete activities and practice problems that cover foundational content and skills for whichever math course they are currently taking. **Learning Tip:** Utilize various problem-solving strategies that have worked in the past.

Science

Students will read selected articles, perform simple investigations, and apply their knowledge of science content. **Learning Tip:** Investigations utilize common household items. If exact materials are unavailable, students can replace with similar materials.

Social Studies

Students will read selected articles and apply their knowledge of social studies content and skills. **Learning Tip:** Readings provide information that can be used to support claims and answer questions.

You are now ready to begin your Summer At-Home Learning Packet!

For more information, visit TexasHomeLearning.org,



Summer At-Home Lesson Plans

IMPORTANT NOTE: Many caregivers are balancing home learning with many other priorities, so families should adjust the schedule to meet their individual needs.

Week 1

☐ Day 1

Comedy and Tragedy: "A Description of a City Shower"

- Read and annotate the satirical poem "A Description of a City Shower" (p. 48).
- Answer text-dependent questions 1–5.

☐ Day 2

Comedy and Tragedy: "A Description of a City Shower"

- Reread the satirical poem "A Description of a City Shower" (p. 48).
- Respond in writing to the discussion questions.

☐ Day 3

Comedy and Tragedy: "Roughing It"

- Read and annotate the satire "Roughing It" (p. 53).
- Answer text-dependent questions 1–5.

☐ Day 4

Comedy and Tragedy: "Roughing It"

- Reread "Roughing It" (p. 53).
- Respond in writing to the discussion questions.

☐ Day 5

Comedy and Tragedy: "An Uncomfortable Bed"

- Read "An Uncomfortable Bed" (p. 61).
- Answer text-dependent questions 1–5.
- Select **one** of the discussion questions to respond in writing to.

Week 2

☐ Day 1

Comedy and Tragedy: “On Tragedy”

- Read and annotate “On Tragedy” (p. 67).
- Answer text-dependent questions 1–5.

☐ Day 2

Comedy and Tragedy: “On Tragedy”

- Reread “On Tragedy” (p. 67).
- Respond in writing to the discussion questions.

☐ Day 3

Comedy and Tragedy: “To Be or Not To Be”

- Read and annotate the soliloquy “To Be or Not To Be” from *Hamlet* (p. 72).
- Answer text-dependent questions 1–5.

☐ Day 4

Comedy and Tragedy: “To Be or Not To Be”

- Reread the soliloquy “To Be or Not To Be” from *Hamlet* (p. 72).
- Respond in writing to the discussion questions.

☐ Day 5

Comedy and Tragedy: "President Lincoln’s Second Inaugural Address"

- Read and annotate "President Lincoln’s Second Inaugural Address" (p. 77).
- Answer the text-dependent questions.

Week 3

☐ Day 1

Resisting and Embracing Change: "Opposing Innovation"

- Read and annotate the article "Opposing Innovation" (p. 81).
- Answer text-dependent questions 1–6.
- Select **one** of the discussion questions to respond to in writing.

☐ Day 2

Resisting and Embracing Change: "Millennials Hands-on When Giving to Charity"

- Read and annotate the article "Millennials Hands-on When Giving to Charity" (p. 88).
- Answer text-dependent QUIZ questions.

☐ Day 3

Resisting and Embracing Change: "Where I Lived and What I Lived For"

- Read and annotate the excerpt from *Walden*: "Where I Lived and What I Lived For" (p. 92).
- Answer text-dependent questions 1–7.

☐ Day 4

Resisting and Embracing Change: "Where I Lived and What I Lived For"

- Reread the excerpt from *Walden*: "Where I Lived and What I Lived For" (p. 92).
- Answer text-dependent question 8 and respond in writing to the discussion questions.

☐ Day 5

Resisting and Embracing Change: "Song of Myself"

- Read and annotate the excerpt from the poem "Song of Myself" (p. 100).
- Answer text-dependent questions 1–8.
- Select **one** of the discussion questions to respond to in writing.

Week 4

☐ Day 1

Man VS. Nature: "The Open Boat"

- Read and annotate the short story "The Open Boat" (p. 107).

☐ Day 2

Man VS. Nature: "The Open Boat"

- Reread the short story "The Open Boat" (p. 107).
- Answer the text-dependent questions.
- Select one of the discussion questions to respond to in writing.

☐ Day 3

Man VS. Nature: "The Transformation of Arachne Into a Spider"

- Read and annotate the myth "The Transformation of Arachne Into a Spider" (p. 132).
- Answer text-dependent questions 1–4.

☐ Day 4

Man VS. Nature: "The Transformation of Arachne Into a Spider"

- Reread the myth "The Transformation of Arachne Into a Spider" (p. 132).
- Answer text-dependent questions 5–10.
- Select one of the discussion questions to respond to in writing.

☐ Day 5

Man VS. Nature: "Ozymandias"

- Read and annotate the poem "Ozymandias" (p. 143).
- Answer the text-dependent questions.
- Respond in writing to the discussion questions.

Additional Lessons

☐ Additional Lesson 1

Man vs. Nature: "The Ponds"

- Read and annotate the excerpt from *Walden*: "The Ponds" (p. 147).
- Answer the text-dependent questions.
- Select one of the discussion questions to respond to in writing.

☐ Additional Lesson 2

Man vs. Nature: "To Earn Trust for Autonomous Vehicles, Company Gives Them Virtual Eyes"

- Read and annotate the article "To Earn Trust for Autonomous Vehicles, Company Gives Them Virtual Eyes" (p. 151).
- Answer the text-dependent quiz questions.
- Respond in writing to the following prompt: What is something (an object, item, product) that you know has evolved and been modified over time? Why do you think these changes and modifications were made?

Hombre vs. Naturaleza: "Para ganar confianza humana, una empresa le agrega "ojos virtuales" a vehículos autónomos"

- Leer y anotar el artículo "Para ganar confianza humana, una empresa le agrega "ojos virtuales" a vehículos autónomos" (pág. 713).
- Responda las preguntas del cuestionario dependientes del texto siguiendo del pasaje.
- Responde por escrito al siguiente mensaje: ¿Qué es algo (un objeto, elemento, producto) que sabe que ha evolucionado y se ha modificado con el tiempo? ¿Por qué crees que se hicieron estos cambios y modificaciones?

☐ Additional Lesson 3

Man VS. Nature: *Frankenstein* or *The Modern Prometheus*

- Read and annotate the excerpt from the novel *Frankenstein; or the Modern Prometheus* (p. 155).
- Answer the text-dependent questions.

☐ Additional Lesson 4

Man VS. Nature: *Frankenstein* or *The Modern Prometheus*

- Reread the excerpt from the novel *Frankenstein; or the Modern Prometheus* (p. 155).
- Respond in writing to the discussion questions.

☐ Additional Lesson 5

Man VS. Nature: "We Grow Accustomed to the Dark"

- Read and annotate the poem "We Grow Accustomed to the Dark" (p. 160).
- Answer the text-dependent questions.
- Select one of the discussion questions to respond to in writing.

☐ Additional Lesson 6

Resilience and Success: *Narrative of the Life of Frederick Douglass*

- Read and annotate the excerpt from *Narrative of the Life of Frederick Douglass* (p. 164).
- Answer text-dependent questions 1–3.

☐ Additional Lesson 7

Resilience and Success: *Narrative of the Life of Frederick Douglass*

- Reread the excerpt from Narrative of the Life of Frederick Douglass (p. 164).
- Answer text-dependent questions 4–10.
- Select one of the discussion questions to respond to in writing.

☐ Additional Lesson 8

Resilience and Success: "First Fireside Chat"

- Read and annotate President Roosevelt's "First Fireside Chat" speech (p. 179).
- Answer text-dependent questions 1–4.

☐ Additional Lesson 9

Resilience and Success: "First Fireside Chat"

- Reread President Roosevelt's "First Fireside Chat" speech (p. 179).
- Answer text-dependent questions 5–6.
- Respond in writing to the discussion questions.

☐ Additional Lesson 10

Resilience and Success: "To Build a Fire"

- Read and annotate the short story "To Build a Fire" (p. 186).
- Answer the text-dependent quiz questions.

☐ Additional Lesson 11

Resilience and Success: "2 Degrees, Flies Planes, Author, Works at NASA. His age? 17"

- Read and annotate the article "2 Degrees, Flies Planes, Author, Works at NASA. His age? 17" (p. 198).
- Answer text-dependent quiz questions.

Resiliencia y Éxito: "Tiene dos títulos, pilota aviones, escribe libros y trabaja en la NASA. ¿Edad? 17 años"

- Leer y anotar el artículo "Tiene dos títulos, pilota aviones, escribe libros y trabaja en la NASA. ¿Edad? 17 años" (pág. 718).
- Responda las preguntas del cuestionario dependientes del texto siguiendo del pasaje.

☐ Additional Lesson 12

Resilience and Success: "2 Degrees, Flies Planes, Author, Works at NASA. His age? 17"

- Reread and annotate the article "2 Degrees, Flies Planes, Author, Works at NASA. His age? 17" (p. 198).
- Respond in writing to the following prompt: How are joy, choice, and success related to each other? Support your answer with at least two details from the article.

Resiliencia y Éxito: "Tiene dos títulos, pilota aviones, escribe libros y trabaja en la NASA. ¿Edad? 17 años"

- Releer el artículo "Tiene dos títulos, pilota aviones, escribe libros y trabaja en la NASA. ¿Edad? 17 años" (pág. 718).
- Escribe 12 párrafos explicando el argumento del texto y si está de acuerdo o en desacuerdo con el argumento. Incluye al menos dos detalles para respaldar tu respuesta.

☐ Additional Lesson 13

Resilience and Success: "Japanese-American Leagues Help Girls Get the Jump on Prep Basketball"

- Read and annotate the article "Japanese-American Leagues Help Girls Get the Jump on Prep Basketball" (p. 202).
- Answer the text-dependent quiz questions.

☐ Additional Lesson 14

Resilience and Success: "Japanese-American Leagues Help Girls Get the Jump on Prep Basketball"

- Reread the article "Japanese-American Leagues Help Girls Get the Jump on Prep Basketball" (p. 202).
- Answer the following writing prompt: Write a paragraph that explains the central idea of the article. Use at least two details from the article to support your response.

☐ Additional Lesson 15

Resilience and Success: "Fishing Lures a Hit for Small-town Teen Entrepreneurs"

- Read and annotate the article "Fishing Lures a Hit for Small-town Teen Entrepreneurs" (p. 206).
- Answer the text-dependent quiz questions.
- Discuss the articles you read this week with someone at home—explaining the main idea and key details of your reading, and the shared themes across the texts.

Resiliencia y Éxito: "Señuelos de pesca, negocio exitoso para empresarios adolescents"

- Leer y anotar el artículo "Señuelos de pesca, negocio exitoso para empresarios adolescents" (pág. 723).
- Responda las preguntas del cuestionario dependientes del texto siguiendo del pasaje.
- Discuta los artículos que leyó esta semana con alguien en casa, explicando la idea principal y los detalles clave de las lecturas, y los temas compartidos en los textos.

☐ Additional Lesson 16

Personal Growth: "A Pair of Silk Stockings"

- Read and annotate the short story "A Pair of Silk Stockings" (p. 211).
- Answer the text-dependent quiz questions

☐ Additional Lesson 17

Personal Growth: "A Pair of Silk Stockings"

- Reread the short story "A Pair of Silk Stockings" (p. 211).
- Answer the following writing prompt: What is a theme of this text? Identify a theme and describe how the author develops that theme through the characters, plot, and other aspects of the text.

☐ Additional Lesson 18

Personal Growth: "Can't Keep Your New Year's Resolutions? Try Being Kind to Yourself"

- Read and annotate the article "Can't Keep Your New Year's Resolutions? Try Being Kind to Yourself" (p. 216).
- Answer the text-dependent quiz questions.

☐ Additional Lesson 19

Personal Growth: "Can't Keep Your New Year's Resolutions? Try Being Kind to Yourself"

- Reread the article "Can't Keep Your New Year's Resolutions? Try Being Kind to Yourself" (p. 216).
- Answer the following writing prompt: Make a clear, defensible claim about the topic of the text. Write a paragraph to support your claim with clear reasons and relevant evidence from the text.

☐ Additional Lesson 20

Personal Growth: "Happiness Can Be a Prime Predictor of Whether We'll Find Success in Life"

- Read and annotate the article "Happiness Can Be a Prime Predictor of Whether We'll Find Success in Life" (p. 222).
- Answer the text-dependent quiz questions.

Week 1

☐ Day 1

Up and Down or Down and Up: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 228).
- Complete activity 1.1.

☐ Day 2

Up and Down or Down and Up: Day 2 of 5

- Complete activity 1.2 (p. 233).

☐ Day 3

Up and Down or Down and Up: Day 3 of 5

- Complete activity 1.3 (p. 235).

☐ Day 4

Up and Down or Down and Up: Day 4 of 5

- Complete the activity 1.4 and Talk the Talk (p. 238).

☐ Day 5

Up and Down or Down and Up: Day 5 of 5

- Complete the Assignment section (p. 242).

Week 2

☐ Day 1

Endless Forms Most Beautiful: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 244).
- Complete activity 2.1.

☐ Day 2

Endless Forms Most Beautiful: Day 2 of 5

- Complete activity 2.2 (p. 251).

☐ Day 3

Endless Forms Most Beautiful: Day 3 of 5

- Complete activity 2.3 (p. 253).

☐ Day 4

Endless Forms Most Beautiful: Day 4 of 5

- Complete the activity 2.4 and Talk the Talk (p. 258).

☐ Day 5

Endless Forms Most Beautiful: Day 5 of 5

- Complete the Assignment section (p. 266).

Week 3

☐ Day 1

More Than Meets the Eye: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 268).
- Complete activity 3.1.

☐ Day 2

More Than Meets the Eye: Day 2 of 5

- Complete activity 3.2 (p. 273).

☐ Day 3

More Than Meets the Eye: Day 3 of 5

- Complete activity 3.3 (p. 279).

☐ Day 4

More Than Meets the Eye: Day 4 of 5

- Complete activity 3.4 (p. 283).

☐ Day 5

More Than Meets the Eye: Day 5 of 5

- Complete activity 3.5 and Talk the Talk (p. 287).

Week 4

☐ Day 1

More Than Meets the Eye

- Complete the Assignment section (p. 292).

☐ Day 2

You Lose Some: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 294).
- Complete activity 4.1.

☐ Day 3

You Lose Some: Day 2 of 5

- Complete activity 4.2 (p. 299).

☐ Day 4

You Lose Some: Day 3 of 5

- Complete activity 4.3 (p. 301).

☐ Day 5

You Lose Some: Day 4 of 5

- Complete activity 4.4 and Talk the Talk (p. 302).

Additional Lessons

☐ Additional Lesson 1

You Lose Some: Day 5 of 5

- Complete the Assignment section (p. 308).

☐ Additional Lesson 2

Introduction to Quadratic Functions: Day 1 of 4

- Complete section I (p. 310).

☐ Additional Lesson 3

Introduction to Quadratic Functions: Day 1 of 4

- Complete section II (p. 315).

☐ Additional Lesson 4

Introduction to Quadratic Functions: Day 1 of 4

- Complete section III (p. 319).

☐ Additional Lesson 5

Introduction to Quadratic Functions: Day 1 of 4

- Complete section IV (p. 323).

☐ Additional Lesson 6

This Time, With Polynomials: Day 1 of 7

- Complete the Warmup and Getting Started sections (p. 329).
- Complete activity 1.1.

☐ Additional Lesson 7

This Time, With Polynomials: Day 2 of 7

- Complete activity 1.2 (p. 334).

☐ Additional Lesson 8

This Time, With Polynomials: Day 3 of 7

- Complete activity 1.3 (p. 336).

☐ Additional Lesson 9

This Time, With Polynomials: Day 4 of 7

- Complete activity 1.4 (p. 341).

☐ Additional Lesson 10

This Time, With Polynomials: Day 5 of 7

- Complete activity 1.5 (p. 343).

☐ Additional Lesson 11

This Time, With Polynomials: Day 6 of 7

- Complete activity 1.6 and Talk the Talk (p. 346).

☐ Additional Lesson 12

This Time, With Polynomials: Day 7 of 7

- Complete the Assignment section (p. 351).

☐ Additional Lesson 13

Solutions, More or Less: Day 1 of 3

- Complete the Warmup and Getting Started sections (p. 355).
- Complete activity 2.1.

☐ Additional Lesson 14

Solutions, More or Less: Day 1 of 3

- Complete activity 2.2 (p. 362).

☐ Additional Lesson 15

Solutions, More or Less: Day 1 of 3

- Complete the Assignment section (p. 367).

☐ Additional Lesson 16

Transforming Solutions: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 369).
- Complete activity 3.1.

☐ Additional Lesson 17

Transforming Solutions: Day 2 of 5

- Complete activity 3.2 (p. 373).

☐ Additional Lesson 18

Transforming Solutions: Day 3 of 5

- Complete activity 3.3 and Talk the Talk (p. 375).

☐ Additional Lesson 19

Transforming Solutions: Day 4 of 5

- Complete the Assignment section practice problems (p. 379).

☐ Additional Lesson 20

Transforming Solutions: Day 5 of 5

- Complete the Assignment section review problems (p. 379).

Week 1

☐ Day 1

The Deriving Force: Day 1 of 5

- Complete the warmup and getting started sections (p. 382).
- Complete activity 1.1 (p. 384).

☐ Day 2

The Deriving Force: Day 2 of 5

- Complete activity 1.2 (p. 385).

☐ Day 3

The Deriving Force: Day 3 of 5

- Complete activity 1.3 (p. 388).

☐ Day 4

The Deriving Force: Day 4 of 5

- Complete activity 1.4 and Talk the Talk (p. 390).

☐ Day 5

The Deriving Force: Day 5 of 5

- Complete the assignment section (p. 394).

Week 2

☐ Day 1

A Sense of Déjà Vu: Day 1 of 3

- Complete the activity 2.1 (p. 399)

☐ Day 2

A Sense of Déjà Vu: Day 2 of 3

- Complete activity 2.2 and Talk the Talk (p. 401).

☐ Day 3

A Sense of Déjà Vu: Day 3 of 3

- Complete the Assignment section (p. 408).

☐ Day 4

The Knights of the Round Table: Day 1 of 3

- Complete the Warmup and Getting Started sections (p. 412).
- Complete activity 3.1 (p. 414).

☐ Day 5

The Knights of the Round Table: Day 2 of 3

- Complete activity 3.2 and Talk the Talk (p. 417).

Week 3

☐ Day 1

The Knights of the Round Table: Day 3 of 3

- Complete the Assignment section (p. 422).

☐ Day 2

What Goes Around: Day 1 of 4

- Complete the Warmup and Getting Started section (p. 424).
- Complete activity 4.1 (p. 427).

☐ Day 3

What Goes Around: Day 2 of 4

- Complete activity 4.2 (p. 428).

☐ Day 4

What Goes Around: Day 3 of 4

- Complete activity 4.3 and Talk the Talk (p. 430).

☐ Day 5

What Goes Around: Day 4 of 4

- Complete the Assignment section (p. 438).

Week 4

☐ Day 1

The Sines They Are A-Changin': Day 1 of 4

- Complete the Warmup and Getting Started sections (p. 440).
- Complete activity 5.1 (p. 442).

☐ Day 2

The Sines They Are A-Changin': Day 2 of 4

- Complete activity 5.2 (p. 444).

☐ Day 3

The Sines They Are A-Changin': Day 3 of 4

- Complete activity 5.3 and Talk the Talk (p. 447).

☐ Day 4

The Sines They Are A-Changin': Day 4 of 4

- Complete the Assignment section (p. 452).

☐ Day 5

Farmer's Tan: Day 1 of 4

- Complete the Warmup and Getting Started section (p. 454).
- Complete activity 6.1 (p. 457).

Additional Lessons

☐ Additional Lesson 1

Farmer's Tan: Day 2 of 4

- Complete activity 6.2 (p. 461).

☐ Additional Lesson 2

Farmer's Tan: Day 3 of 4

- Complete activity 6.3 and Talk the Talk (p. 463).

☐ Additional Lesson 3

Farmer's Tan: Day 4 of 4

- Complete the Assignment section (p. 470).

☐ Additional Lesson 4

Trigonometric Relationships: Day 1 of 5

- Complete section I (p. 472).

☐ Additional Lesson 5

Trigonometric Relationships: Day 2 of 5

- Complete section II (p. 476).

☐ Additional Lesson 6

Trigonometric Relationships: Day 3 of 5

- Complete section III (p. 479).

☐ Additional Lesson 7

Trigonometric Relationships: Day 4 of 5

- Complete section IV (p. 483).

☐ Additional Lesson 8

Trigonometric Relationships: Day 5 of 5

- Complete section V (p. 487).

☐ Additional Lesson 9

Chasing Theta: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 492).
- Complete activity 1.1 (p. 494).

☐ Additional Lesson 10

Chasing Theta: Day 2 of 5

- Complete activity 1.2 (p. 497).

☐ Additional Lesson 11

Chasing Theta: Day 3 of 5

- Complete activity 1.3 (p. 499).

☐ Additional Lesson 12

Chasing Theta: Day 4 of 5

- Complete activity 1.4 and Talk the Talk (p. 501).

☐ Additional Lesson 13

Chasing Theta: Day 5 of 5

- Complete the Assignment section (p. 504).

☐ Additional Lesson 14

Wascally Wabbits: Day 1 of 2

- Complete the Warmup and Getting Started sections (p. 506).
- Complete activity 2.1 (p. 508).

☐ Additional Lesson 15

Wascally Wabbits: Day 2 of 2

- Complete activity 2.2 and Talk the Talk (p. 511).

☐ Additional Lesson 16

The Wheel Deal: Day 1 of 2

- Complete the Warmup and Getting Started sections (p. 518).
- Complete activity 3.1 and Talk the Talk (p. 520).

☐ Additional Lesson 17

The Wheel Deal: Day 2 of 2

- Complete the Assignment section (p. 526).

☐ Additional Lesson 18

Spring Eternal: Day 1 of 3

- Complete the Warmup and Getting Started sections (p. 528).
- Complete activity 4.1 (p. 530).

☐ Additional Lesson 19

Spring Eternal: Day 2 of 3

- Complete activity 4.2 and Talk the Talk (p. 532).

☐ Additional Lesson 20

Spring Eternal: Day 3 of 3

- Complete the Assignment section (p. 538).

Week 1

☐ Day 1

Wave Behavior and Sound: "Experiment: What do you hear underwater?"

- Perform the experiment and recording finding for "Experiment: What do you hear underwater?" (p. 542)

☐ Day 2

Wave Behavior and Sound: Experiment

- Based on your findings in the experiment yesterday, answer the questions: Do patterns appear? What can you conclude about how humans perceive sound?
- Try variations on the experiment to see if the sound seems different when you close your eyes or cover your ear. Record your findings.

☐ Day 3

Wave Behavior and Sound: "What do you hear underwater?"

- Read "What do you hear underwater?" (p. 546)
- Relate your findings in the experiment with what your read.
- Answer the question: Why does sound seem different underwater as compared to in air?

☐ Day 4

Wave Behavior and Sound: "How dolphins communicate with whistles and clicks"

- Read "How dolphins communicate with whistles and clicks" (p. 551).
- Consider how dolphins use sound waves to communicate and travel.
- Summarize your understanding of sound and waves based on your readings.

☐ Day 5

Wave Behavior and Sound: Response

- Consider different ways that sound and other types of waves are used every day. Make a list of how you use sound and wave behaviors daily.

Week 2

☐ Day 1

Static Electricity: "Everyday Mysteries: What is static electricity?"

- Read "Everyday Mysteries: What is static electricity?" (p. 555).
- Try to generate electricity around your home. Try to shock someone by generating electricity.

☐ Day 2

Static Electricity: Response

- Consider when the generation of static electricity can be dangerous. List some examples of when people would need to be cautious of this phenomenon.
- Create a public service announcement to share the dangers of static electricity.

☐ Day 3

Static Electricity: "What causes lightning and thunder?"

- Read "What causes lightning and thunder?" (p. 557).
- Answer the questions: What causes lightning and thunder? Why is there a delay between lightning and thunder?

☐ Day 4

Static Electricity: "Thunderstorms and homemade lightning"

- Perform the experiment and record your findings using "Thunderstorms and homemade lightning" (p. 562).

☐ Day 5

Static Electricity: Summary

- Complete the summary of results from the experiment yesterday. Share your findings with someone else.

Week 3

☐ Day 1

Magnetism: "Sea turtles are natural ocean navigators"

- Read "Sea turtles are natural ocean navigators" (p. 566).
- Write a summary of how sea turtles use magnetic fields to navigate.

☐ Day 2

Magnetism: "Magnets and Magnetism"

- Read "Magnets and Magnetism" (p. 570).
- Answer the questions: What causes magnetism? Are all metals magnetic? What are some uses of magnets?

☐ Day 3

Magnetism: Response

- Based on the readings you have done, explain how the Earth can contain magnetic particles and how animals (including people) can use this property in navigation systems.

☐ Day 4

Magnetism: "What is a compass?"

- Read "What is a compass?" (p. 573).
- Based on your reading, explain how compasses work and are used in navigation.

☐ Day 5

Magnetism: Experiment

- If you have a device with a compass or can get a compass app, take a walk and track your location using the compass. Share your location based on the compass reading.

Week 4

☐ Day 1

Force, Motion, and Energy: "How roller coasters work"

- Read "How roller coasters work" (p. 579).
- List the properties of motion, force, and energy discussed in the article. Write a brief description of each listed property.

☐ Day 2

Force, Motion, and Energy: Response

- Consider other amusement park rides or water slides.
- Pick one to describe and identify the specific properties of force, motion, and energy.

☐ Day 3

Force, Motion, and Energy: "An explanation of two types of energy: potential and kinetic"

- Read "An explanation of two types of energy: potential and kinetic" (p. 583).
- Think of something your used or did today that involved potential and kinetic energy. Explain how you used the form of energy.

☐ Day 4

Force, Motion, and Energy: "Experiment: Swinging with a pendulum"

- Perform the experiment and record findings using "Experiment: Swinging with a pendulum" (p. 587).

☐ Day 5

Force, Motion, and Energy: Experiment

- Perform the experiment you did yesterday again, but this time change a different variable such as mass or initial angle.
- Explain the impact the variable had on the pendulum's period or total time.

Additional Lessons

☐ Additional Lesson 1

Newton's Laws: "A history of rockets"

- Read "A history of rockets" (p. 591).
- Explain the physics concepts discussed in the article.

☐ Additional Lesson 2

Newton's Laws: "How does gravity pull things down to Earth?"

- Read "How does gravity pull things down to Earth?" (p. 597).
- List Newton's three laws of motion and write a short description of each.
- Identify the relationship between the laws and the examples provided in the readings.

☐ Additional Lesson 3

Newton's Laws: Response

- Consider Newton's laws in your everyday life. Identify examples of all three that you experienced today.

☐ Additional Lesson 4

Newton's Laws: Response

- Create a design to power a toy car by balloon. Draw your design.

☐ Additional Lesson 5

Newton's Laws: Experiment

- Consider factors that could influence a balloon-powered car.
- Write an experiment someone else could perform to test the impact of adjusting a particular variable on the balloon-powered car.

☐ Additional Lesson 6

Quantum Physics: "Time travel may be possible for certain tiny particles, but probably not"

- Read "Time travel may be possible for certain tiny particles, but probably not" (p. 599).
- Take a position on whether or not you believe time travel is possible and use evidence from the article to support your claim.

☐ Additional Lesson 7

Quantum Physics: "The Sun, an engine of nuclear energy"

- Read "The Sun, an engine of nuclear energy" (p. 604).
- Answer the questions: What is nuclear fusion? What are two key parts that make up nuclear fusion?

☐ Additional Lesson 8

Quantum Physics: "The Sun, an engine of nuclear energy"

- Reread "The Sun, an engine of nuclear energy" (p. 604).
- Write a short summary about the cycle of a star as related to nuclear fusion.

☐ Additional Lesson 9

Quantum Physics: "Explainer: the difference between radiation and radioactivity"

- Read "Explainer: the difference between radiation and radioactivity" (p. 609).
- Explain the difference between radiation and radioactivity and give examples of each.

☐ Additional Lesson 10

Quantum Physics: Response

- Consider uses of radioactivity and radiation to help people. List and describe some examples.

☐ Additional Lesson 11

Space Physics: "The nature of dark matter"

- Read "The nature of dark matter" (p. 614).
- Write a short summary to help explain to someone else about dark matter.

☐ Additional Lesson 12

Space Physics: "What is a black hole?"

- Read "What is a black hole?" (p. 618).
- Answer the questions: What is a black hole? How can scientists detect black holes?

☐ Additional Lesson 13

Space Physics: Quiz

- Reread the previous two articles and then consider the impact black holes and dark matter have on life.
- Take the quizzes.

☐ Additional Lesson 14

Space Physics: "Wanted: An orbiting garbage collector to clean"

- Read "Wanted: An orbiting garbage collector to clean" (p. 622).
- What are your thoughts about how space garbage can be collected and/or disposed? Write a short summary of your thoughts and how principles of physics can be leveraged.

☐ Additional Lesson 15

Space Physics: Response

- Propose a solution to the space garbage problem based on what you have learned and your understanding of physics.

☐ Additional Lesson 16

Science Professions: "Dream Jobs: Food Chemist"

- Read "Dream Jobs: Food Chemist" (p. 625).
- Answer the questions: What did you find interesting about the job? What did you learn about food chemistry?

☐ Additional Lesson 17

Science Professions: "Dream Jobs: Particle physicist"

- Read "Dream Jobs: Particle physicist" (p. 628).
- Answer the questions: What did you find interesting about the job? What did you learn about particle physics?

☐ Additional Lesson 18

Science Professions: "Dream Jobs: Doctor and researcher"

- Read "Dream Jobs: Doctor and researcher" (p. 632).
- Answer the questions: What did you finding interesting about the job? What did you learn and medical research?

☐ Additional Lesson 19

Science Professions: Response

- Consider careers you are potentially interested in for the future.
- Answer the question: Is there a connection to science?
- Make a list of careers you might like to explore or learn more about.

☐ Additional Lesson 20

Science Professions: Response and Discussion

- Draft a plan for yourself to explore new careers that you might be interested in learning more about. Reach out to your teacher or a family member to help you explore career options.

Week 1

☐ Day 1

World War I: "World War I was World's First "Total War""

- Read and annotate "World War I was World's First "Total War"" (p. 638).
- Write a one paragraph summary of the passage.
- Answer the text-dependent quiz questions.

☐ Day 2

World War I: "World War I was World's First "Total War""

- Reread "World War I was World's First "Total War"" (p. 638).
- Respond to the following prompt in 2–3 paragraphs: What role did the United States play in World War I? What were the reasons for being involved?

☐ Day 3

Stock Market Crash of 1929s: "The stock market crash in 1929: Warning signs went unheeded"

- Read and annotate "The stock market crash in 1929: Warning signs went unheeded" (p. 642).
- Answer the text-dependent quiz questions.

☐ Day 4

Stock Market Crash of 1929: "The stock market crash in 1929: Warning signs went unheeded"

- Reread "The stock market crash in 1929: Warning signs went unheeded" (p. 642).
- Write a summary explaining why the stock market crashed and the impact it had.

☐ Day 5

World War I: Response

- Consider the readings from this week.
- Respond to the following prompt in 2–3 paragraphs: What impact did these major events have on modern life?

Week 2

☐ Day 1

Great Depression: "Great Depression: The New Deal"

- Read and annotate "Great Depression: The New Deal" (p. 647).
- Write a one paragraph summary of the passage.
- Answer the text-dependent quiz questions.

☐ Day 2

Great Depression: "Great Depression: The New Deal"

- Reread "Great Depression: The New Deal" (p. 647).
- Respond to the following prompt in 2–3 paragraphs: What was the New Deal and what did it do for the Great Depression?

☐ Day 3

Great Depression: "Farming and the Dust Bowl During the Great Depression"

- Read and annotate "Farming and the Dust Bowl During the Great Depression" (p. 651).
- Write a short summary of the passage.
- Answer the text-dependent quiz questions.

☐ Day 4

Great Depression: "Farming and the Dust Bowl During the Great Depression"

- Reread "Farming and the Dust Bowl During the Great Depression" (p. 651).
- Answer the questions: Why did the Dust Bowl occur? What were some ofthe acts passed as a result of the Dust Bowl?

☐ Day 5

Great Depression: Response and Discussion

- Consider the readings from this week.
- Respond to following prompt in the 2–3 paragraphs: What did you learn regarding World War II this week that you did not know before? What would you like to learn more about?
- Discuss your response with a friend of someone in your household.

Week 3

☐ Day 1

World War II: "The Holocaust, Part One: The Rise of Adolf Hitler and World War II"

- Read and annotate "The Holocaust, Part One: The Rise of Adolf Hitler and World War II" (p. 656).
- Write a one paragraph summary of the passage.
- Answer the text-dependent quiz questions.

☐ Day 2

World War II: "The Holocaust, Part One: The Rise of Adolf Hitler and World War II"

- Reread "The Holocaust, Part One: The Rise of Adolf Hitler and World War II" (p. 656).
- Respond to the following prompt in 2–3 paragraphs: Explain how the Holocaust happened and who it affected.

☐ Day 3

World War II: "The Road to Pearl Harbor"

- Read and annotate "The Road to Pearl Harbor" (p. 660).
- Write a short summary of the passage.
- Answer the text-dependent quiz questions.

☐ Day 4

World War II: "The Road to Pearl Harbor"

- Reread "The Road to Pearl Harbor" (p. 660).
- Answer the questions: What was the Lend-Lease Act? What resulted from this act passed by Congress?

☐ Day 5

World War II: Response and Discussion

- Consider the readings from this week.
- Respond to following prompt in the 2–3 paragraphs: What did you learn regarding World War II this week that you did not know before? What would you like to learn more about?
- Discuss your response with a friend of someone in your household.

Week 4

☐ Day 1

World War II: "The Holocaust, Part Two: The "Final Solution"

- Read and annotate "The Holocaust, Part Two: The "Final Solution" (p. 665).
- Write a summary of the reading.
- Answer the text-dependent quiz questions.

☐ Day 2

World War II: "The Holocaust, Part Two: The "Final Solution"

- Read and annotate "The Holocaust, Part Two: The "Final Solution" (p. 665).
- Respond to the following: What impact did the Holocaust have on the world?

☐ Day 3

World War II: "A photographer's photos show WWII life of Japanese in America"

- Read and annotate "A photographer's photos show WWII life of Japanese in America" (p. 669).
- Answer the questions: What did the photos show about life in America for Japanese American people following the attack on Pearl Harbor? Why did this happen?

☐ Day 4

World War II: Response

- Respond to the following in 2–3 paragraphs: Describe the reasons for impact and constitutional issues of the internment of Japanese American in the United States during World War II.

☐ Day 5

World War II: Response

- Consider the readings from this week and last.
- Write a response to the following: What impact did the events of World War II have on current times?

Additional Lessons

☐ Additional Lesson 1

Cold War: "The Cold War: An age of two global economies"

- Read and annotate "The Cold War: An age of two global economies" (p. 673)
- Write a summary of the passage.
- Answer the text-dependent quiz questions.

☐ Additional Lesson 2

Cold War: "The Cold War: An age of two global economies"

- Reread "The Cold War: An age of two global economies" (p. 673).
- Explain communism and capitalism using evidence from the text.

☐ Additional Lesson 3

Cold War: "Cold War, warm hearth"

- Read and annotate "Cold War, warm hearth" (p. 677).
- Answer the text-dependent quiz questions.

☐ Additional Lesson 4

Cold War: Response

- Respond to the following in 2–3 paragraphs: Explain the domestic effect of the Cold War.

☐ Additional Lesson 5

Cold War: Response

- Imagine you were the president of the United States during the Cold War. Prepare a speech to be delivered to the nation that highlights the issues of the Cold War but also calms the fears of the people. Consider recording your speech and sharing it with others.

☐ Additional Lesson 6

Korean War: "The Korean War and why there are two Koreas"

- Read and annotate "The Korean War and why there are two Koreas" (p. 682).
- Summarize the passage.
- Answer the text-dependent quiz questions.

☐ Additional Lesson 7

Korean War: "The Korean War and why there are two Koreas"

- Reread "The Korean War and why there are two Koreas" (p. 682).
- Explain why the Korean War reached a stalemate.

☐ Additional Lesson 8

Vietnam War: "Causes of the Vietnam War, 1945–1954"

- Read and annotate "Causes of the Vietnam War, 1945–1954" (p.687).
- Explain the politics of the United States involvement.

☐ Additional Lesson 9

Vietnam War: Response

- Explain why there are two Koreas and why this remains true today.

☐ Additional Lesson 10

Cold War Era: Response

- Respond to the following in 2–3 paragraphs: How have changes of developments during the Cold War shaped American society today?

☐ Additional Lesson 11

Civil Rights: "Birth of the Civil Rights Movement, 1941–1954"

- Read and annotate "Birth of the Civil Rights Movement, 1941–1954" (p. 691).
- Summarize the passage.
- Answer the text-dependent quiz questions.

☐ Additional Lesson 12

Civil Rights: "Birth of the Civil Rights Movement, 1941–1954"

- Reread "Birth of the Civil Rights Movement, 1941–1954" (p. 691).
- Answer the question: How did the end of World War II contribute to the Civil Rights movement?

☐ Additional Lesson 13

Civil Rights: "Organizations of the civil rights movement"

- Read and annotate "Organizations of the civil rights movement" (p. 695).
- Create a table to organize and record information about the different organizations identified in the passage.

☐ Additional Lesson 14

Civil Rights: "Organizations of the civil rights movement"

- Reread "Organizations of the civil rights movement" (p. 695).
- Answer the text-dependent quiz questions.

☐ Additional Lesson 15

Civil Rights: Response

- Respond to the following in 2–3 paragraphs: Describe the movements or actions that helped in the fight for equality in the United States.

☐ Additional Lesson 16

Civil Rights: "Heroes of the civil rights movement were not all men"

- Read and annotate "Heroes of the civil rights movement were not all men" (p. 698).
- Summarize the passage.
- Answer the text-dependent questions.

☐ Additional Lesson 17

Civil Rights: "Heroes of the civil rights movement were not all men"

- Reread "Heroes of the civil rights movement were not all men" (p. 698).
- Consider the women highlighted in the article.
- Answer the questions: Who do you find most inspiring? Why?

☐ Additional Lesson 18

Civil Rights: "Legislative and Judicial Results of the Civil Rights Movement"

- Read and annotate "Legislative and Judicial Results of the Civil Rights Movement" (p. 703).
- Answer the text-dependent quiz questions.

Additional Lesson 19

Civil Rights: "Legislative and Judicial Results of the Civil Rights Movement"

- Reread "Legislative and Judicial Results of the Civil Rights Movement" (p. 703).
- Summarize the legislative and judicial results of the Civil Rights Movement.

Additional Lesson 20

Civil Rights: Response

- Consider the readings from this week and last as well as your knowledge of U.S. History.
- Create a timeline depicting 7–10 events of the Civil Rights Movement. The timeline should include key facts about the event as well as assess the significance of the event.



English III
Inglés III

Name: _____ Class: _____

A Description of A City Shower

By Jonathan Swift
1710

Jonathan Swift (1667-1745) was an Irish satirist, essayist, and poet. As a satirist, Swift pointed out the flaws in people and societies through humor. As you read, take notes on how Swift uses satire throughout the poem.



"Untitled" by MichaelGaida is licensed under CC0.

Careful observers may foretell the hour
(By sure prognostics)[1] when to dread a shower:
While rain depends, the pensive cat gives o'er
Her frolics, and pursues her tail no more.
Returning home at night, you'll find the sink
Strike your offended sense with double stink.
If you be wise, then go not far to dine;
You'll spend in coach hire[2] more than save in wine.
A coming shower your shooting corns presage,[3]
Old achès throb, your hollow tooth will rage.
Sauntering in coffeehouse is Dulman[4] seen;
He damns the climate and complains of spleen.
Meanwhile the South, rising with dabbled wings,
A sable cloud athwart[5] the welkin[6] flings,
That swilled more liquor than it could contain,
And, like a drunkard, gives it up again.
Brisk Susan whips her linen from the rope,
While the first drizzling shower is born aslope:
Such is that sprinkling which some careless quean[7]
Flirts on you from her mop, but not so clean:
You fly, invoke the gods; then turning, stop
To rail; she singing, still whirls on her mop.
Not yet the dust had shunned the unequal strife,
But, aided by the wind, fought still for life,
And wafted with its foe by violent gust,
'Twas doubtful which was rain and which was dust.
Ah! where must needy poet seek for aid,
When dust and rain at once his coat invade?
Sole coat, where dust cemented by the rain
Erects the nap, and leaves a mingled stain.

1. predictions
2. paying to ride in a horse-drawn carriage
3. to signal or warn
4. a type of urban Englishman
5. across
6. sky
7. an ill-behaved girl or woman

Now in contiguous[8] drops the flood comes down,
Threatening with deluge[9] this devoted town.
To shops in crowds the daggled females fly,
Pretend to cheapen goods, but nothing buy.
The Templar spruce, while every spout's abroach,
Stays till 'tis fair, yet seems to call a coach.
The tucked-up sempstress walks with hasty strides,
While seams run down her oiled umbrella's sides.
Here various kinds, by various fortunes led,
Commence acquaintance underneath a shed.
Triumphant Tories and desponding Whigs[10]
Forget their feuds, and join to save their wigs.
Boxed in a chair the beau impatient sits,
While spouts run clattering o'er the roof by fits,
And ever and anon with frightful din
The leather sounds; he trembles from within.
So when Troy chairmen bore the wooden steed,
Pregnant with Greeks impatient to be freed[11]
(Those bully Greeks, who, as the moderns do,
Instead of paying chairmen, run them through),
Laocoön[12] struck the outside with his spear,
And each imprisoned hero quaked for fear.
Now from all parts the swelling kennels flow,
And bear their trophies with them as they go:
Filth of all hues and odors seem to tell
What street they sailed from, by their sight and smell.
They, as each torrent[13] drives with rapid force,
From Smithfield or St. Pulchre's shape their course,
And in huge confluence[14] joined at Snow Hill ridge,
Fall from the conduit prone to Holborn Bridge.
Sweepings from butchers' stalls, dung, guts, and blood,
Drowned puppies, stinking sprats, all drenched in mud,
Dead cats, and turnip tops, come tumbling down the flood.

"A Description of A City Shower" by Jonathan Swift (1710) is in the public domain.

8. **Contiguous** ***(adjective):*** continuous
9. **Deluge** ***(noun):*** a heavy downpour
10. Tories and Whigs were two political parties in England
11. a reference to the Trojan Horse, which was a wooden structure used to trick the people of Troy into unwittingly smuggling in their enemies, the Greeks
12. Laocoön was a Trojan priest who struck the Trojan Horse with a spear in an attempt to expose the Greeks hidden inside of it. He was unsuccessful in this attempt and was eventually killed by the goddess Athena for this.
13. a strong and fast-moving stream of water
14. a meeting of streams

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following statements best identifies a theme of the poem?
    A. When exposed, life in the city is actually quite dirty and miserable.
    B. Human civilization is no match for the sheer strength of nature.
    C. Serious problems like poverty plague cities and cannot be washed away easily.
    D. Civilizations experience a kind of rebirth and renewal whenever it rains.

2. PART B: Which of the following quotes best supports the answer to Part A?
    A. "A coming shower your shooting corns presage, / Old achès throb, your hollow tooth will rage. / Sauntering in coffeehouse is Dulman seen; / He damns the climate and complains of spleen." (Lines 9-12)
    B. "Now in contiguous drops the flood comes down, / Threatening with deluge this devoted town. / To shops in crowds the daggled females fly, / Pretend to cheapen goods, but nothing buy." (Lines 31-34)
    C. "Boxed in a chair the beau impatient sits, / While spouts run clattering o'er the roof by fits, / And ever and anon with frightful din / The leather sounds; he trembles from within." (Lines 43-46)
    D. "Sweepings from butchers' stalls, dung, guts, and blood, / Drowned puppies, stinking sprats, all drenched in mud, / Dead cats, and turnip tops, come tumbling down the flood." (Lines 61-63)

3. What effect did the author most likely intend with the comparison drawn in lines 43-52 between the beau and the Greeks?
    A. The author mocks the Greeks by comparing them to a man sitting in his carriage, implying that the warriors' trick with the wooden horse was cowardly.
    B. The author seems to suggest that the rain is just as fearful as when one's enemies stabbing a spear into one's hideout.
    C. The author mocks the beau sitting in his carriage trembling because of the rain by comparing him to the Greeks fearfully waiting to attack their enemies.
    D. The author seems to suggest that the beau is clever for sitting in his carriage because, like the Greeks, it allows him to proceed through the city without trouble.

4. What impact does the author's choice of resolution have on the overall meaning of the text?
    A. The conclusion of the poem describes the filth of the city being washed away, a shocking ending that nevertheless implies that only a little hard work is needed to improve the city.
    B. The conclusion of the poem focuses on the great force of the flood and therefore suggests that nature will soon destroy all that humans have created.
    C. The conclusion of the poem describes dead animals being washed away, meant to shock and sadden the reader, thereby emphasizing the need for compassion in the city.
    D. The conclusion of the poem focuses on the sheer filth found in the city, meant to shock and disgust the reader, thereby emphasizing the poem's criticism of city life.

5. How does the figurative language used in lines 13-16 develop the poem's use of satire?

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Do you think the author's description of city life is at all accurate? Why or why not?

2. Why might a person want to live in a city? Why might a person not want to live in a city? Explain your answer.

3. After reading "A Description of a City Shower," and thinking about city life in Swift's time, how can technological advancements improve city life? Are there drawbacks to technology? Explain your answer.

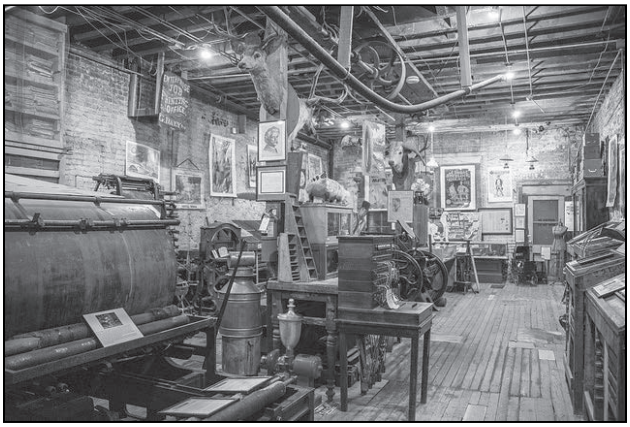
Name: _____ Class: _____

Excerpts from Roughing It

By Mark Twain
1872

Samuel Clemens (1835-1910), recognized by his pen name Mark Twain, was an American author and humorist. Roughing It*, his second published book, is a semi-autobiographical, humorous collection of stories loosely based on Twain's actual travels through the "Wild West" from 1861-1866. Twain had traveled west to find work and escape fighting during the Civil War. The protagonist, presented as a young Twain, recounts his adventures as a naïve and inexperienced easterner, during the beginning of his time out West. As you read, take notes on how Twain narrates his own experiences to create a comic effect.*

Prefatory



"Mark Twain worked here as a reporter in 1863: Territorial Enterprise Office, Virginia City, Nevada." by Kent Kanouse is licensed under CC BY-NC 2.0.

[1] This book is merely a personal narrative, and not a pretentious history or a philosophical dissertation.[1] It is a record of several years of variegated vagabondizing,[2] and its object is rather to help the resting reader while away an idle hour than afflict him with metaphysics, or goad him with science. Still, there is information in the volume; information concerning an interesting episode in the history of the Far West[3], about which no books have been written by persons who were on the ground in person, and saw the happenings of the time with their own eyes. I allude[4] to the rise, growth and culmination of the silver-mining fever in Nevada — a curious episode, in some respects; the only one, of its peculiar kind, that has occurred in the land; and the only one, indeed, that is likely to occur in it.

Yes, take it all around, there is quite a good deal of information in the book. I regret this very much; but really it could not be helped: information appears to stew out of me naturally, like the precious ottar of roses out of the otter. Sometimes it has seemed to me that I would give worlds if I could retain my facts; but it cannot be. The more I calk[5] up the sources, and the tighter I get, the more I leak wisdom. Therefore, I can only claim indulgence at the hands of the reader, not justification.

THE AUTHOR.

[...]

1. **Dissertation** ***(noun):*** a long piece of writing about a particular subject
2. Twain invents this word from the root "vagabond" in order to describe the act of traveling from place to place without a home or job.
3. The "Far West" refers to the "Wild West," a large area of the growing United States in the 1800s west of the Mississippi River and stretching towards the Pacific Coast. Many people traveled west throughout the 1800s looking for adventure, opportunity, or a new life.
4. **Allude** ***(verb):*** subtly reference
5. An alternative spelling of caulk, which means to seal so that something is waterproof.

Chapter 42

What to do next?

It was a momentous question. I had gone out into the world to shift[6] for myself, at the age of thirteen (for my father had endorsed for friends; and although he left us a sumptuous legacy of pride in his fine Virginian stock and its national distinction, I presently found that I could not live on that alone without occasional bread to wash it down with). I had gained a livelihood in various vocations,[7] but had not dazzled anybody with my successes; still the list was before me, and the amplest liberty in the matter of choosing, provided I wanted to work — which I did not, after being so wealthy. I had once been a grocery clerk, for one day, but had consumed so much sugar in that time that I was relieved from further duty by the proprietor;[8] said he wanted me outside, so that he could have my custom. I had studied law an entire week, and then given it up because it was so prosy and tiresome. I had engaged briefly in the study of blacksmithing, but wasted so much time trying to fix the bellows[9] so that it would blow itself, that the master turned me adrift in disgrace, and told me I would come to no good. I had been a bookseller's clerk for awhile, but the customers bothered me so much I could not read with any comfort, and so the proprietor gave me a furlough[10] and forgot to put a limit to it. I had clerked in a drug store part of a summer, but my prescriptions were unlucky, and we appeared to sell more stomach pumps than soda water. So I had to go.

[5] I had made of myself a tolerable printer, under the impression that I would be another Franklin some day, but somehow had missed the connection thus far. There was no berth[11] open in the Esmeralda Union, and besides I had always been such a slow compositor[12] that I looked with envy upon the achievements of apprentices of two years' standing; and when I took a "take," foremen[13] were in the habit of suggesting that it would be wanted "some time during the year."

I was a good average St. Louis and New Orleans pilot[14] and by no means ashamed of my abilities in that line; wages were two hundred and fifty dollars a month and no board to pay, and I did long to stand behind a wheel again and never roam any more — but I had been making such an ass of myself lately in grandiloquent[15] letters home about my blind lead and my European excursion that I did what many and many a poor disappointed miner had done before; said "It is all over with me now, and I will never go back home to be pitied — and snubbed." I had been a private secretary, a silver miner and a silver mill operative, and amounted to less than nothing in each, and now —

What to do next?

6. When prospecting, or looking for valuable minerals, one often shifts sandy, rocky sediment through a screened pan to look for small flecks of minerals.
7. **Vocation** ***(noun}):*** a job
8. **Proprietor** ***(noun):*** a person who owns a business or property
9. **Bellows** ***(noun):*** a device with an air bag that blows out a stream of air when two handles are squeezed together, often used for blowing air into a fire
10. **Furlough** ***(noun):*** official permission to leave one's work for a certain amount of time because there is not enough work to do
11. **Berth** ***(noun):*** an appointment or employment
12. **Compositor** ***(noun):*** one who arranges the text and pictures of a book, magazine, or newspaper before it is printed
13. **Foremen** ***(noun):*** people who are in charge of groups of workers
14. A pilot is a mariner who can navigate ships through dangerous or busy waterways, often rivers. Twain was a river-boat pilot on the Mississippi River for two years before journeying out west.
15. **Grandiloquent** ***(adjective):*** formal and exaggerated, often describing language

I yielded to Higbie's[16] appeals and consented to try the mining once more. We climbed far up on the mountain side and went to work on a little rubbishy claim of ours that had a shaft on it eight feet deep. Higbie descended into it and worked bravely with his pick till he had loosened up a deal of rock and dirt and then I went down with a long-handled shovel (the most awkward invention yet contrived by man) to throw it out. You must brace the shovel forward with the side of your knee till it is full, and then, with a skilful toss, throw it backward over your left shoulder. I made the toss, and landed the mess just on the edge of the shaft and it all came back on my head and down the back of my neck. I never said a word, but climbed out and walked home. I inwardly resolved that I would starve before I would make a target of myself and shoot rubbish at it with a long-handled shovel.

I sat down, in the cabin, and gave myself up to solid misery — so to speak. Now in pleasanter days I had amused myself with writing letters to the chief paper of the Territory, the *Virginia Daily Territorial Enterprise*, and had always been surprised when they appeared in print. My good opinion of the editors had steadily declined; for it seemed to me that they might have found something better to fill up with than my literature. I had found a letter in the post office as I came home from the hill side, and finally I opened it. Eureka! [I never did know what Eureka meant, but it seems to be as proper a word to heave in as any when no other that sounds pretty offers.] It was a deliberate offer to me of Twenty-Five Dollars a week to come up to Virginia[17] and be city editor of the *Enterprise*.

[10] I would have challenged the publisher in the "blind lead" days[18] — I wanted to fall down and worship him, now. Twenty-Five Dollars a week — it looked like bloated luxury — a fortune a sinful and lavish waste of money. But my transports cooled when I thought of my inexperience and consequent unfitness for the position — and straightway, on top of this, my long array of failures rose up before me. Yet if I refused this place I must presently become dependent upon somebody for my bread, a thing necessarily distasteful to a man who had never experienced such a humiliation since he was thirteen years old. Not much to be proud of, since it is so common — but then it was all I had to be proud of. So I was scared into being a city editor. I would have declined, otherwise. Necessity is the mother of "taking chances." I do not doubt that if, at that time, I had been offered a salary to translate the Talmud[19] from the original Hebrew, I would have accepted — albeit with diffidence and some misgivings[20] — and thrown as much variety into it as I could for the money.

I went up to Virginia and entered upon my new vocation. I was a rusty looking city editor, I am free to confess — coatless, slouch hat, blue woolen shirt, pantaloons stuffed into boot-tops, whiskered half down to the waist, and the universal navy revolver slung to my belt. But I secured a more Christian costume and discarded the revolver.

I had never had occasion to kill anybody, nor ever felt a desire to do so, but had worn the thing in deference[21] to popular sentiment, and in order that I might not, by its absence, be offensively conspicuous,[22] and a subject of remark. But the other editors, and all the printers, carried revolvers. I asked the chief editor and proprietor (Mr. Goodman, I will call him, since it describes him as well as any name could do) for some instructions with regard to my duties, and he told me to go all over town and ask all sorts of people all sorts of questions, make notes of the information gained, and write them out for publication. And he added:

16. Mr. Higbie is a character who appears earlier in Roughing It and who prospects for silver with Twain.
17. Virginia City, Nevada
18. A "blind lead" is a style of writing in newspapers in which writers hurry into a story without including too many facts in the lead, or first paragraph, of the story. This strategy aims to keep readers from being overwhelmed so that they will continue reading.
19. The Talmud is a Jewish religious text central to Rabbinic teachings and written originally in Hebrew.
20. **Misgiving** ***(noun):*** a feeling of doubt about something

"Never say 'We learn' so-and-so, or 'It is reported,' or 'It is rumored,' or 'We understand' so-and-so, but go to headquarters and get the absolute facts, and then speak out and say 'It is so-and-so.' Otherwise, people will not put confidence in your news. Unassailable certainty is the thing that gives a newspaper the firmest and most valuable reputation."

It was the whole thing in a nut-shell; and to this day when I find a reporter commencing his article with "We understand," I gather a suspicion that he has not taken as much pains to inform himself as he ought to have done. I moralize well, but I did not always practice well when I was a city editor; I let fancy[23] get the upper hand of fact too often when there was a dearth[24] of news. I can never forget my first day's experience as a reporter. I wandered about town questioning everybody, boring everybody, and finding out that nobody knew anything. At the end of five hours my notebook was still barren. I spoke to Mr. Goodman. He said:

[15] "Dan used to make a good thing out of the hay wagons in a dry time when there were no fires or inquests. Are there no hay wagons in from the Truckee? If there are, you might speak of the renewed activity and all that sort of thing, in the hay business, you know.

"It isn't sensational or exciting, but it fills up and looks business like."

I canvassed the city again and found one wretched old hay truck dragging in from the country. But I made affluent[25] use of it. I multiplied it by sixteen, brought it into town from sixteen different directions, made sixteen separate items out of it, and got up such another sweat about hay as Virginia City had never seen in the world before.

This was encouraging. Two nonpareil[26] columns had to be filled, and I was getting along. Presently, when things began to look dismal again, a desperado[27] killed a man in a saloon and joy returned once more. I never was so glad over any mere trifle[28] before in my life. I said to the murderer:

"Sir, you are a stranger to me, but you have done me a kindness this day which I can never forget. If whole years of gratitude can be to you any slight compensation, they shall be yours. I was in trouble and you have relieved me nobly and at a time when all seemed dark and drear. Count me your friend from this time forth, for I am not a man to forget a favor."

[20] If I did not really say that to him I at least felt a sort of itching desire to do it. I wrote up the murder with a hungry attention to details, and when it was finished experienced but one regret — namely, that they had not hanged my benefactor on the spot, so that I could work him up too.

21. **Deference** ***(noun):*** a polite and respectful attitude
22. **Conspicuous** ***(adjective):*** noticed easily
23. **Fancy** ***(noun):*** the power of the mind to imagine
24. **Dearth** ***(noun):*** absence or deficiency
25. This uncommon use of the word affluent means abundant.
26. **Nonpareil** ***(adj.):*** having no match or equal; unrivaled
27. **Desperado** ***(noun):*** a desperate or reckless person, often a criminal
28. **Trifle** ***(noun):*** something that does not have much value or importance

Next I discovered some emigrant[29] wagons going into camp on the plaza and found that they had lately come through the hostile Indian country and had fared rather roughly. I made the best of the item that the circumstances permitted, and felt that if I were not confined within rigid limits by the presence of the reporters of the other papers I could add particulars that would make the article much more interesting. However, I found one wagon that was going on to California, and made some judicious[30] inquiries of the proprietor. When I learned, through his short and surly answers to my cross-questioning, that he was certainly going on and would not be in the city next day to make trouble, I got ahead of the other papers, for I took down his list of names and added his party to the killed and wounded. Having more scope here, I put this wagon through an Indian fight that to this day has no parallel in history. My two columns were filled. When I read them over in the morning I felt that I had found my legitimate occupation at last. I reasoned within myself that news, and stirring news, too, was what a paper needed, and I felt that I was peculiarly endowed with the ability to furnish it. Mr. Goodman said that I was as good a reporter as Dan. I desired no higher commendation. With encouragement like that, I felt that I could take my pen and murder all the immigrants on the plains if need be and the interests of the paper demanded it.

Roughing It by Mark Twain (1872) is in the public domain.

29. **Emigrant** ***(noun):*** those who have left their own land or country for a new land
30. **Judicious** ***(adj.):*** of good judgment or sense

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. How are the details about Twain's failures in his odd jobs important to our understanding of the character?
    A. They reinforce the notion that the character is lazy, does not want to work, and is not capable of working hard.
    B. They detail how prospects in the American West were much dimmer than advertised, making for a harder life for those who sought fame and fortune in the new frontier.
    C. They mark his development from an inexperienced easterner trying to make-it-rich to an experienced yet cynical Western writer.
    D. They show that he is eager to work but has few useful skills, making him a loveable but pathetic figure.

2. PART A: Which statement best expresses a central theme of the text?
    A. The West is a great place for people with no skills to succeed.
    B. Stories of the West are often invented myths of exaggerated characters and events.
    C. Twain supports liars because lying is the key to impressing others.
    D. Book knowledge is more important to success than personal experience.

3. PART B: What phrase from the text best supports the answer to Part A?
    A. "Yes, take it all around, there is quite a good deal of information in the book." (Paragraph 2)
    B. "I did long to stand behind a wheel again and never roam any more" (Paragraph 6)
    C. "Unassailable certainty is the thing that gives a newspaper the firmest and most valuable reputation." (Paragraph 13)
    D. "(I) found one wretched old hay truck dragging in from the country… I multiplied it by sixteen… and got up such another sweat about hay as Virginia City had never seen" (Paragraph 17)

4. What effect does the comedic resolution of this excerpt have on the passage's overall meaning?
    A. It provides insight into Twain's uncertainty about his future out West and the opportunities in the new territory.
    B. It suggests that in the end, everything works out well for Western adventurers when individuals reflect on their experiences.
    C. It relieves tension regarding the constant possibility of uncertainty and tragedy awaiting Westerners in an unfamiliar context.
    D. It undermines the seriousness of any moral lesson that might be found in Roughing It and highlights the personal narrative of Twain.

5. Explain how Twain uses “sorrow,” whether through making fun of himself or others’ poor circumstances, to achieve humor, using evidence from the text.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. In your opinion, is Twain's use of exaggeration and hyperbole amusing or does it make him an unreliable narrator? Why?

2. What allows Twain to succeed out West? Do you think that he wants readers to follow in his footsteps? Why or why not?

3. Roughing It is loosely based on Twain's own experiences out West. Think of a time when you have embellished or altered the truth of a story for an audience, and what was your motivation? (ex. comedy, tragedy, joy, defeat, glory)

4. Theatre experts claim that the only difference between comedy and tragedy lies in the ending of a story. Yet Twain alters happy or semi-happy endings of news stories into tragedies in order to sensationalize and sell a story. What does Twain's mingling of the comic and the tragic reveal about the absurdity of the world around us, especially in the "Wild West?"

Name: _____ Class: _____

An Uncomfortable Bed

By Guy de Maupassant
1909

Guy de Maupassant (1850-1893) was a popular French writer during the 19th century. He is considered one of the fathers of the modern short story, and he delighted in clever plot twists. In his short story "An Uncomfortable Bed," the speaker is a wealthy yet suspicious man invited by his friends, who often play tricks on him, to stay at their lavish mansion. As you read, pay attention to how de Maupassant's use of point of view affects the story.

[1] One autumn I went to spend the hunting season with some friends in a chateau[1] in Picardy.

My friends were fond of practical jokes. I do not care to know people who are not.

When I arrived, they gave me a princely reception, which at once awakened suspicion in my mind. They fired off rifles, embraced me, made much of me, as if they expected to have great fun at my expense.

I said to myself: "Look out, old ferret! They have something in store for you."



"Hotel Room" by Mario's Planet is licensed under CC BY-NC 2.0.

[5] During the dinner the mirth[2] was excessive, exaggerated, in fact. I thought: "Here are people who have more than their share of amusement, and apparently without reason. They must have planned some good joke. Assuredly I am to be the victim of the joke. Attention!"

During the entire evening every one laughed in an exaggerated fashion. I scented a practical joke in the air, as a dog scents game.[3] But what was it? I was watchful, restless. I did not let a word, or a meaning, or a gesture escape me. Every one seemed to me an object of suspicion, and I even looked distrustfully at the faces of the servants.

The hour struck for retiring; and the whole household came to escort me to my room. Why? They called to me: "Good-night." I entered the apartment, shut the door, and remained standing, without moving a single step, holding the wax candle in my hand.

I heard laughter and whispering in the corridor. Without doubt they were spying on me. I cast a glance round the walls, the furniture, the ceiling, the hangings, the floor. I saw nothing to justify suspicion. I heard persons moving about outside my door. I had no doubt they were looking through the keyhole.

An idea came into my head: "My candle may suddenly go out and leave me in darkness."

1. a large country house
2. **Mirth** ***(noun):*** happiness accompanied by laughter
3. Game (also known as prey or quarry) refers to any animal hunted for sport or for food.

[10] Then I went across to the mantelpiece and lighted all the wax candles that were on it. After that I cast another glance around me without discovering anything. I advanced with short steps, carefully examining the apartment. Nothing. I inspected every article, one after the other. Still nothing. I went over to the window. The shutters, large wooden shutters, were open. I shut them with great care, and then drew the curtains, enormous velvet curtains, and placed a chair in front of them, so as to have nothing to fear from outside.

Then I cautiously sat down. The armchair was solid. I did not venture to get into the bed. However, the night was advancing; and I ended by coming to the conclusion that I was foolish. If they were spying on me, as I supposed, they must, while waiting for the success of the joke they had been preparing for me, have been laughing immoderately[4] at my terror. So I made up my mind to go to bed. But the bed was particularly suspicious-looking. I pulled at the curtains. They seemed to be secure.

All the same, there was danger. I was going perhaps to receive a cold shower both from overhead, or perhaps, the moment I stretched myself out, to find myself sinking to the floor with my mattress. I searched in my memory for all the practical jokes of which I ever had experience. And I did not want to be caught. Ah! certainly not! certainly not! Then I suddenly bethought myself of a precaution[5] which I considered insured safety. I caught hold of the side of the mattress gingerly, and very slowly drew it toward me. It came away, followed by the sheet and the rest of the bedclothes. I dragged all these objects into the very middle of the room, facing the entrance door. I made my bed over again as best I could at some distance from the suspected bedstead and the corner which had filled me with such anxiety. Then I extinguished all the candles, and, groping my way, I slipped under the bed clothes.

For at least another hour I remained awake, starting at the slightest sound. Everything seemed quiet in the chateau. I fell asleep.

I must have been in a deep sleep for a long time, but all of a sudden I was awakened with a start by the fall of a heavy body tumbling right on top of my own, and, at the same time, I received on my face, on my neck, and on my chest a burning liquid which made me utter a howl of pain. And a dreadful noise, as if a sideboard[6] laden with plates and dishes had fallen down, almost deafened me.

[15] I was smothering beneath the weight that was crushing me and preventing me from moving. I stretched out my hand to find out what was the nature of this object. I felt a face, a nose, and whiskers. Then, with all my strength, I launched out a blow at this face. But I immediately received a hail of cuffings[7] which made me jump straight out of the soaked sheets, and rush in my nightshirt into the corridor, the door of which I found open.

Oh, heavens! it was broad daylight. The noise brought my friends hurrying into my apartment, and we found, sprawling over my improvised[8] bed, the dismayed valet, who, while bringing me my morning cup of tea, had tripped over this obstacle in the middle of the floor and fallen on his stomach, spilling my breakfast over my face in spite of himself.

The precautions I had taken in closing the shutters and going to sleep in the middle of the room had only brought about the practical joke I had been trying to avoid.

4. **Immoderate** ***(adjective):*** going beyond a reasonable limit or amount
5. **Precaution** ***(noun):*** an action taken to prevent or avoid injury or harm
6. a type of dining-room furniture with shelves
7. blows with a fist or an open hand
8. **Improvise** ***(verb):*** to make, invent, or arrange on the spur of the moment

Oh, how they all laughed that day!

An Uncomfortable Bed by Guy de Maupassant is in the public domain.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following statements best describes a theme of the text?
    A. Practical jokes have a price, often a friendship.
    B. Paranoia can make fools out of people.
    C. True friends are never cruel.
    D. Better to be paranoid and wrong then oblivious.

2. PART B: Which of the following passages best supports the answer to Part A?
    A. Paragraph 1
    B. Paragraph 6
    C. Paragraph 12
    D. Paragraph 17

3. In the passage, what causes the conflict between the narrator and his friends?
    A. The narrator secretly despises his friends for their mean-spirited pranks, and he visits only to get the better of them.
    B. The friends' laughter causes the narrator to be anxious, for he interprets it as a joke on his behalf.
    C. The friends' exaggerated merriment and predilection to prank the narrator make him paranoid when he visits.
    D. The narrator dislikes the lodgings given to him by his friends.

4. Reread the following quote from paragraph 6: "I smelled a practical joke in the air, as a dog scents game." How does this figurative language impact the tone of the story?
    A. The comparison of an animal smelling game to the narrator sniffing out a practical joke is inappropriate, adding to the mocking tone of the piece.
    B. The comparison of an animal smelling game to the narrator sniffing out a practical joke is silly and deluded (since, as a victim of pranks, he is normally the prey), adding to the comedic tone of the piece.
    C. The word "game" implies that the narrator is the true predator when it comes to pranks, adding to the ironic and cruel tone of the story.
    D. The comparison of an animal smelling game to the narrator sniffing out a practical joke creates a frightened mood, adding to the dark and anxious tone of the story.

5. Explain how the structural timeline of the piece helps to build tension, thus heightening the story's comedic ending.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Identify a few of the humorous elements of the story. How do they contribute to the story as a comedy? Explain your answer.

2. Comedy is often used to make light of man's follies. How does de Maupassant use comedy to reveal his theme about weakness in human nature?

3. What can we learn from comedy? Use evidence from this text, your own experience, and other art or literature in your answer.

Name: _____ Class: _____

On Tragedy

By Aristotle
c. 335 BCE

Aristotle (385 B.C.–322 B.C.) was an ancient Greek philosopher and scientist. A student of Plato and the teacher of Alexander the Great, Aristotle authored many influential works regarding the physical sciences, philosophy, literature, and politics. In this chapter from Poetics*, Aristotle seeks to define "tragedy" as it relates to literature and human emotion. As you read, take notes on the different elements of what Aristotle considers to be an ideal tragedy and construct a working definition.*

Chapter 13



"The School of Athens (fresco)" by Raphael is in the public domain.

[1] As the sequel to what has already been said, we must proceed to consider what the poet should aim at, and what he should avoid, in constructing his plots; and by what means[1] the specific effect of Tragedy will be produced.

A perfect tragedy should, as we have seen, be arranged not on the simple but on the complex plan. It should, moreover, imitate actions which excite pity and fear, this being the distinctive mark of tragic imitation. It follows plainly, in the first place, that the change of fortune presented must not be the spectacle of a virtuous man brought from prosperity to adversity: for this moves neither pity nor fear; it merely shocks us. Nor, again, that of a bad man passing from adversity to prosperity: for nothing can be more alien to the spirit of Tragedy; it possesses no single tragic quality; it neither satisfies the moral sense nor calls forth pity or fear. Nor, again, should the downfall of the utter villain be exhibited. A plot of this kind would, doubtless, satisfy the moral sense, but it would inspire neither pity nor fear; for pity is aroused by unmerited[2] misfortune, fear by the misfortune of a man like ourselves. Such an event, therefore, will be neither pitiful nor terrible. There remains, then, the character between these two extremes — that of a man who is not eminently[3] good and just, yet whose misfortune is brought about not by vice[4] or depravity,[5] but by some error of judgement or frailty. He must be one who is highly renowned and prosperous — a personage like Oedipus,[6] Thyestes,[7] or other illustrious men of such families.

1. action or system by which a result is brought about; a method
2. undeserved or undeserving
3. **Eminent** ***(adjective):*** famous, respected, and successful
4. **Vice** ***(noun):*** bad or immoral behavior or habits
5. an evil or immoral act; a state of moral corruption

A well-constructed plot should, therefore, be single in its issue, rather than double as some maintain. The change of fortune should be not from bad to good, but, reversely, from good to bad. It should come about as the result not of vice, but of some great error or frailty, in a character either such as we have described, or better rather than worse. The practice of the stage bears out our view. At first the poets recounted any legend that came in their way. Now, the best tragedies are founded on the story of a few houses — on the fortunes of Alcmaeon, Oedipus, Orestes, Meleager, Thyestes, Telephus,[8] and those others who have done or suffered something terrible. A tragedy, then, to be perfect according to the rules of art, should be of this construction. Hence they are in error who censure Euripides just because he follows this principle in his plays, many of which end unhappily. It is, as we have said, the right ending. The best proof is that on the stage and in dramatic competition, such plays, if well worked out, are the most tragic in effect; and Euripides,[9] faulty though he may be in the general management of his subject, yet is felt to be the most tragic of the poets.

In the second rank comes the kind of tragedy which some place first. Like the Odyssey, it has a double thread of plot, and also an opposite catastrophe[10] for the good and for the bad. It is accounted the best because of the weakness of the spectators; for the poet is guided in what he writes by the wishes of his audience. The pleasure, however, thence derived is not the true tragic pleasure. It is proper rather to Comedy, where those who, in the piece, are the deadliest enemies — like Orestes and Aegisthus — quit the stage as friends at the close, and no one slays or is slain.

"On Tragedy" from Poetics by Aristotle is in the public domain.

6. Oedipus was a mythical Greek king. A tragic hero in mythology, Oedipus accidentally fulfilled the prophecy, despite his efforts not to, that he would end up killing his father and marrying his mother, thereby bringing disaster to his city and family. When the truth was discovered, his wife-mother hanged herself, and Oedipus gouged out his own eyes.
7. Thyestes was son of the King of Olympia in Greek mythology. Thyestes and his brother, Atreus, were exiled by their father for having murdered their half-brother, Chrysippus, in their desire for the throne of Olympia.
8. various tragic heroes of Greek mythology
9. Euripedes (c. 480-406 BC) was a writer of tragedy from Athens. Euripides is identified with theatrical innovations that have profoundly influenced drama down to modern times, especially in the representation of traditional, mythical heroes as ordinary people in extraordinary circumstances. This new approach led him to pioneer developments that later writers adapted to comedy, some of which are characteristic of romance. Yet he also became, as Aristotle says, "the most tragic of poets," focusing on the inner lives and motives of his characters in a way previously unknown.
10. This is a term used in drama to describe the ending or resolution of a narrative plot. It is used most frequently when referring to ancient or classical tragedies.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. Summarize at least 3 elements of an ideal tragedy, as described by Aristotle.

2. How does paragraph 1 contribute to the development of ideas in the article/passage?
    A. It captures the reader's attention by making the topic of the text seem relatable to the experience of the reader.
    B. It summarizes the central idea of the text: that poets should avoid constructing complicated plot lines when crafting a work of tragedy.
    C. It introduces the purpose of the subsequent paragraphs: to advise writers on the components of an ideal tragedy.
    D. It summarizes central ideas relating to how poets construct plot as described in earlier parts of the book (not included in this excerpt).

3. PART A: What does the word "spectacle" most closely mean as it is used in paragraph 2?
    A. Tragic hardship or misfortune
    B. Success as the result of deceit or foul play
    C. A boring or mundane story
    D. A dramatic scene often involving scandal

4. PART B: Which phrase from the paragraph best supports the answer to Part A?
    A. "change of fortune"
    B. "prosperity to adversity"
    C. "moves neither pity nor fear"
    D. "merely shocks us"

5. Some literacy critics have defined tragedy as “the downfall of a hero.” Would Aristotle agree? How might he revise this definition?

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Why do you think tragedy is a popular genre? Is tragedy entertaining? What benefit do people derive from watching the downfall of a tragic hero?

2. What is the significance of pity and fear in tragedy?

3. How does what Aristotle calls our "moral sense" play into the concept of tragedy?

4. Aristotle says that the tragic hero must be similar to the audience in order to evoke fear. How do we see ourselves in literary characters?

Name: _____ Class: _____

'To Be Or Not To Be' Soliloquy

By William Shakespeare
c. 1599

William Shakespeare (1564-1616) was an English poet, playwright, and actor, widely regarded as the greatest writer in the English language and the world's pre-eminent dramatist. Hamlet *is one of Shakespeare's most famous tragedies. The play dramatizes the revenge Prince Hamlet is instructed to enact on his uncle Claudius, who murdered Hamlet's father. In this soliloquy from Act III, Scene I, a despondent Prince Hamlet contemplates death and suicide while waiting for Ophelia, his love interest. As you read, make notes about the way Shakespeare describes life and death.*

HAMLET: To be, or not to be — that is the question:
Whether 'tis nobler in the mind to suffer
The slings and arrows of outrageous fortune
Or to take arms against a sea of troubles
And by opposing end them. To die, to sleep —
No more — and by a sleep to say we end
The heartache, and the thousand natural shocks
That flesh is heir to. 'Tis a consummation[1]
Devoutly to be wished. To die, to sleep —
To sleep — perchance to dream: ay, there's the rub,
For in that sleep of death what dreams may come
When we have shuffled off this mortal coil,
Must give us pause. There's the respect
That makes calamity[2] of so long life.
For who would bear the whips and scorns of time,
Th' oppressor's wrong, the proud man's contumely[3]
The pangs of despised love, the law's delay,
The insolence[4] of office, and the spurns
That patient merit of th' unworthy takes,
When he himself might his quietus[5] make
With a bare bodkin?[6] Who would fardels[7] bear,
To grunt and sweat under a weary life,
But that the dread of something after death,
The undiscovered country, from whose bourn[8]



"Hamlet, The Philosopher" by Andrew Smith is licensed under CC BY-SA 2.0.

1. completetion (of life)
2. **Calamity** ***(noun):*** a misforunate disaster
3. insulting language or treatment
4. **Insolence** ***(noun):*** rude and disrespectful behavior
5. something with a calming or soothing effect; death
6. a sharp dagger or knife
7. burdens

No traveller returns, puzzles the will,
And makes us rather bear those ills we have
Than fly to others that we know not of?
Thus conscience does make cowards of us all,
And thus the native hue of resolution
Is sicklied o'er with the pale cast of thought,
And enterprise of great pitch and moment
With this regard their currents turn awry
And lose the name of action. — Soft you now,
The fair Ophelia![9] — Nymph,[10] in thy orisons[11]
Be all my sins remembered.

"'To Be Or Not To Be' Soliloquy" by William Shakespeare (c.1599) is in the public domain.

8. boundary
9. Ophelia is the love interest of Hamlet in the play.
10. Nymphs are beautiful mythological spirits of nature.
11. prayers

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following best states a theme of the soliloquy?
    A. Suicide is not only tragic but morally wrong, and should be discouraged.
    B. When life is full of pain and struggle, it is worthwhile to end one's life rather than suffer.
    C. It is better to take one's own life rather than take another's in the name of revenge.
    D. Life is full of struggle, but the great unknown of death is far more fearsome.

2. PART B: Which of the following quotes best supports the answer to Part A?
    A. "To die, to sleep — / No more — and by a sleep to say we end / The heartache, and the thousand natural shocks / That flesh is heir to. 'Tis a consummation / Devoutly to be wished." (Lines 5-9)
    B. "For who would bear the whips and scorns of time, / Th' oppressor's wrong, the proud man's contumely / The pangs of despised love, the law's delay, / The insolence of office, and the spurns / That patient merit of th' unworthy takes, / When he himself might his quietus make" (Lines 15-20)
    C. "The undiscovered country, from whose bourn / No traveller returns, puzzles the will, / And makes us rather bear those ills we have / Than fly to others that we know not of?" (Lines 24-27)
    D. "And thus the native hue of resolution / Is sicklied o'er with the pale cast of thought, / And enterprise of great pitch and moment / With this regard their currents turn awry / And lose the name of action." (Lines 29-33)

3. PART A: How does Shakespeare use figurative language to talk about death?
    A. Shakespeare compares life to a nightmare and death to peaceful sleep.
    B. Shakespeare compares life to crossing into new countries and death to being in a fixed state.
    C. Shakespeare compares life and death to battles in which one has the choice of fighting.
    D. Shakespeare compares death to sleep and dreams to the afterlife.

4. PART B: Which TWO quotes from the text support the answer to Part A?
    A. "'tis nobler in the mind to suffer / The slings and arrows of outrageous fortune" (Lines 2-3)
    B. "take arms against a sea of troubles / And by opposing end them." (Lines 4-5)
    C. "and by a sleep to say we end / The heartache, and the thousand natural shocks / That flesh is heir to." (Lines 6-8)
    D. "For in that sleep of death what dreams may come / When we have shuffled off this mortal coil, / Must give us pause." (Lines 11-13)
    E. "That patient merit of th' unworthy takes, / When he himself might his quietus make / With a bare bodkin?" (Lines 19-21)
    F. "But that the dread of something after death, / The undiscovered country, from whose bourn / No traveller returns" (Lines 23-25)

5. How does Hamlet's conclusion on the question of "To be or not to be" develop the reader's understanding of his character?

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. How does Hamlet describe life? How does he describe death? Do you agree with Hamlet's view on life and death?

2. Is the question "to be or not to be" the most important question we can ask ourselves? Cite evidence from the text, your personal experience, and other literature, art, or history in your answer.

3. Why do you think this particular excerpt from Hamlet is so famous? Do you think it is as relevant today as when it was first written?

Name: _____ Class: _____

President Lincoln's Second Inaugural Address

By President Abraham Lincoln
1865

On March 4, 1865, President Abraham Lincoln (1809-1865), the United States' 16th President, delivered his second inaugural speech. Weeks of wet weather turned Pennsylvania Avenue into a sea of mud; nevertheless, thousands of people came out to see the president standing tall beneath the Capitol dome, a reminder of the strength of his administration throughout the war. In little over a month, and just after the official end of the Civil War, Lincoln would be assassinated. The following speech is considered one of the most eloquent in American history. As you read, take notes on the central themes or ideas of the speech—how does Lincoln view the horrors of slavery and war, and how will the country move forward?

[1] Fellow Countrymen:



"Abraham Lincoln delivering his second inaugural address as President of the United States, Washington, D.C." by Alexander Gardener is in the public domain.

At this second appearing to take the oath of the presidential office, there is less occasion for an extended address than there was at the first. Then a statement, somewhat in detail, of a course to be pursued, seemed fitting and proper. Now, at the expiration of four years, during which public declarations have been constantly called forth on every point and phase of the great contest which still absorbs the attention, and engrosses[1] the energies of the nation, little that is new could be presented. The progress of our arms, upon which all else chiefly depends, is as well known to the public as to myself; and it is, I trust, reasonably satisfactory and encouraging to all. With high hope for the future, no prediction in regard to it is ventured.[2]

On the occasion corresponding to this four years ago, all thoughts were anxiously directed to an impending civil-war. All dreaded it – all sought to avert it. While the inaugural address was being delivered from this place, devoted altogether to saving the Union without war, insurgent[3] agents were in the city seeking to destroy it without war – seeking to dissolve the Union, and divide effects, by negotiation. Both parties deprecated[4] war; but one of them would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came.

1. **Engross** ***(verb):*** to hold the complete interest or attention of (someone)
2. **Venture** ***(verb):*** to do, say, or offer something (such as a guess or an opinion) even though you are not sure about it
3. **Insurgent** ***(adjective):*** rebellious
4. **Deprecate** ***(verb):*** to express disapproval

One eighth of the whole population were colored slaves, not distributed generally over the Union, but localized in the Southern part of it. These slaves constituted a peculiar and powerful interest. All knew that this interest was, somehow, the cause of the war. To strengthen, perpetuate,[5] and extend this interest was the object for which the insurgents would rend[6] the Union, even by war; while the government claimed no right to do more than to restrict the territorial enlargement of it. Neither party expected for the war, the magnitude,[7] or the duration, which it has already attained. Neither anticipated that the cause of the conflict might cease with, or even before, the conflict itself should cease. Each looked for an easier triumph, and a result less fundamental and astounding. Both read the same Bible, and pray to the same God; and each invokes His[8] aid against the other.

[5] It may seem strange that any men should dare to ask a just God's assistance in wringing their bread from the sweat of other men's faces;[9] but let us judge not that we be not judged.[10] The prayers of both could not be answered; that of neither has been answered fully. The Almighty has His own purposes. "Woe[11] unto the world because of offences! for it must needs be that offences come; but woe to that man by whom the offence cometh!"[12]

If we shall suppose that American Slavery is one of those offences which, in the providence of God, must needs come, but which, having continued through His appointed time, He now wills to remove, and that He gives to both North and South, this terrible war, as the woe due to those by whom the offence came, shall we discern therein any departure from those divine attributes which the believers in a Living God always ascribe[13] to Him? Fondly do we hope – fervently[14] do we pray – that this mighty scourge[15] of war may speedily pass away. Yet, if God wills that it continue, until all the wealth piled by the bond-man's[16] two hundred and fifty years of unrequited toil[17] shall be sunk, and until every drop of blood drawn with the lash, shall be paid by another drawn with the sword, as was said three thousand years ago, so still it must be said "the judgments of the Lord, are true and righteous altogether."[18]

With malice[19] toward none; with charity for all; with firmness in the right, as God gives us to see the right, let us strive on to finish the work we are in; to bind up the nation's wounds; to care for him who shall have borne the battle, and for his widow, and his orphan to do all which may achieve and cherish a just, and a lasting peace, among ourselves, and with all nations.

President Lincoln's Second Inaugural Address by President Abraham Lincoln is in the public domain.

5. **Perpetuate** ***(verb):*** to cause (something that should be stopped, such as a mistaken idea or a bad situation) to continue
6. "Rend" means to tear something apart
7. **Magnitude** ***(noun):*** the size, extent, or importance of something
8. God's
9. An allusion to the Fall of Man from the Book of Genesis
10. An allusion to the words of Jesus from Mathew 7:1
11. An expression of grief or regret
12. A quote from Jesus that appears in Mathew 18:7
13. **Ascribe** ***(verb):*** to attribute something to a cause or source
14. **Fervently** ***(adjective):*** felt very strongly : having or showing very strong feelings
15. **Scourge** ***(noun):*** a cause of wide or great pain or suffering
16. A "bond-man" is an archaic term for "slave"
17. In this speech, "unrequited toil" refers to the unpaid work done by black slaves since the earliest days of American history.
18. A quote from Psalm 19.9 in the King James Bible
19. **Malice** ***(noun):*** a desire to cause harm to another person

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which statement identifies the central idea of the speech?
    A. President Lincoln believes that the Civil War was God's way of punishing the United Sates for its history of slavery.
    B. President Lincoln believes that the South is to blame for the causalities of war, as it refused to give up slavery.
    C. The nation has changed in many positive ways since President Lincoln's last inauguration.
    D. The Civil War continued after the abolishment of slavery, proving that slavery was never the true cause of the war.

2. PART B: Which quote from the text best supports the answer to Part A?
    A. "The progress of our arms, upon which all else chiefly depends, is as well known to the public as to myself; and it is, I trust, reasonably satisfactory and encouraging to all." (Paragraph 2)
    B. "One eighth of the whole population were colored slaves, not distributed generally over the Union, but localized in the Southern part of it." (Paragraph 4)
    C. "Neither anticipated that the cause of the conflict might cease with, or even before, the conflict itself should cease." (Paragraph 4)
    D. "having continued through His appointed time, He now wills to remove, and that He gives to both North and South, this terrible war, as the woe due to those by whom the offence came," (Paragraph 6)

3. According to the text, how does the difference of four years (between inaugural speeches) alter the context of the speeches?
    A. The first speech was longer, as the people needed explanation as they anxiously entered war, but the second, in light of the casualties of war, is briefer and more solemn.
    B. The second speech is far more triumphant than the first, which was given in an uncertain time at the beginning of the war.
    C. The second speech is more emotional and filled with more hatred towards the Confederacy, which the Union has almost defeated.
    D. The first speech was longer as President Lincoln praised the strength of the Union, whereas in the second speech the Union is no longer so intimidating.

4. What distinction does President Lincoln make in paragraph 3 about both sides of the war?
    A. Lincoln argues that the Union wanted to avoid war all together, while the Confederacy wanted nothing more than to fight.
    B. Lincoln acknowledges that the Union was the first to declare war in order to maintain the United States and that, perhaps, they should have let the Confederacy peacefully secede.
    C. Lincoln emphasizes the fault of the Confederacy for seeking to destroy the larger union, with all states united, but does not condemn them as blood-thirsty.
    D. Lincoln stresses the idea that neither side actively sought war; their motivations may have been different, but neither party wanted to declare war if negotiation was possible.

5. PART A: Upon whom does Lincoln cast blame for the civil war and to what effect?
    A. Lincoln blames the Confederate States, particularly those states that first seceded, for refusing to negotiate.
    B. Lincoln does not actively blame anyone for the civil war, likely to avoid future hostility, but points to the institution of slavery as the cause of the war.
    C. Lincoln does not actively blame either side; rather he blames individual supporters of slavery, thus emphasizing the evils of the institution of slavery.
    D. Lincoln blames divine intervention for this war, for he sees the civil war as a form of senseless violence caused by an angry God.

6. PART B: Which of the following best supports the answer to Part A?
    A. “On the occasion corresponding to this four years ago all thoughts were anxiously directed to an impending civil war.” (Paragraph 3)
    B. “Neither party expected for the war the magnitude or the duration which it has already attained. Neither anticipated that the cause of the conflict might cease with or even before the conflict itself should cease. (Paragraph 4)
    C. “Both read the same Bible and pray to the same God, and each invokes His aid against the other.” (Paragraph 4)
    D. “Yet, if God wills that it continue until all the wealth piled by the bondsman’s two hundred and fifty years of unrequited toil shall be sunk, and until every drop of blood drawn with the lash shall be paid by another drawn with the sword, as was said three thousand years ago, so still it must be said “the judgments of the Lord are true and righteous altogether.”” (Paragraph 6)

7. How does paragraph 6 contribute to the development of ideas in the text?

Name: _____ Class: _____

Opposing Innovation

The Luddite Lesson

By Mike Kubic
2016

In this article, Mike Kubic, a former Newsweek *correspondent, examines the history of the term "Luddite." The Luddites were bands of English workers who, believing technological advancements would threaten their livelihood, banded together to destroy new machinery between 1811 and 1816. Cotton and woolen mills were particularly popular targets. In modern usage, the term "Luddite" refers to any person who opposes the adoption of new technologies. As you read, identify the ways that innovations have improved people's quality of life, and identify some of the unintended consequences that these innovations have had.*

[1] The Luddites were part of one of the most transitory[1] labor movements in history, but they taught us an important lesson that is still valid: the cure for problems caused by innovation is not revolution, but more innovation.

The group is believed to have taken its name and inspiration from Ned Ludd, an English youngster who, in 1779, secured a spot in history by smashing a labor-saving innovation — two frames on which even unskilled workers could produce more stockings than skilled workers could do by hand. ;

In the late 18th Century, thousands of English textile workers came to share Ludd's fear that the introduction of mechanized equipment would make their skills worthless, and that they would lose their jobs as a result. By the turn of the century, as the Napoleonic wars[2] depressed the English economy and inventors kept developing increasingly improved tools and machinery, this anxiety turned into anger and a destructive force.



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The Luddite workers gave vent to it by forming a militia that launched a rebellion, ransacked[3] textile plants, and severely damaged the industry in northern England. To borrow from William F. Buckley's, Jr., description of his own conservative credo,[4] the Luddites tried to "stand in front of history, and shout 'Stop!'"

1. **Transitory** ***(adjective):*** lasting only for a short time
2. Napoleon Bonaparte (1769-1821) led the French Empire in a series of global wars from 1803 to 1815 against European alliances often led by Great Britain.
3. **Ransack** ***(verb):*** to search through a place in a way that causes destruction

[5] Of course, history did no such thing. It took thousands of British troops to put down the rebellion, but by the 1820s, it was done. The British parliament passed two laws — the Frame Breaking Act and the Malicious Damage Act — that made "machine breaking" and other forms of industrial sabotage capital crimes. But those who really buried the Luddite movement were English engineers and inventors. Without skipping a beat, they went on developing new labor-saving tools and technological marvels, such as the steam engine, chemical manufacturing, and more efficient iron production processes.

By the 1860s, England had launched the historical Industrial Revolution, which brought unprecedented economic, technological, and social progress. The new and fast-coming inventions gave the world the first steam-powered railways, boats, and ocean-going ships; large-scale manufacture of machine tools; and novel machinery in steam-powered plants.

The new factories, which vastly outperformed the traditional, manual production process, lowered the prices of consumer goods and other products, multiplied their variety, and made them available to far more people than ever before. Mass production and industrialization caused, and was fueled by, a major exodus of farm workers to blue-color jobs in the cities.

It also replaced thousands of skilled artisans with machinery. But above all, in many parts of the world, foremost in Europe and the United States, the Industrial Revolution energized and modernized economies. This resulted in the creation of millions of new jobs for industrial workers, who enjoyed history's first substantial, sustained rise in the standard of living.

Despite periodic slow-downs and recessions, this system has continued to work well. In the United States, the economy's most serious episode of dysfunction — the Great Depression of the 1930s — ended only at the onset of World War II, but it prompted the greatest legislative reforms in our history.

[10] The administration of President Franklin Delano Roosevelt enacted the Social Security Act and other frequently strengthened social welfare measures, collectively referred to as "The New Deal." To this day, they continue to protect millions of Americans against the most grievous[5] effects of disease and unemployment.

And these safeguards have served us well when our economic system took a dramatic, and potentially dislocating,[6] leap forward. That development took place in 1956, when George Devol, an American inventor, was granted the patent for Unimate, the first industrial robot.

The Age of Robotics

Devol's invention of a digitally operated programmable robotic arm triggered an explosive change in the manufacturing industry — a change that, like the introduction of mechanized spindle rods[7] and textile frames of the 1800s, has replaced tens of thousands of workers. Ever-new and more accomplished robots have taken over the jobs of assembly line operators, welders, and others who used to perform skilled and semi-skilled jobs in factories.

4. a statement of beliefs
5. **Grievous** ***(adjective):*** causing great suffering
6. to disrupt the usual status or order of (something)
7. A spindle rod is a bar on a spinning wheel that twists the thread.

This sea change, which started 60 years ago, continues to generate a whirlwind of still more labor- and cost-saving innovations. New robots now entering into use can not only perform the functions of personal servants, but an increasing number are smart enough to command and operate other robots. The old industrial system, in which unskilled laborers fulfilled had some roles in factories, is on its way out for good.

Economists warn that this trend poses a threat to the millions of young people who may plan to follow in the footsteps of their fathers: get factory jobs with only a high school degree, and work their way up to middle positions and wages. Statistics show that those low-level starting jobs of yesteryear are increasingly performed by robots.

[15] Moreover, a similar trend is also setting in outside the factories. In the offices of businesses from coast to coast, increasingly intelligent devices have begun replacing white-collar "knowledge workers" — people whose main salary-earning skill is knowledge, and whose jobs were traditionally regarded as secure.

For example, according to an Associated Press analysis of data from the U.S. Bureau of Labor Statistics, the first decade of the current century has seen the elimination of the jobs of 1.1 million secretaries. They were replaced by Internet firms that provide, more cheaply, a wide variety of services that range from maintaining calendars to planning foreign travel.

In the same period, the number of telephone operators dropped by 64%, travel agents by 46%, and bookkeepers by 26%. And the U.S. was not a special case. According to the AP, "two-thirds of the 7.6 million middle-class jobs that vanished during that period in Europe were the victims of technology."

A prominent student of these changes, Erik Brynjolfsson, a professor at MIT's Sloan School of Management, says that this technological progress creates several significant problems. One of them is that it tends to exacerbate[8] income inequality by making well-educated employees much more valuable and better paid than workers without the necessary skills.

Even more problematic, according to Brynjolfsson, is evidence that technological progress no longer creates enough jobs to compensate for the displacement of workers whose skills are no longer needed.

[20] He points out that, for decades after the Second World War, the increase in technology-enhanced productivity and wealth creation in the United States was paralleled by an increase in total employment. As automation[9] and other industrial efficiencies generated more value, the country as a whole became richer. That fueled increased economic activity and created jobs for new and dislocated workers.

However, beginning in 2000, the two previously parallel developments — rising productivity and job creation — have begun to diverge. While innovation-driven productivity has continued to rise, employment statistics have started to lag behind. By 2011, the two sets of data were separated by a significant gap that Brynjolfsson attributes to the new technology. Joseph Stiglitz, Nobel prize-winning economist, agrees that "[e]conomies don't make these [technological] transitions well." ;

8. **Exacerbate** ***(verb):*** to make something bad even worse
9. Automation, or automatic control, is the use of various technological control systems to operate equipment such as machinery to reduce or eliminate human intervention.

The unsettling statistics have sparked some alarmed speculation that the U.S. may be approaching conditions that in other countries have led to social unrest reminiscent[10] of the Luddite rebellion.

The American experience does not justify such fears. In the early 1800s, nine out of every ten Americans worked in agriculture; now, it's around two in one hundred. At its peak, about a third of the U.S. population worked in manufacturing, and now it's less than 10%. These vast transformations have taken place in relative harmony, thanks to uniquely American optimism, the undeniable benefits of innovation, and the social safety nets established in the 1930s.

There is no evidence that Americans fear or reject technological progress, which continues to be one of our honored values. But the unstoppable drive to innovate will no doubt bring dramatic changes and new challenges. We need to do all we can to be ready.

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10. **Reminiscent** ***(adjective):*** tending to remind of (something)

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following TWO phrases best identify the central ideas of this article?
    A. Automated services are a cheaper, more effective, and less error-prone alternative to employing humans in secretarial positions.
    B. The original Luddites, fearful of their jobs being rendered obsolete by technology, tried in vain to prevent that technology from being implemented.
    C. George Devol's invention, Unimate, caused civil unrest by revolutionizing the structure of the American economy.
    D. Unskilled factory jobs are increasingly difficult to hold onto; within 100 years there will likely be no more factory jobs left in America.
    E. Technological advancement may have both negative and positive economic effects; what is certain is that it is a force that cannot be slowed.
    F. The Industrial Revolution doomed progressive efforts to reduce income inequality between the upper and lower classes.

2. PART B: Which TWO phrases from the text best support the answers to Part A?
    A. "[The Luddites] fear[ed] that the introduction of mechanized equipment would make their skills worthless, and that they would lose their jobs as a result. …this anxiety turned into anger and a destructive force." (Paragraph 3)
    B. "By the 1860s, England had launched the historical Industrial Revolution, which brought unprecedented economic, technological, and social progress." (Paragraph 6)
    C. "Devol's invention of a digitally operated programmable robotic arm triggered an explosive change in the manufacturing industry" (Paragraph 12)
    D. "Statistics show that those low-level starting jobs of yesteryear are increasingly performed by robots." (Paragraph 14)
    E. "They were replaced by Internet firms that provide, more cheaply, a wide variety of services that range from maintaining calendars to planning foreign travel." (Paragraph 16)
    F. "But the unstoppable drive to innovate will no doubt bring dramatic changes and new challenges. We need to do all we can to be ready." (Paragraph 24)

3. PART A: What does the phrase "sea change" most closely mean as it is used in Paragraph 13?
    A. a period of substantial technological advancement
    B. a time of increased demand for specialized labor
    C. a profound or notable transformation
    D. a disruptive and undesirable change

4. PART B: Which phrase from the text best supports the answer to Part A?
    A. "replaced tens of thousands of workers" (Paragraph 12)
    B. "a whirlwind of still more labor- and cost-saving innovations" (Paragraph 13)
    C. "smart enough to command and operate other robots" (Paragraph 13)
    D. "unskilled laborers fulfilled had some roles in factories" (Paragraph 13)

5. Which statement best describes how the author responds to the criticism that the adoption of new technologies intensifies the issue of income inequality?

   A. He emphasizes that increased economic activity that occurs in technologically advanced societies will offset this undesirable effect.
   B. He acknowledges that this is one of several potential adverse consequences, but insists that history shows that America is equipped to recover from these negative side effects.
   C. He suggests that the "safety net" that social programs provide to Americans will serve as a cure-all for those affected by income inequality.
   D. He refutes the claim by demonstrating that, throughout history, people and societies have effectively rebounded from job loss and job reduction.

6. What is the author's main purpose in writing this article? Cite evidence from the text in your response.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. In Paragraphs 10-11, the author discusses social programs as a safeguard against the most harmful economic effects of new technologies. Do you think these are an effective solution to the potential problems presented in the text?

2. The author points out that America's "vast transformations have taken place in relative harmony, thanks to the uniquely American optimism" (Paragraph 23). Do you agree that optimism is characteristic of the United States citizenry? Cite historical examples to support your answer.

3. Based on the text and your knowledge of history, do you think the tale of the Luddites' resistance to technology is a common one?

4. While advances in technology have rendered some jobs obsolete, they have also continuously improved quality of life on a global scale. In the context of this article, what are the costs and benefits of technology? In your opinion, are the positive effects of technological advances worth the problems they create?

5. The article suggests that the Luddites' destructive impulses were motivated by concerns "that the introduction of mechanized equipment would make their skills worthless, and that they would lose their jobs as a result" (Paragraph 3). In the context of this article, why do people resist change? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Millennials hands-on when giving to charity

By Joyce Gannon, Pittsburgh Post-Gazette on 12.22.15
Word Count **704**
Level **MAX**



Suzanne Haines Walsh, 60, who is homeless, left, gets a meal from volunteers working with the nonprofit group Love Thy Neighbor Inc. AP/Lynne Sladky

PITTSBURGH — Earlier this month, on the national day of philanthropy known as Giving Tuesday, about 100 employees of Dick's Sporting Goods showed up at the Sarah Heinz House on Pittsburgh's north side to clean, paint and decorate for the holidays.

While millions of people worldwide marked Giving Tuesday by making online donations to charities, the group from Dick's — many of them millennials in their 20s and 30s — worked side by side at the Sarah Heinz House with middle-school students who participate in clubs, lessons and other activities at the nonprofit facility.

"They completely cleaned and beautified gyms, kitchen areas and classrooms," said Deb Hopkins, executive director of Pittsburgh Cares, an organization that matches businesses and individuals with volunteer opportunities.

For millennials, she said, being involved in a hands-on activity that helps a group in need is often as fulfilling as pledging financial support.

"(Millennials) really want to see a direct impact."

Giving Tuesday — launched in 2012 as an antidote to the shopping frenzy between Thanksgiving Day and Cyber Monday — this year generated an estimated $116.7 million from nearly 700,000 donors, according to its founders, the 92nd Street Y in New York.

It also sparked a wave of grassroots volunteerism like the spruce-up at Sarah Heinz House. According to a study released this month, millennials are more inspired to give when charities provide such on-the-ground opportunities.

“We’ve learned that millennials deem monetary giving just as important as giving their time, skills and network to a cause,” said Derrick Feldmann, lead researcher for The Millennial Impact Project, which studied how nine nonprofits conducted their Giving Tuesday fundraising campaigns.

Based in Indianapolis, the project was launched in 2009 to study and analyze millennial behavior. Its research on millennial giving is funded by the Case Foundation, which is run by philanthropists Steve and Jean Case. Steve Case was a co-founder of America Online.

The project decided to study Giving Tuesday, Feldmann said, because it’s a relatively new digital-based initiative that has relied mainly on social media to generate contributions.

“It looks and feels like millennials should be a part of it and would be highly involved … so we try to find out whether that’s true or not.”

The researchers recruited nine nonprofits — including Rutgers and Otterbein universities, the University of North Carolina and WBEZ public radio in Chicago — and studied their marketing efforts leading up to Giving Tuesday and how they promoted it the day of the event.

Nonprofits that used digital-only campaigns limited to emails and social media posts “didn’t get the highest response rate” from millennials, Feldmann said.

But when nonprofits linked Giving Tuesday to actual events, “they got the most heightened millennial response,” he said.

At the University of North Carolina (UNC), for example, a student-giving council and a young alumni leadership council hosted on-campus Giving Tuesday events.

UNC created its own hashtag for the day, "#TarHeelTuesday," and encouraged students to volunteer with a student ambassadors program and to share their photos on Snapchat.

The university raised about $236,000 — far exceeding its goal of $150,000 — including about $23,000 from millennials who accounted for 29 percent of all donors.

“A combination of digital, grass-roots and self-organizing strategies for millennials to own that day and experience it first hand will get a good response,” Feldmann said.

In addition to the Dick’s event at Sarah Heinz House, Pittsburgh Cares organized other Giving Tuesday activities, including some involving sorting and packaging inventory for the U.S. Marine Corps’ Toys for Tots initiative.

An evening event at the regional Toys for Tots storage facility was designed for families so that children could help their parents choose and pack toys designated for boys and girls in need.

“That’s another trend: Millennials very much want their children involved,” Hopkins said. “I get four or five calls a day from people looking for volunteer opportunities for kids as young as 5 years old.”

The concept of linking philanthropy to hands-on participation in charitable causes isn’t limited to millennials, though, she said.

“I wouldn’t say they want that experience more than other people. They are more tech savvy, but we see a tremendous amount of activity among baby boomers and our retired and senior volunteers.”

Quiz

1 Read the sentence below.

"We've learned that millennials deem monetary giving just as important as giving their time, skills and network to a cause," said Derrick Feldmann, lead researcher for The Millennial Impact Project, which studied how nine nonprofits conducted their Giving Tuesday fundraising campaigns.

Which of the following words would CHANGE the meaning of the sentence if it replaced "deem"?

(A) consider

(B) regard

(C) evaluate

(D) dismiss

2 Read the sentence below.

Giving Tuesday — launched in 2012 as an antidote to the shopping frenzy between Thanksgiving Day and Cyber Monday — this year generated an estimated $116.7 million from nearly 700,000 donors, according to its founders, the 92nd Street Y in New York.

What is the connotation of the word "frenzy" in the sentence above? Why?

(A) Positive; it is associated with the Thanksgiving holiday.

(B) Positive; it is associated with the excitement of shopping.

(C) Negative; Giving Tuesday is offered as a remedy for excessive spending.

(D) Negative; the fundraising on Giving Tuesday is insignificant compared to money spent shopping.

3 How do the first three and final three paragraphs of the article relate to each other?

(A) The first paragraphs provide an anecdote of one Giving Tuesday event, while the final paragraphs use a quote from someone at that event to broaden the concept of volunteering.

(B) The first paragraphs provide an anecdote of one Giving Tuesday event, while the final paragraphs provide comments encouraging people to become involved with that event in the future.

(C) The first paragraphs use a quote from someone at a Giving Tuesday event to establish the concept of volunteering, then the final paragraphs use a quote from that person to describe the experience of volunteering on Giving Tuesday.

(D) The first paragraphs use a quote from someone at a Giving Tuesday event to establish the concept of volunteering, then the final paragraphs encourage others to volunteer.

4 What purpose is served by including the information about the hashtag campaign #TarHeelTuesday in the article?

(A) It illustrates the impact of Giving Tuesday from the perspective of a nonprofit organization.

(B) It illustrates the experience of Giving Tuesday from the perspective of a volunteer.

(C) It illustrates why millennials prefer to volunteer with organizations rather than only donating money.

(D) It illustrates how the combination of digital and hands-on activities appeal to millennials.

Name: _____ Class: _____

Excerpt from Walden: "Where I Lived and What I Lived For"

By Henry David Thoreau
1854

Henry David Thoreau (1817-1862) was an American author, essayist, abolitionist, and philosopher. He was one of the major figures of Transcendentalism, alongside writers such as Ralph Waldo Emerson and Margaret Fuller. The following text comes from his best known work, Walden*, a reflection upon his two years spent living in the wilderness near Walden Pond in Massachusetts. As you read, take notes on Thoreau's use of figurative language.*

[1] I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived. I did not wish to live what was not life, living is so dear; nor did I wish to practise resignation, unless it was quite necessary. I wanted to live deep and suck out all the marrow of life, to live so sturdily and Spartan-like[1] as to put to rout[2] all that was not life, to cut a broad swath and shave close, to drive life into a corner, and reduce it to its lowest terms, and, if it proved to be mean, why then to get the whole and genuine meanness of it, and publish its meanness to the world; or if it were sublime,[3] to know it by experience, and be able to give a true account of it in my next excursion. For most men, it appears to me, are in a strange uncertainty about it, whether it is of the devil or of God, and have *somewhat hastily* concluded that it is the chief end of man here to "glorify God and enjoy him forever."[4]



"Thoreau's Cabin, Walden Pond" by Ryan Taylor is licensed under CC BY-NC-ND 2.0

1. The Spartans were ancient Greeks from the city-state of Sparta, known for their skill as warriors and for their simple living.
2. The phrase "to put to rout" means "to defeat or overcome."
3. **Sublime** ***(adjective):*** of such excellence, grandeur, or beauty as to inspire great admiration or awe
4. a Westminster catechism

Still we live meanly, like ants; though the fable tells us that we were long ago changed into men; like pygmies we fight with cranes; it is error upon error, and clout upon clout, and our best virtue has for its occasion a superfluous[5] and evitable[6] wretchedness. Our life is frittered away by detail. An honest man has hardly need to count more than his ten fingers, or in extreme cases he may add his ten toes, and lump the rest. Simplicity, simplicity, simplicity! I say, let your affairs be as two or three, and not a hundred or a thousand; instead of a million count half a dozen, and keep your accounts on your thumb-nail. In the midst of this chopping sea of civilized life, such are the clouds and storms and quicksands and thousand-and-one items to be allowed for, that a man has to live, if he would not founder and go to the bottom and not make his port at all, by dead reckoning, and he must be a great calculator indeed who succeeds. Simplify, simplify. Instead of three meals a day, if it be necessary eat but one; instead of a hundred dishes, five; and reduce other things in proportion. Our life is like a German Confederacy,[7] made up of petty states, with its boundary forever fluctuating,[8] so that even a German cannot tell you how it is bounded at any moment. The nation itself, with all its so-called internal improvements, which, by the way are all external and superficial, is just such an unwieldy and overgrown establishment, cluttered with furniture and tripped up by its own traps, ruined by luxury and heedless expense, by want of calculation and a worthy aim, as the million households in the land; and the only cure for it, as for them, is in a rigid economy, a stern and more than Spartan simplicity of life and elevation of purpose. It lives too fast. Men think that it is essential that the Nation have commerce, and export ice, and talk through a telegraph, and ride thirty miles an hour, without a doubt, whether they do or not; but whether we should live like baboons or like men, is a little uncertain. If we do not get out sleepers,[9] and forge rails, and devote days and nights to the work, but go to tinkering upon our lives to improve them, who will build railroads? And if railroads are not built, how shall we get to heaven in season? But if we stay at home and mind our business, who will want railroads? We do not ride on the railroad; it rides upon us. Did you ever think what those sleepers are that underlie the railroad? Each one is a man, an Irishman, or a Yankee man. The rails are laid on them, and they are covered with sand, and the cars run smoothly over them. They are sound sleepers, I assure you. And every few years a new lot is laid down and run over; so that, if some have the pleasure of riding on a rail, others have the misfortune to be ridden upon. And when they run over a man that is walking in his sleep, a supernumerary[10] sleeper in the wrong position, and wake him up, they suddenly stop the cars, and make a hue[11] and cry about it, as if this were an exception. I am glad to know that it takes a gang of men for every five miles to keep the sleepers down and level in their beds as it is, for this is a sign that they may sometime get up again.

5. **Superfluous** ***(adjective):*** more than enough or what is necessary
6. avoidable
7. a group of European states (1815-1866)
8. **Fluctuate** ***(verb):*** to shift irregularly or uncertainly
9. wooden railroad ties that support the rails
10. exceeding the usual or stated number; exceeding what is necessary or required
11. In this context, "hue" means an outcry or great noise.

Why should we live with such hurry and waste of life? We are determined to be starved before we are hungry. Men say that a stitch in time saves nine, and so they take a thousand stitches today to save nine tomorrow. As for work, we haven't any of any consequence. We have the Saint Vitus' dance,[12] and cannot possibly keep our heads still. If I should only give a few pulls at the parish bell-rope, as for a fire, that is, without setting the bell, there is hardly a man on his farm in the outskirts of Concord, notwithstanding that press of engagements which was his excuse so many times this morning, nor a boy, nor a woman, I might almost say, but would forsake all and follow that sound, not mainly to save property from the flames, but, if we will confess the truth, much more to see it burn, since burn it must, and we, be it known, did not set it on fire — or to see it put out, and have a hand in it, if that is done as handsomely; yes, even if it were the parish church itself. Hardly a man takes a half-hour's nap after dinner, but when he wakes he holds up his head and asks, "What's the news?" as if the rest of mankind had stood his sentinels.[13] Some give directions to be waked every half-hour, doubtless for no other purpose; and then, to pay for it, they tell what they have dreamed. After a night's sleep the news is as indispensable as the breakfast. "Pray tell me anything new that has happened to a man anywhere on this globe" — and he reads it over his coffee and rolls, that a man has had his eyes gouged out this morning on the Wachito River; never dreaming the while that he lives in the dark unfathomed mammoth cave of this world, and has but the rudiment[14] of an eye himself.

For my part, I could easily do without the post-office. I think that there are very few important communications made through it. To speak critically, I never received more than one or two letters in my life — I wrote this some years ago — that were worth the postage. The penny-post is, commonly, an institution through which you seriously offer a man that penny for his thoughts which is so often safely offered in jest. And I am sure that I never read any memorable news in a newspaper. If we read of one man robbed, or murdered, or killed by accident, or one house burned, or one vessel wrecked, or one steamboat blown up, or one cow run over on the Western Railroad, or one mad dog killed, or one lot of grasshoppers in the winter — we never need read of another. One is enough. If you are acquainted with the principle, what do you care for a myriad[15] instances and applications? To a philosopher all news, as it is called, is gossip, and they who edit and read it are old women over their tea. Yet not a few are greedy after this gossip. There was such a rush, as I hear, the other day at one of the offices to learn the foreign news by the last arrival, that several large squares of plate glass belonging to the establishment were broken by the pressure — news which I seriously think a ready wit might write a twelve-month, or twelve years, beforehand with sufficient accuracy. As for Spain, for instance, if you know how to throw in Don Carlos and the Infanta, and Don Pedro and Seville and Granada,[16] from time to time in the right proportions — they may have changed the names a little since I saw the papers — and serve up a bull-fight when other entertainments fail, it will be true to the letter, and give us as good an idea of the exact state or ruin of things in Spain as the most succinct[17] and lucid[18] reports under this head in the newspapers: and as for England, almost the last significant scrap of news from that quarter was the revolution of 1649;[19] and if you have learned the history of her crops for an average year, you never need attend to that thing again, unless your speculations are of a merely pecuniary[20] character. If one may judge who rarely looks into the newspapers, nothing new does ever happen in foreign parts, a French revolution not excepted.

12. an old-fashioned term for Sydenham's chorea, a nervous disorder characterized by involuntary movements
13. guards
14. a basic principle or element; something unformed or undeveloped
15. **Myriad** ***(adjective):*** countless or great in number
16. relating to Spanish-Portuguese politics (1830s - 1840s)
17. **Succinct** ***(adjective):*** precise; without wasted words
18. **Lucid** ***(adjective):*** expressed clearly; easy to understand
19. the English Civil War
20. relating to money

[5] What news! how much more important to know what that is which was never old! "Kieou-pe-yu[21] (great dignitary of the state of Wei) sent a man to Khoung-tseu[22] to know his news. Khoung-tseu caused the messenger to be seated near him, and questioned him in these terms: What is your master doing? The messenger answered with respect: My master desires to diminish the number of his faults, but he cannot accomplish it... The messenger being gone, the philosopher remarked: What a worthy messenger! What a worthy messenger!"[23] The preacher, instead of vexing the ears of drowsy farmers on their day of rest at the end of the week — for Sunday is the fit conclusion of an ill-spent week, and not the fresh and brave beginning of a new one — with this one other draggle-tail of a sermon, should shout with thundering voice, "Pause! Avast! Why so seeming fast, but deadly slow?"

Shams and delusions are esteemed for soundest truths, while reality is fabulous. If men would steadily observe realities only, and not allow themselves to be deluded, life, to compare it with such things as we know, would be like a fairy tale and the Arabian Nights' Entertainments.[24] If we respected only what is inevitable and has a right to be, music and poetry would resound along the streets. When we are unhurried and wise, we perceive that only great and worthy things have any permanent and absolute existence, that petty fears and petty pleasures are but the shadow of the reality. This is always exhilarating and sublime. By closing the eyes and slumbering, and consenting to be deceived by shows, men establish and confirm their daily life of routine and habit everywhere, which still is built on purely illusory foundations. Children, who play life, discern[25] its true law and relations more clearly than men, who fail to live it worthily, but who think that they are wiser by experience, that is, by failure. I have read in a Hindoo book,[26] that "there was a king's son, who, being expelled in infancy from his native city, was brought up by a forester, and, growing up to maturity in that state, imagined himself to belong to the barbarous[27] race with which he lived. One of his father's ministers having discovered him, revealed to him what he was, and the misconception of his character was removed, and he knew himself to be a prince. So soul," continues the Hindoo philosopher, "from the circumstances in which it is placed, mistakes its own character, until the truth is revealed to it by some holy teacher, and then it knows itself to be Brahme."[28] I perceive that we inhabitants of New England live this mean life that we do because our vision does not penetrate the surface of things. We think that that is which appears to be. If a man should walk through this town and see only the reality, where, think you, would the "Mill-dam" go to? If he should give us an account of the realities he beheld there, we should not recognize the place in his description. Look at a meeting-house, or a court-house, or a jail, or a shop, or a dwelling-house, and say what that thing really is before a true gaze, and they would all go to pieces in your account of them. Men esteem truth remote, in the outskirts of the system, behind the farthest star, before Adam[29] and after the last man. In eternity there is indeed something true and sublime. But all these times and places and occasions are now and here. God himself culminates in the present moment, and will never be more divine in the lapse of all the ages. And we are enabled to apprehend[30] at all what is sublime and noble only by the perpetual instilling and drenching of the reality that surrounds us. The universe constantly and obediently answers to our conceptions; whether we travel fast or slow, the track is laid for us. Let us spend our lives in conceiving then. The poet or the artist never yet had so fair and noble a design but some of his posterity at least could accomplish it.

21. A character in The Analects, a book of philosophy with quotation attributed to Confucius. Today, we would spell his name Qu Boyu.
22. Confucius, also known as Kongzi
23. The Analects, 14.25
24. also known as *A Thousand and One Nights*, a medieval collection of Middle Eastern folktales
25. **Discern** ***(verb):*** to deduce or recognize
26. Hindu
27. uncivilized
28. Brahma, Hindu god of creation
29. In the Old Testament, according to the book of Genesis, Adam was the first man created by God.

Let us spend one day as deliberately as Nature, and not be thrown off the track by every nutshell and mosquito's wing that falls on the rails. Let us rise early and fast, or break fast, gently and without perturbation;[31] let company come and let company go, let the bells ring and the children cry — determined to make a day of it. Why should we knock under and go with the stream? Let us not be upset and overwhelmed in that terrible rapid and whirlpool called a dinner, situated in the meridian shallows. Weather this danger and you are safe, for the rest of the way is down hill. With unrelaxed nerves, with morning vigor, sail by it, looking another way, tied to the mast like Ulysses.[32] If the engine whistles, let it whistle till it is hoarse for its pains. If the bell rings, why should we run? We will consider what kind of music they are like. Let us settle ourselves, and work and wedge our feet downward through the mud and slush of opinion, and prejudice, and tradition, and delusion, and appearance, that alluvion[33] which covers the globe, through Paris and London, through New York and Boston and Concord, through Church and State, through poetry and philosophy and religion, till we come to a hard bottom and rocks in place, which we can call reality, and say, This is, and no mistake; and then begin, having a *point d'appui*,[34] below freshet[35] and frost and fire, a place where you might found a wall or a state, or set a lamp-post safely, or perhaps a gauge, not a Nilometer,[36] but a Realometer, that future ages might know how deep a freshet of shams and appearances had gathered from time to time. If you stand right fronting and face to face to a fact, you will see the sun glimmer on both its surfaces, as if it were a cimeter,[37] and feel its sweet edge dividing you through the heart and marrow, and so you will happily conclude your mortal career. Be it life or death, we crave only reality. If we are really dying, let us hear the rattle in our throats and feel cold in the extremities; if we are alive, let us go about our business.

Time is but the stream I go a-fishing in. I drink at it; but while I drink I see the sandy bottom and detect how shallow it is. Its thin current slides away, but eternity remains. I would drink deeper; fish in the sky, whose bottom is pebbly with stars. I cannot count one. I know not the first letter of the alphabet. I have always been regretting that I was not as wise as the day I was born. The intellect is a cleaver;[38] it discerns and rifts its way into the secret of things. I do not wish to be any more busy with my hands than is necessary. My head is hands and feet. I feel all my best faculties[39] concentrated in it. My instinct tells me that my head is an organ for burrowing, as some creatures use their snout and fore paws, and with it I would mine and burrow my way through these hills. I think that the richest vein is somewhere hereabouts; so by the divining-rod[40] and thin rising vapors I judge; and here I will begin to mine.

Walden by Henry David Thoreau (1854) is in the public domain.

30. **Apprehend** ***(verb):*** to grasp with understanding
31. **Perturb** ***(verb):*** to make (someone) anxious or unsettled
32. The Roman name for Odysseus, character in Homer's The Iliad and The Odyssey. In The Odyssey, Ulysses orders his men tie him to the mast of the boat so he could hear the deadly sirens sing and remain safe.
33. the flow of water (against a shore)
34. "a point of support"
35. a rising or overflowing of a stream caused by heavy rain or snowmelt
36. a gauge used to measure the rise of the Nile River in Egypt
37. Also called a scimitar, it is a sword with a curved blade associated with use in the Middle East.
38. a butcher's instrument for cutting animal meats
39. mental or physical abilities
40. a forked rod believed to indicate the presence of water or minerals below ground

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following best describes a central idea of the text?
    A. Time is fleeting and so people should live life to the fullest by experiencing everything it has to offer.
    B. People should put art and academics before work and society because work and society are meaningless.
    C. Life should be lived without complication or hurry in order to find meaning.
    D. Technology is invasive and must be stopped before it takes over all aspects of one's life.

2. PART B: Which TWO of the following quotes best support the answer to Part A?
    A. "Our life is frittered away by detail... Simplicity, simplicity, simplicity!" (Paragraph 2)
    B. "Men think that it is essential that the Nation have commerce, and export ice, and talk through a telegraph, and ride thirty miles an hour" (Paragraph 2)
    C. "Why should we live with such hurry and waste of life? We are determined to be starved before we are hungry." (Paragraph 3)
    D. "Hardly a man takes a half-hour's nap after dinner, but when he wakes he holds up his head and asks, 'What's the news?'" (Paragraph 3)
    E. "For my part, I could easily do without the post-office. I think that there are very few important communications made through it." (Paragraph 4)
    F. "Men esteem truth remote, in the outskirts of the system, behind the farthest star, before Adam and after the last man." (Paragraph 6)

3. PART A: Which of the following best describes what the word "mean" conveys, as used in paragraph 1?
    A. amazing
    B. lowly
    C. average
    D. useful

4. PART B: Which of the following phrases best supports the answer to Part A?
    A. "drive life into a corner" (Paragraph 1)
    B. "reduce it" (Paragraph 1)
    C. "of the devil or of God" (Paragraph 1)
    D. "like ants" (Paragraph 2)

5. In paragraph 2, Thoreau states, “We do not ride on the railroad; it rides upon us.” Which of the following statements best explains the figurative language used in this quote?
    A. Thoreau grieves for those whom the railroad industry has taken advantage of, specifically those who died while building it.
    B. Thoreau predicts the end of small business craftsmanship in the face of an increasingly industrialized world represented by the train.
    C. Thoreau comments on how aspects of modern life, such as the train, control the lives of the people who use them, rather than the other way around.
    D. Thoreau denounces the use of public transportation, arguing that is pointless if it cannot take one exactly where one chooses.

6. How does the author respond to people’s interest in the news, as shown in paragraph 3?
    A. He is saddened by the people’s interest in gossip and tragedy rather than “real” news from around the world.
    B. He mocks the news and the people who obsess over it, implying that they are blind to life and reality because of their news obsession.
    C. He becomes angry because their obsession with the news prevents them from recognizing when something important, such as a fire, is actually happening nearby.
    D. He mocks the news and the people who obsess over it, suggesting that they don’t actually understand what they are reading.

7. How does the story of the prince in paragraph 6 contribute to the development of ideas in the passage?
    A. The story supports Thoreau’s idea that one can see the “reality” of things when one looks past superficial circumstances.
    B. The story supports Thoreau’s argument that superficial titles are just distractions and have nothing to do with who a person really is.
    C. Thoreau praises the story because the prince’s childhood of living in the forest shows how going to the woods in order to “live deliberately” can be beneficial.
    D. Thoreau uses the story to argue that what one thinks to be the truth can actually be false, and so there is no such thing as “reality.”

8. Explain Thoreau's figurative use of the word “burrowing” in the final paragraph. What is he digging for? Cite evidence from the text in your answer.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Why did Thoreau resist change? Use evidence from this text, your own experience, and other literature, art, or history in your answer.

2. Do you believe that Thoreau's writing is still relevant today? Explain your answer.

3. In the context of this text, what does it mean to feel alone? Why did Thoreau seek solitude? Cite evidence from this text, your own experience, and other literature or art in your answer.

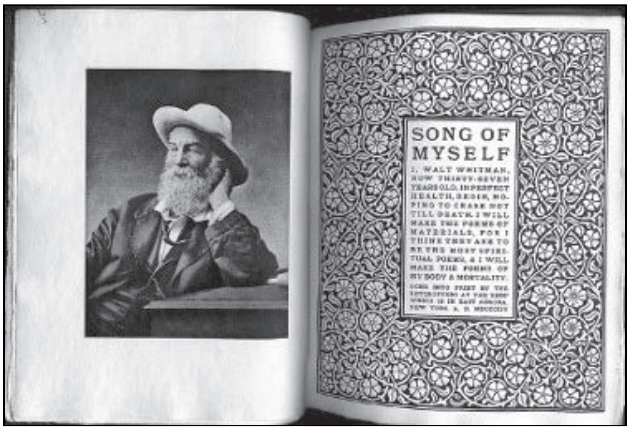
Name: _____ Class: _____

Excerpts from 'Song of Myself': 1, 2, 6, 52

By Walt Whitman
1855

Walt Whitman (1819-1892) was an American poet, essayist, and journalist. Whitman is considered one of the most influential poets of his time and also recognized as the father of free verse. His epic, "Song of Myself" contains 52 verses and is regarded as one of the greatest depictions of the American experience. The poem was written in a time of unrest within America right before the Civil War, and also has strong influence from the transcendental movement. As you read, keep this in mind and pay attention to the themes and ideas that emerge.

1



"Song of Myself by Walt Whitman, Roycroft 1906" by William Creswell is licensed under CC BY 2.0.

[1] I Celebrate myself, and sing myself,
And what I assume[1] you shall assume,
For every atom belonging to me as good belongs to you.

I loafe and invite my soul,
I lean and loafe at my ease observing a spear of summer grass.

My tongue, every atom of my blood, form'd from this soil, this air,
Born here of parents born here from parents the same, and their parents the same,
I, now thirty-seven years old in perfect health begin,
Hoping to cease not till death.

Creeds and schools[2] in abeyance,
Retiring back a while sufficed at what they are, but never forgotten,
I harbor[3] for good or bad, I permit to speak at every hazard,
Nature without check with original energy.

2

Houses and rooms are full of perfumes.... the shelves are crowded with perfumes,
I breathe the fragrance myself, and know it and like it,
The distillation[4] would intoxicate me also, but I shall not let it.

1. **Assume** ***(verb):*** to believe; to take on (character, quality, mode of life, beliefs)
2. Creeds and schools refer to the formal institutions in society, such as religion, law, politics etc.
3. **Harbor** ***(verb):*** to contain
4. purification; extraction of essential or important aspects of something

The atmosphere is not a perfume.... it has no taste of the distillation.... it is odorless,
It is for my mouth forever.... I am in love with it,
I will go to the bank by the wood and become undisguised and naked,
I am mad[5] for it to be in contact with me.

The smoke of my own breath,
Echoes, ripples, and buzzed whispers.... loveroot, silkthread, crotch and vine,[6]
My respiration and inspiration.... the beating of my heart.... the passing of blood and air through my lungs,
The sniff of green leaves and dry leaves, and of the shore and dark-colored sea-rocks, and of hay in the barn,
The sound of the belched words of my voice.... words loosed to the eddies[7] of the wind,

A few light kisses.... a few embraces.... reaching around of arms,
The play of shine and shade on the trees as the supple boughs[8] wag,
The delight alone or in the rush of the streets, or along the fields and hill-sides,
The feeling of health.... the full-noon trill[9].... the song of me rising from bed and meeting the sun.

Have you reckoned[10] a thousand acres much? Have you reckoned the earth much?
Have you practiced so long to learn to read?
Have you felt so proud to get at the meaning of poems?

Stop this day and night with me and you shall possess the origin of all poems,
You shall possess the good of the earth and sun.... there are millions of suns left,
You shall no longer take things at second or third hand.... nor look through the eyes of the dead, nor feed on the spectres[11] in books,
You shall not look through my eyes either, nor take things from me,
You shall listen to all sides and filter them from yourself.

6

A child said *What is the grass?* fetching it to me with full hands;
How could I answer the child? I do not know what it is any more than he.

I guess it must be the flag of my disposition, out of hopeful green stuff woven.

Or I guess it is the handkerchief of the Lord,
A scented gift and remembrancer[12] designedly[13] dropt,
Bearing the owner's name someway in the corners, that we may see and remark, and say *Whose?*

5. overcome by desire; excessively fond
6. The speaker is conveying his overwhelming need to physically connect with nature.
7. circular movements; swirls
8. tree branches
9. vibrating sound, such as laughter or birdsong
10. **Reckon** ***(verb):*** to think of or consider
11. ghosts or spirits
12. one who is tasked with reminding or chronicling

Or I guess the grass is itself a child, the produced babe of the vegetation.

Or I guess it is a uniform hieroglyphic,
And it means, Sprouting alike in broad zones and narrow zones,
Growing among black folks as among white,
Kanuck, Tuckahoe, Congressman, Cuff, I give them the same, I receive then the same.

And now it seems to me the beautiful uncut hair of graves.

Tenderly will I use you curling grass,
It may be you transpire[14] from the breasts of young men,
It may be you are from old people, or from offspring taken,
It may be if I had known them I would have loved them, soon out of their mother's laps,
And here you are the mothers' laps.

This grass is very dark to be from the white heads of old mothers,
Darker than the colorless beards of old men,
Dark to come from under the faint red roofs of mouths.

O I perceive after all so many uttering tongues,
And I perceive they do not come from the roofs of mouths for nothing.

I wish I could translate the hints about the dead young men and women,
And the hints about old men and mothers, and the offspring taken soon out of their laps.
What do you think has become of the young and old men?
And what do you think has become of the women and children?

They are alive and well somewhere,
The smallest sprout shows there is really no death,
And if ever there was it led forward life, and does not wait at the end to arrest[15] it,
And ceas'd the moment life appear'd.

All goes onward and outward, nothing collapses,
And to die is different from what any one supposed, and luckier.

52

The spotted hawk swoops by and accuses me, he complains of my gab[16] and my loitering.

I too am not a bit tamed, I too am untranslatable,
I sound my barbaric yawp[17] over the roofs of the world.

13. deliberate for a specific purpose or effect
14. **Transpire** ***(verb):*** to occur
15. **Arrest** ***(verb):*** to stop
16. chatter
17. harsh cry

The last scud[18] of day holds back for me,
It flings my likeness after the rest and true as any on the shadow'd wilds,
It coaxes me to the vapor and the dusk.

I depart as air, I shake my white locks at the runaway sun,
I effuse[19] my flesh in eddies, and drift it in lacy jags.

I bequeath[20] myself to the dirt to grow from the grass I love,
If you want me again look for me under your boot-soles.

You will hardly know who I am or what I mean,
But I shall be good health to you nevertheless,
And filter and fibre[21] your blood.

Failing to fetch me at first keep encouraged,
Missing me one place search another,
I stop somewhere waiting for you.

Excerpts from 'Song of Myself': 1, 2, 6, 52 by Walt Whitman is in the public domain.

18. flash; swift movement
19. **Effuse** ***(verb):*** to pour or flow
20. **Bequeath** ***(verb):*** to hand down
21. As a noun, fibre is matter or material; it also means an essential character or quality.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following best identifies one of the themes of the poem?
    A. One must abandon all material objects to truly enjoy life.
    B. All things and people are interconnected.
    C. Real knowledge is gained from books and formal education.
    D. Formal institutions such as religion and law have no purpose in society.

2. PART B: Which of the following quotes best supports the answer to Part A?
    A. “For every atom belonging to me as good belongs to you.” (Stanza 1)
    B. “Creeds and schools in abeyance, / Retiring back a while sufficed at what they are, but never forgotten” (Stanza 4)
    C. “Nature without check with original energy.” (Stanza 4)
    D. “I will go to the bank by the wood and become undisguised and naked” (Stanza 6)

3. PART A: What does the word “loafe” mean as it is used in stanza 2?
    A. to begin
    B. to sing
    C. to relax
    D. to examine

4. PART B: Which phrase best supports the answer to Part A?
    A. “I Celebrate myself, and sing myself” (Stanza 1)
    B. “invite my soul” (Stanza 2)
    C. “at my ease” (Stanza 2)
    D. “observing a spear of summer grass” (Stanza 2)

5. PART A: How does the symbol of grass develop the theme of section 6?
    A. It reveals that God is in everything, whether that thing is aware of God's existence.
    B. It reveals that life and death are cyclical and connect everything.
    C. It reveals that nature is resilient and indifferent to mankind.
    D. It reveals that unlearned children understand the universe better than learned adults.

6. PART B: Which quote from the text best supports the answer to Part A?
    A. “A child said What is the grass? fetching it to me with full hands; / How could I answer the child? I do not know what it is any more than he.” (Stanza 11)
    B. “Or I guess it is the handkerchief of the Lord, / A scented gift and remembrancer designedly dropt” (Stanza 13)
    C. “What do you think has become of the young and old men? / And what do you think has become of the women and children?” (Stanza 20)
    D. “They are alive and well somewhere, / The smallest sprout shows there is really no death, / And if ever there was it led forward life” (Stanza 21)

7. What is the author’s likely purpose in having the speaker address “you” throughout the poem?
    A. to urge the reader to learn with and identify with the speaker
    B. to depart from the more traditional approach of speaking about one’s own life
    C. to reveal that the speaker and the reader are born with shared knowledge
    D. to allow the speaker to brag about their knowledge to the reader

8. How does the author use imagery from section 52 to develop the poem’s themes? Cite evidence from multiple sections of the poem in your response.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Some people have considered this poem to be “egotistical.” Do you agree with this view? Why or why not?

2. Think about the state of America at the time Whitman wrote “Song of Myself.” How do the themes of the poem relate to the times in which it was written? Are these themes still relevant today? Why or why not?

3. Identity is said to be one of the major themes within the poem. What identities does the speaker reveal? What about identity is significant about the time in which the poem was written?

Name: _____ Class: _____

The Open Boat

By Stephen Crane
1901

Stephen Crane (1871-1900) was an American author and journalist. His best known work is the novel The Red Badge of Courage*. His short story "The Open Boat" is based on his own experiences: in 1896, en route to Cuba, his vessel the SS Commodore sank off the coast of Florida, and he and a few other survivors were left adrift in a dinghy (boat). As you read, take notes on how the men survive and how the author depicts nature, specifically the sea, in the story.*

A Tale intended to be after the Fact. Being the Experience of Four Men from the Sunk Steamer 'Commodore'



"Dinghy Dreams" by Cocoabiscuit is licensed under CC BY-NC-ND 2.0

I

[1] None of them knew the color of the sky. Their eyes glanced level, and were fastened upon the waves that swept toward them. These waves were of the hue of slate,[1] save for the tops, which were of foaming white, and all of the men knew the colors of the sea. The horizon narrowed and widened, and dipped and rose, and at all times its edge was jagged with waves that seemed thrust up in points like rocks.

Many a man ought to have a bath-tub larger than the boat which here rode upon the sea. These waves were most wrongfully and barbarously abrupt and tall, and each froth-top was a problem in small boat navigation.

The cook squatted in the bottom and looked with both eyes at the six inches of gunwale[2] which separated him from the ocean. His sleeves were rolled over his fat forearms, and the two flaps of his unbuttoned vest dangled as he bent to bail out the boat. Often he said: "Gawd! That was a narrow clip." As he remarked it he invariably gazed eastward over the broken sea.

The oiler, steering with one of the two oars in the boat, sometimes raised himself suddenly to keep clear of water that swirled in over the stern.[3] It was a thin little oar and it seemed often ready to snap.

[5] The correspondent,[4] pulling at the other oar, watched the waves and wondered why he was there.

1. **Slate** ***(noun):*** a gray, green, or bluish metamorphic rock easily split into smooth, flat pieces
2. **Gunwale** ***(noun):*** the upper edge of a boat's side
3. **Stern** ***(noun):*** the rearmost part of a boat
4. Referring to a war correspondent, as that was Crane's job when the SS Commodore sunk

The injured captain, lying in the bow,[5] was at this time buried in that profound dejection and indifference which comes, temporarily at least, to even the bravest and most enduring when, willy nilly, the firm fails, the army loses, the ship goes down. The mind of the master of a vessel is rooted deep in the timbers of her, though he commanded for a day or a decade, and this captain had on him the stern impression of a scene in the greys of dawn of seven turned faces, and later a stump of a top-mast with a white ball on it that slashed to and fro at the waves, went low and lower, and down. Thereafter there was something strange in his voice. Although steady, it was deep with mourning, and of a quality beyond oration or tears.

"Keep 'er a little more south, Billie," said he.

"'A little more south,' sir," said the oiler in the stern.

A seat in this boat was not unlike a seat upon a bucking bronco, and, by the same token, a bronco is not much smaller. The craft pranced and reared, and plunged like an animal. As each wave came, and she rose for it, she seemed like a horse making at a fence outrageously high. The manner of her scramble over these walls of water is a mystic thing, and, moreover, at the top of them were ordinarily these problems in white water, the foam racing down from the summit[6] of each wave, requiring a new leap, and a leap from the air. Then, after scornfully bumping a crest,[7] she would slide, and race, and splash down a long incline, and arrive bobbing and nodding in front of the next menace.

[10] A singular disadvantage of the sea lies in the fact that after successfully surmounting one wave you discover that there is another behind it just as important and just as nervously anxious to do something effective in the way of swamping boats. In a ten-foot dingey[8] one can get an idea of the resources of the sea in the line of waves that is not probable to the average experience which is never at sea in a dingey. As each salty wall of water approached, it shut all else from the view of the men in the boat, and it was not difficult to imagine that this particular wave was the final outburst of the ocean, the last effort of the grim water. There was a terrible grace in the move of the waves, and they came in silence, save for the snarling of the crests.

In the wan[9] light, the faces of the men must have been grey. Their eyes must have glinted in strange ways as they gazed steadily astern. Viewed from a balcony, the whole thing would doubtlessly have been weirdly picturesque. But the men in the boat had no time to see it, and if they had had leisure there were other things to occupy their minds. The sun swung steadily up the sky, and they knew it was broad day because the color of the sea changed from slate to emerald-green, streaked with amber lights, and the foam was like tumbling snow. The process of the breaking day was unknown to them. They were aware only of this effect upon the color of the waves that rolled toward them.

In disjointed sentences the cook and the correspondent argued as to the difference between a life-saving station and a house of refuge. The cook had said: "There's a house of refuge just north of the Mosquito Inlet Light, and as soon as they see us, they'll come off in their boat and pick us up."

"As soon as who see us?" said the correspondent.

5. **Bow** ***(noun):*** the front end of a boat
6. **Summit** ***(noun):*** the top or highest point of something
7. **Crest** ***(noun):*** the top or highest point of something
8. Alternate spelling of a “dinghy” – a small boat used for recreation or as a lifeboat
9. **Wan** ***(adjective):*** pale and weak

"The crew," said the cook.

[15] "Houses of refuge don't have crews," said the correspondent. "As I understand them, they are only places where clothes and grub are stored for the benefit of shipwrecked people. They don't carry crews."

"Oh, yes, they do," said the cook.

"No, they don't," said the correspondent.

"Well, we're not there yet, anyhow," said the oiler, in the stern.

"Well," said the cook, "perhaps it's not a house of refuge that I'm thinking of as being near Mosquito Inlet Light. Perhaps it's a life-saving station."

[20] "We're not there yet," said the oiler, in the stern.

II

As the boat bounced from the top of each wave, the wind tore through the hair of the hatless men, and as the craft plopped her stern down again the spray slashed past them. The crest of each of these waves was a hill, from the top of which the men surveyed, for a moment, a broad tumultuous[10] expanse, shining and wind-riven. It was probably splendid. It was probably glorious, this play of the free sea, wild with lights of emerald and white and amber.

"Bully good thing it's an on-shore wind," said the cook. "If not, where would we be? Wouldn't have a show."

"That's right," said the correspondent.

The busy oiler nodded his assent.

[25] Then the captain, in the bow, chuckled in a way that expressed humour, contempt, tragedy, all in one. "Do you think we've got much of a show now, boys?" said he.

Whereupon the three were silent, save for a trifle of hemming and hawing. To express any particular optimism at this time they felt to be childish and stupid, but they all doubtless possessed this sense of the situation in their mind. A young man thinks doggedly[11] at such times. On the other hand, the ethics of their condition was decidedly against any open suggestion of hopelessness. So they were silent.

"Oh, well," said the captain, soothing his children, "we'll get ashore all right."

But there was that in his tone which made them think, so the oiler quoth: "Yes! If this wind holds!"

The cook was bailing: "Yes! If we don't catch hell in the surf."

10. **Tumultuous** ***(adjective):*** disorderly, stormy, or violent
11. **Dogged** ***(adjective):*** stubbornly determined

[30] Canton flannel gulls flew near and far. Sometimes they sat down on the sea, near patches of brown sea-weed that rolled over the waves with a movement like carpets on a line in a gale. The birds sat comfortably in groups, and they were envied by some in the dingey, for the wrath of the sea was no more to them than it was to a covey[12] of prairie chickens a thousand miles inland. Often they came very close and stared at the men with black bead-like eyes. At these times they were uncanny and sinister in their unblinking scrutiny, and the men hooted angrily at them, telling them to be gone. One came, and evidently decided to alight on the top of the captain's head. The bird flew parallel to the boat and did not circle, but made short sidelong jumps in the air in chicken-fashion. His black eyes were wistfully fixed upon the captain's head. "Ugly brute," said the oiler to the bird. "You look as if you were made with a jack-knife." The cook and the correspondent swore darkly at the creature. The captain naturally wished to knock it away with the end of the heavy painter;[13] but he did not dare do it, because anything resembling an emphatic[14] gesture would have capsized this freighted boat, and so with his open hand, the captain gently and carefully waved the gull away. After it had been discouraged from the pursuit the captain breathed easier on account of his hair, and others breathed easier because the bird struck their minds at this time as being somehow gruesome and ominous.

In the meantime the oiler and the correspondent rowed. And also they rowed.

They sat together in the same seat, and each rowed an oar. Then the oiler took both oars; then the correspondent took both oars; then the oiler; then the correspondent. They rowed and they rowed. The very ticklish part of the business was when the time came for the reclining one in the stern to take his turn at the oars. By the very last star of truth, it is easier to steal eggs from under a hen than it was to change seats in the dingey. First the man in the stern slid his hand along the thwart[15] and moved with care, as if he were of Sèvres.[16] Then the man in the rowing seat slid his hand along the other thwart. It was all done with the most extraordinary care. As the two sidled past each other, the whole party kept watchful eyes on the coming wave, and the captain cried: "Look out now! Steady there!"

The brown mats of sea-weed that appeared from time to time were like islands, bits of earth. They were travelling, apparently, neither one way nor the other. They were, to all intents, stationary. They informed the men in the boat that it was making progress slowly toward the land.

The captain, rearing cautiously in the bow, after the dingey soared on a great swell, said that he had seen the lighthouse at Mosquito Inlet. Presently the cook remarked that he had seen it. The correspondent was at the oars then, and for some reason he too wished to look at the lighthouse, but his back was toward the far shore and the waves were important, and for some time he could not seize an opportunity to turn his head. But at last there came a wave more gentle than the others, and when at the crest of it he swiftly scoured the western horizon.

[35] "See it?" said the captain.

"No," said the correspondent slowly, "I didn't see anything."

"Look again," said the captain. He pointed. "It's exactly in that direction."

12. **Covey** ***(noun):*** a small flock of birds
13. **Painter** ***(noun):*** a rope attached to the front of a boat to tying to a quay
14. **Emphatic** ***(adjective):*** expressing something forcibly and clearly; with great emphasis
15. a structural crosspiece sometimes forming a seat for a rower in a boat
16. “of Sèvres” refers to a type of French porcelain

At the top of another wave, the correspondent did as he was bid, and this time his eyes chanced on a small still thing on the edge of the swaying horizon. It was precisely like the point of a pin. It took an anxious eye to find a lighthouse so tiny.

"Think we'll make it, captain?"

[40] "If this wind holds and the boat don't swamp, we can't do much else," said the captain.

The little boat, lifted by each towering sea, and splashed viciously by the crests, made progress that in the absence of sea-weed was not apparent to those in her. She seemed just a wee thing wallowing, miraculously top-up, at the mercy of five oceans. Occasionally, a great spread of water, like white flames, swarmed into her.

"Bail her, cook," said the captain serenely.

"All right, captain," said the cheerful cook.

III

It would be difficult to describe the subtle brotherhood of men that was here established on the seas. No one said that it was so. No one mentioned it. But it dwelt in the boat, and each man felt it warm him. They were a captain, an oiler, a cook, and a correspondent, and they were friends, friends in a more curiously iron-bound degree than may be common. The hurt captain, lying against the water-jar in the bow, spoke always in a low voice and calmly, but he could never command a more ready and swiftly obedient crew than the motley[17] three of the dingey. It was more than a mere recognition of what was best for the common safety. There was surely in it a quality that was personal and heartfelt. And after this devotion to the commander of the boat there was this comradeship that the correspondent, for instance, who had been taught to be cynical of men, knew even at the time was the best experience of his life. But no one said that it was so. No one mentioned it.

[45] "I wish we had a sail," remarked the captain. "We might try my overcoat on the end of an oar and give you two boys a chance to rest." So the cook and the correspondent held the mast and spread wide the overcoat. The oiler steered, and the little boat made good way with her new rig. Sometimes the oiler had to scull[18] sharply to keep a sea from breaking into the boat, but otherwise sailing was a success.

Meanwhile the lighthouse had been growing slowly larger. It had now almost assumed color, and appeared like a little grey shadow on the sky. The man at the oars could not be prevented from turning his head rather often to try for a glimpse of this little grey shadow.

At last, from the top of each wave the men in the tossing boat could see land. Even as the lighthouse was an upright shadow on the sky, this land seemed but a long black shadow on the sea. It certainly was thinner than paper. "We must be about opposite New Smyrna," said the cook, who had coasted this shore often in schooners.[19] "Captain, by the way, I believe they abandoned that life-saving station there about a year ago."

17. **Motley** ***(adjective):*** diverse (and sometimes poorly organized)
18. **Scull** ***(verb):*** to row or propel a boat
19. **Schooners** ***(noun):*** a type of sailing ship with two or more masts

"Did they?" said the captain.

The wind slowly died away. The cook and the correspondent were not now obliged to slave in order to hold high the oar. But the waves continued their old impetuous[20] swooping at the dingey, and the little craft, no longer under way, struggled woundily over them. The oiler or the correspondent took the oars again.

[50] Shipwrecks are à propos of nothing. If men could only train for them and have them occur when the men had reached pink condition, there would be less drowning at sea. Of the four in the dingey none had slept any time worth mentioning for two days and two nights previous to embarking in the dingey, and in the excitement of clambering about the deck of a foundering ship they had also forgotten to eat heartily.

For these reasons, and for others, neither the oiler nor the correspondent was fond of rowing at this time. The correspondent wondered ingenuously how in the name of all that was sane could there be people who thought it amusing to row a boat. It was not an amusement; it was a diabolical punishment, and even a genius of mental aberrations could never conclude that it was anything but a horror to the muscles and a crime against the back. He mentioned to the boat in general how the amusement of rowing struck him, and the weary-faced oiler smiled in full sympathy. Previously to the foundering, by the way, the oiler had worked double-watch in the engine-room of the ship.

"Take her easy, now, boys," said the captain. "Don't spend yourselves. If we have to run a surf you'll need all your strength, because we'll sure have to swim for it. Take your time."

Slowly the land arose from the sea. From a black line it became a line of black and a line of white, trees and sand. Finally, the captain said that he could make out a house on the shore. "That's the house of refuge, sure," said the cook. "They'll see us before long, and come out after us."

The distant lighthouse reared high. "The keeper ought to be able to make us out now, if he's looking through a glass,"[21] said the captain. "He'll notify the life-saving people."

[55] "None of those other boats could have got ashore to give word of the wreck," said the oiler, in a low voice. "Else the life-boat would be out hunting us."

Slowly and beautifully the land loomed out of the sea. The wind came again. It had veered from the north-east to the south-east. Finally, a new sound struck the ears of the men in the boat. It was the low thunder of the surf on the shore. "We'll never be able to make the lighthouse now," said the captain. "Swing her head a little more north, Billie," said he.

"'A little more north,' sir," said the oiler.

Whereupon the little boat turned her nose once more down the wind, and all but the oarsman watched the shore grow. Under the influence of this expansion doubt and direful apprehension was leaving the minds of the men. The management of the boat was still most absorbing, but it could not prevent a quiet cheerfulness. In an hour, perhaps, they would be ashore.

20. **Impetuous** ***(adjective):*** moving forcefully or rapidly
21. A spyglass, or handheld telescope

Their backbones had become thoroughly used to balancing in the boat, and they now rode this wild colt of a dingey like circus men. The correspondent thought that he had been drenched to the skin, but happening to feel in the top pocket of his coat, he found therein eight cigars. Four of them were soaked with sea-water; four were perfectly scatheless. After a search, somebody produced three dry matches, and thereupon the four waifs rode impudently[22] in their little boat, and with an assurance of an impending rescue shining in their eyes, puffed at the big cigars and judged well and ill of all men. Everybody took a drink of water.

IV

[60] "Cook," remarked the captain, "there don't seem to be any signs of life about your house of refuge."

"No," replied the cook. "Funny they don't see us!"

A broad stretch of lowly coast lay before the eyes of the men. It was of dunes topped with dark vegetation. The roar of the surf was plain, and sometimes they could see the white lip of a wave as it spun up the beach. A tiny house was blocked out black upon the sky. Southward, the slim lighthouse lifted its little grey length.

Tide, wind, and waves were swinging the dingey northward. "Funny they don't see us," said the men.

The surf's roar was here dulled, but its tone was, nevertheless, thunderous and mighty. As the boat swam over the great rollers, the men sat listening to this roar. "We'll swamp sure," said everybody.

[65] It is fair to say here that there was not a life-saving station within twenty miles in either direction, but the men did not know this fact, and in consequence they made dark and opprobrious[23] remarks concerning the eyesight of the nation's life-savers. Four scowling men sat in the dingey and surpassed records in the invention of epithets.[24]

"Funny they don't see us."

The light-heartedness of a former time had completely faded. To their sharpened minds it was easy to conjure pictures of all kinds of incompetency and blindness and, indeed, cowardice. There was the shore of the populous land, and it was bitter and bitter to them that from it came no sign.

"Well," said the captain, ultimately, "I suppose we'll have to make a try for ourselves. If we stay out here too long, we'll none of us have strength left to swim after the boat swamps."

And so the oiler, who was at the oars, turned the boat straight for the shore. There was a sudden tightening of muscles. There was some thinking.

[70] "If we don't all get ashore — " said the captain. "If we don't all get ashore, I suppose you fellows know where to send news of my finish?"

22. **Impudent** ***(adjective):*** showing little or no respect
23. **Opprobrious** ***(adjective):*** expressing scorn or criticism
24. **Epithet** ***(noun):*** an insult or term of abuse

They then briefly exchanged some addresses and admonitions.[25] As for the reflections of the men, there was a great deal of rage in them. Perchance they might be formulated thus: "If I am going to be drowned — if I am going to be drowned — if I am going to be drowned, why, in the name of the seven mad gods who rule the sea, was I allowed to come thus far and contemplate sand and trees? Was I brought here merely to have my nose dragged away as I was about to nibble the sacred cheese of life? It is preposterous.[26] If this old ninny-woman, Fate, cannot do better than this, she should be deprived of the management of men's fortunes. She is an old hen who knows not her intention. If she has decided to drown me, why did she not do it in the beginning and save me all this trouble? The whole affair is absurd.... But no, she cannot mean to drown me. She dare not drown me. She cannot drown me. Not after all this work." Afterward the man might have had an impulse to shake his fist at the clouds: "Just you drown me, now, and then hear what I call you!"

The billows[27] that came at this time were more formidable. They seemed always just about to break and roll over the little boat in a turmoil of foam. There was a preparatory and long growl in the speech of them. No mind unused to the sea would have concluded that the dingey could ascend these sheer heights in time. The shore was still afar. The oiler was a wily surfman. "Boys," he said swiftly, "she won't live three minutes more, and we're too far out to swim. Shall I take her to sea again, captain?"

"Yes! Go ahead!" said the captain.

This oiler, by a series of quick miracles, and fast and steady oarsmanship, turned the boat in the middle of the surf and took her safely to sea again.

[75] There was a considerable silence as the boat bumped over the furrowed sea to deeper water. Then somebody in gloom spoke. "Well, anyhow, they must have seen us from the shore by now."

The gulls went in slanting flight up the wind toward the grey desolate east. A squall,[28] marked by dingy clouds, and clouds brick-red, like smoke from a burning building, appeared from the south-east.

"What do you think of those life-saving people? Ain't they peaches?"

"Funny they haven't seen us."

"Maybe they think we're out here for sport! Maybe they think we're fishin'. Maybe they think we're damned fools."

[80] It was a long afternoon. A changed tide tried to force them southward, but wind and wave said northward. Far ahead, where coast-line, sea, and sky formed their mighty angle, there were little dots which seemed to indicate a city on the shore.

"St. Augustine?"

The captain shook his head. "Too near Mosquito Inlet."

25. **Admonition** ***(noun):*** gentle reproof; counsel, advice, or caution
26. **Preposterous** ***(adjective):*** absurd
27. great surging waves
28. **Squall** ***(noun):*** a sudden strong wind or storm

And the oiler rowed, and then the correspondent rowed. Then the oiler rowed. It was a weary business. The human back can become the seat of more aches and pains than are registered in books for the composite anatomy of a regiment. It is a limited area, but it can become the theatre of innumerable[29] muscular conflicts, tangles, wrenches, knots, and other comforts.

"Did you ever like to row, Billie?" asked the correspondent.

[85] "No," said the oiler. "Hang it."

When one exchanged the rowing-seat for a place in the bottom of the boat, he suffered a bodily depression that caused him to be careless of everything save an obligation to wiggle one finger. There was cold sea-water swashing to and fro in the boat, and he lay in it. His head, pillowed on a thwart, was within an inch of the swirl of a wave crest, and sometimes a particularly obstreperous[30] sea came in-board and drenched him once more. But these matters did not annoy him. It is almost certain that if the boat had capsized he would have tumbled comfortably out upon the ocean as if he felt sure that it was a great soft mattress.

"Look! There's a man on the shore!"

"Where?"

"There! See 'im? See 'im?"

[90] "Yes, sure! He's walking along."

"Now he's stopped. Look! He's facing us!"

"He's waving at us!"

"So he is! By thunder!"

"Ah, now we're all right! Now we're all right! There'll be a boat out here for us in half-an-hour."

[95] "He's going on. He's running. He's going up to that house there."

The remote beach seemed lower than the sea, and it required a searching glance to discern the little black figure. The captain saw a floating stick and they rowed to it. A bath-towel was by some weird chance in the boat, and, tying this on the stick, the captain waved it. The oarsman did not dare turn his head, so he was obliged to ask questions.

"What's he doing now?"

"He's standing still again. He's looking, I think.... There he goes again. Towards the house.... Now he's stopped again."

"Is he waving at us?"

29. **Innumerable** ***(adjective):*** incapable of being counted
30. **Obstreperous** ***(adjective):*** resisting control or restraint; unruly

[100] "No, not now! he was, though."

"Look! There comes another man!"

"He's running."

"Look at him go, would you."

"Why, he's on a bicycle. Now he's met the other man. They're both waving at us. Look!"

[105] "There comes something up the beach."

"What the devil is that thing?"

"Why, it looks like a boat."

"Why, certainly it's a boat."

"No, it's on wheels."

[110] "Yes, so it is. Well, that must be the life-boat. They drag them along shore on a wagon."

"That's the life-boat, sure."

"No, by — it's — it's an omnibus."

"I tell you it's a life-boat."

"It is not! It's an omnibus. I can see it plain. See? One of these big hotel omnibuses."

[115] "By thunder, you're right. It's an omnibus, sure as fate. What do you suppose they are doing with an omnibus? Maybe they are going around collecting the life-crew, hey?"

"That's it, likely. Look! There's a fellow waving a little black flag. He's standing on the steps of the omnibus. There come those other two fellows. Now they're all talking together. Look at the fellow with the flag. Maybe he ain't waving it."

"That ain't a flag, is it? That's his coat. Why certainly, that's his coat."

"So it is. It's his coat. He's taken it off and is waving it around his head. But would you look at him swing it."

"Oh, say, there isn't any life-saving station there. That's just a winter resort hotel omnibus that has brought over some of the boarders to see us drown."

[120] "What's that idiot with the coat mean? What's he signaling, anyhow?"

"It looks as if he were trying to tell us to go north. There must be a life-saving station up there."

"No! He thinks we're fishing. Just giving us a merry hand. See? Ah, there, Willie."

"Well, I wish I could make something out of those signals. What do you suppose he means?"

"He don't mean anything. He's just playing."

[125] "Well, if he'd just signal us to try the surf again, or to go to sea and wait, or go north, or go south, or go to hell — there would be some reason in it. But look at him. He just stands there and keeps his coat revolving like a wheel. The ass!"

"There come more people."

"Now there's quite a mob. Look! Isn't that a boat?"

"Where? Oh, I see where you mean. No, that's no boat."

"That fellow is still waving his coat."

[130] "He must think we like to see him do that. Why don't he quit it? It don't mean anything."

"I don't know. I think he is trying to make us go north. It must be that there's a life-saving station there somewhere."

"Say, he ain't tired yet. Look at 'im wave."

"Wonder how long he can keep that up. He's been revolving his coat ever since he caught sight of us. He's an idiot. Why aren't they getting men to bring a boat out? A fishing boat — one of those big yawls — could come out here all right. Why don't he do something?"

"Oh, it's all right, now."

[135] "They'll have a boat out here for us in less than no time, now that they've seen us."

A faint yellow tone came into the sky over the low land. The shadows on the sea slowly deepened. The wind bore coldness with it, and the men began to shiver.

"Holy smoke!" said one, allowing his voice to express his impious[31] mood, "if we keep on monkeying out here! If we've got to flounder out here all night!"

"Oh, we'll never have to stay here all night! Don't you worry. They've seen us now, and it won't be long before they'll come chasing out after us."

The shore grew dusky. The man waving a coat blended gradually into this gloom, and it swallowed in the same manner the omnibus and the group of people. The spray, when it dashed uproariously over the side, made the voyagers shrink and swear like men who were being branded.

[140] "I'd like to catch the chump who waved the coat. I feel like soaking him one, just for luck."

31. **Impious** ***(adjective):*** not religious; lacking reverence for God

"Why? What did he do?"

"Oh, nothing, but then he seemed so damned cheerful."

In the meantime the oiler rowed, and then the correspondent rowed, and then the oiler rowed. Grey-faced and bowed forward, they mechanically, turn by turn, plied the leaden oars. The form of the lighthouse had vanished from the southern horizon, but finally a pale star appeared, just lifting from the sea. The streaked saffron[32] in the west passed before the all-merging darkness, and the sea to the east was black. The land had vanished, and was expressed only by the low and drear thunder of the surf.

"If I am going to be drowned — if I am going to be drowned — if I am going to be drowned, why, in the name of the seven mad gods who rule the sea, was I allowed to come thus far and contemplate sand and trees? Was I brought here merely to have my nose dragged away as I was about to nibble the sacred cheese of life?"

[145] The patient captain, drooped over the water-jar, was sometimes obliged to speak to the oarsman.

"Keep her head up! Keep her head up!"

"'Keep her head up,' sir." The voices were weary and low.

This was surely a quiet evening. All save the oarsman lay heavily and listlessly in the boat's bottom. As for him, his eyes were just capable of noting the tall black waves that swept forward in a most sinister silence, save for an occasional subdued growl of a crest.

The cook's head was on a thwart, and he looked without interest at the water under his nose. He was deep in other scenes. Finally he spoke. "Billie," he murmured, dreamfully, "what kind of pie do you like best?"

V

[150] "Pie," said the oiler and the correspondent, agitatedly. "Don't talk about those things, blast you!"

"Well," said the cook, "I was just thinking about ham sandwiches, and — "

A night on the sea in an open boat is a long night. As darkness settled finally, the shine of the light, lifting from the sea in the south, changed to full gold. On the northern horizon a new light appeared, a small bluish gleam on the edge of the waters. These two lights were the furniture of the world. Otherwise there was nothing but waves.

32. a yellowish-orange color

Two men huddled in the stern, and distances were so magnificent in the dingey that the rower was enabled to keep his feet partly warmed by thrusting them under his companions. Their legs indeed extended far under the rowing-seat until they touched the feet of the captain forward. Sometimes, despite the efforts of the tired oarsman, a wave came piling into the boat, an icy wave of the night, and the chilling water soaked them anew. They would twist their bodies for a moment and groan, and sleep the dead sleep once more, while the water in the boat gurgled about them as the craft rocked.

The plan of the oiler and the correspondent was for one to row until he lost the ability, and then arouse the other from his sea-water couch in the bottom of the boat.

[155] The oiler plied the oars until his head drooped forward, and the overpowering sleep blinded him. And he rowed yet afterward. Then he touched a man in the bottom of the boat, and called his name. "Will you spell me for a little while?" he said, meekly.

"Sure, Billie," said the correspondent, awakening and dragging himself to a sitting position. They exchanged places carefully, and the oiler, cuddling down in the sea-water at the cook's side, seemed to go to sleep instantly.

The particular violence of the sea had ceased. The waves came without snarling. The obligation of the man at the oars was to keep the boat headed so that the tilt of the rollers would not capsize her, and to preserve her from filling when the crests rushed past. The black waves were silent and hard to be seen in the darkness. Often one was almost upon the boat before the oarsman was aware.

In a low voice the correspondent addressed the captain. He was not sure that the captain was awake, although this iron man seemed to be always awake. "Captain, shall I keep her making for that light north, sir?"

The same steady voice answered him. "Yes. Keep it about two points off the port bow."

[160] The cook had tied a life-belt around himself in order to get even the warmth which this clumsy cork contrivance could donate, and he seemed almost stove-like when a rower, whose teeth invariably chattered wildly as soon as he ceased his labour, dropped down to sleep.

The correspondent, as he rowed, looked down at the two men sleeping under-foot. The cook's arm was around the oiler's shoulders, and, with their fragmentary clothing and haggard faces, they were the babes of the sea, a grotesque rendering of the old babes in the wood.

Later he must have grown stupid at his work, for suddenly there was a growling of water, and a crest came with a roar and a swash into the boat, and it was a wonder that it did not set the cook afloat in his life-belt. The cook continued to sleep, but the oiler sat up, blinking his eyes and shaking with the new cold.

"Oh, I'm awful sorry, Billie," said the correspondent contritely.

"That's all right, old boy," said the oiler, and lay down again and was asleep.

[165] Presently it seemed that even the captain dozed, and the correspondent thought that he was the one man afloat on all the oceans. The wind had a voice as it came over the waves, and it was sadder than the end.

There was a long, loud swishing astern of the boat, and a gleaming trail of phosphorescence,[33] like blue flame, was furrowed on the black waters. It might have been made by a monstrous knife.

Then there came a stillness, while the correspondent breathed with the open mouth and looked at the sea.

Suddenly there was another swish and another long flash of bluish light, and this time it was alongside the boat, and might almost have been reached with an oar. The correspondent saw an enormous fin speed like a shadow through the water, hurling the crystalline spray and leaving the long glowing trail.

The correspondent looked over his shoulder at the captain. His face was hidden, and he seemed to be asleep. He looked at the babes of the sea. They certainly were asleep. So, being bereft[34] of sympathy, he leaned a little way to one side and swore softly into the sea.

[170] But the thing did not then leave the vicinity of the boat. Ahead or astern, on one side or the other, at intervals long or short, fled the long sparkling streak, and there was to be heard the whiroo of the dark fin. The speed and power of the thing was greatly to be admired. It cut the water like a gigantic and keen projectile.

The presence of this biding thing did not affect the man with the same horror that it would if he had been a picnicker. He simply looked at the sea dully and swore in an undertone.

Nevertheless, it is true that he did not wish to be alone. He wished one of his companions to awaken by chance and keep him company with it. But the captain hung motionless over the water-jar, and the oiler and the cook in the bottom of the boat were plunged in slumber.

VI

"If I am going to be drowned — if I am going to be drowned — if I am going to be drowned, why, in the name of the seven mad gods who rule the sea, was I allowed to come thus far and contemplate sand and trees?"

During this dismal night, it may be remarked that a man would conclude that it was really the intention of the seven mad gods to drown him, despite the abominable[35] injustice of it. For it was certainly an abominable injustice to drown a man who had worked so hard, so hard. The man felt it would be a crime most unnatural. Other people had drowned at sea since galleys swarmed with painted sails, but still —

33. **Phosphorescence** ***(noun):*** luminescence
34. **Bereft** ***(adjective):*** deprived of or lacking something
35. **Abominable** ***(adjective):*** very bad or unpleasant; causing moral revulsion

[175] When it occurs to a man that nature does not regard him as important, and that she feels she would not maim the universe by disposing of him, he at first wishes to throw bricks at the temple, and he hates deeply the fact that there are no bricks and no temples. Any visible expression of nature would surely be pelleted[36] with his jeers.

Then, if there be no tangible thing to hoot he feels, perhaps, the desire to confront a personification and indulge in pleas, bowed to one knee, and with hands supplicant, saying: "Yes, but I love myself."

A high cold star on a winter's night is the word he feels that she says to him. Thereafter he knows the pathos[37] of his situation.

The men in the dingey had not discussed these matters, but each had, no doubt, reflected upon them in silence and according to his mind. There was seldom any expression upon their faces save the general one of complete weariness. Speech was devoted to the business of the boat.

To chime the notes of his emotion, a verse mysteriously entered the correspondent's head. He had even forgotten that he had forgotten this verse, but it suddenly was in his mind.

> "A soldier of the Legion lay dying in Algiers,
>
> There was lack of woman's nursing, there was dearth of woman's tears;
>
> But a comrade stood beside him, and he took that comrade's hand,
>
> And he said: 'I shall never see my own, my native land.'"[38]

[180] In his childhood, the correspondent had been made acquainted with the fact that a soldier of the Legion lay dying in Algiers, but he had never regarded the fact as important. Myriads[39] of his school-fellows had informed him of the soldier's plight, but the dinning had naturally ended by making him perfectly indifferent. He had never considered it his affair that a soldier of the Legion lay dying in Algiers, nor had it appeared to him as a matter for sorrow. It was less to him than the breaking of a pencil's point.

Now, however, it quaintly came to him as a human, living thing. It was no longer merely a picture of a few throes in the breast of a poet, meanwhile drinking tea and warming his feet at the grate; it was an actuality — stern, mournful, and fine.

The correspondent plainly saw the soldier. He lay on the sand with his feet out straight and still. While his pale left hand was upon his chest in an attempt to thwart the going of his life, the blood came between his fingers. In the far Algerian distance, a city of low square forms was set against a sky that was faint with the last sunset hues. The correspondent, plying the oars and dreaming of the slow and slower movements of the lips of the soldier, was moved by a profound and perfectly impersonal comprehension. He was sorry for the soldier of the Legion who lay dying in Algiers.

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36. **Pellet** ***(verb):*** to hit something, as if with pellets
37. **Pathos** ***(noun):*** a quality that evokes pity or sadness
38. This is a verse from the poem “Bingen on the Rhine” by Caroline Norton
39. **Myriad** ***(adjective):*** countless or great in number

The thing which had followed the boat and waited, had evidently grown bored at the delay. There was no longer to be heard the slash of the cut-water, and there was no longer the flame of the long trail. The light in the north still glimmered, but it was apparently no nearer to the boat. Sometimes the boom of the surf rang in the correspondent's ears, and he turned the craft seaward then and rowed harder. Southward, some one had evidently built a watch-fire on the beach. It was too low and too far to be seen, but it made a shimmering, roseate[40] reflection upon the bluff back of it, and this could be discerned from the boat. The wind came stronger, and sometimes a wave suddenly raged out like a mountain-cat, and there was to be seen the sheen and sparkle of a broken crest.

The captain, in the bow, moved on his water-jar and sat erect. "Pretty long night," he observed to the correspondent. He looked at the shore. "Those life-saving people take their time."

[185] "Did you see that shark playing around?"

"Yes, I saw him. He was a big fellow, all right."

"Wish I had known you were awake."

Later the correspondent spoke into the bottom of the boat.

"Billie!" There was a slow and gradual disentanglement. "Billie, will you spell me?"

[190] "Sure," said the oiler.

As soon as the correspondent touched the cold comfortable sea-water in the bottom of the boat, and had huddled close to the cook's life-belt he was deep in sleep, despite the fact that his teeth played all the popular airs.[41] This sleep was so good to him that it was but a moment before he heard a voice call his name in a tone that demonstrated the last stages of exhaustion. "Will you spell me?"

"Sure, Billie."

The light in the north had mysteriously vanished, but the correspondent took his course from the wide-awake captain.

Later in the night they took the boat farther out to sea, and the captain directed the cook to take one oar at the stern and keep the boat facing the seas. He was to call out if he should hear the thunder of the surf. This plan enabled the oiler and the correspondent to get respite together. "We'll give those boys a chance to get into shape again," said the captain. They curled down and, after a few preliminary chatterings and trembles, slept once more the dead sleep. Neither knew they had bequeathed[42] to the cook the company of another shark, or perhaps the same shark.

[195] As the boat caroused on the waves, spray occasionally bumped over the side and gave them a fresh soaking, but this had no power to break their repose.[43] The ominous[44] slash of the wind and the water affected them as it would have affected mummies.

40. **Roseate** ***(adjective):*** rose-colored
41. “Airs” is a term for “songs,” meaning that the correspondent’s chattering resembled music.
42. **Bequeath** ***(verb):*** to pass something on or leave something to another person
43. **Repose** ***(noun):*** a state of rest or sleep
44. **Ominous** ***(adjective):*** suggesting that something bad is going to happen

"Boys," said the cook, with the notes of every reluctance in his voice, "she's drifted in pretty close. I guess one of you had better take her to sea again." The correspondent, aroused, heard the crash of the toppled crests.

As he was rowing, the captain gave him some whisky-and-water, and this steadied the chills out of him. "If I ever get ashore and anybody shows me even a photograph of an oar — "

At last there was a short conversation.

"Billie.... Billie, will you spell me?"

[200] "Sure," said the oiler.

VII

When the correspondent again opened his eyes, the sea and the sky were each of the grey hue of the dawning. Later, carmine[45] and gold was painted upon the waters. The morning appeared finally, in its splendour, with a sky of pure blue, and the sunlight flamed on the tips of the waves.

On the distant dunes were set many little black cottages, and a tall white windmill reared above them. No man, nor dog, nor bicycle appeared on the beach. The cottages might have formed a deserted village.

The voyagers scanned the shore. A conference was held in the boat. "Well," said the captain, "if no help is coming we might better try a run through the surf right away. If we stay out here much longer we will be too weak to do anything for ourselves at all." The others silently acquiesced[46] in this reasoning. The boat was headed for the beach. The correspondent wondered if none ever ascended the tall wind-tower, and if then they never looked seaward. This tower was a giant, standing with its back to the plight of the ants. It represented in a degree, to the correspondent, the serenity of nature amid the struggles of the individual — nature in the wind, and nature in the vision of men. She did not seem cruel to him then, nor beneficent, nor treacherous, nor wise. But she was indifferent, flatly indifferent. It is, perhaps, plausible that a man in this situation, impressed with the unconcern of the universe, should see the innumerable flaws of his life, and have them taste wickedly in his mind and wish for another chance. A distinction between right and wrong seems absurdly clear to him, then, in this new ignorance of the grave-edge, and he understands that if he were given another opportunity he would mend his conduct and his words, and be better and brighter during an introduction or at a tea.

"Now, boys," said the captain, "she is going to swamp, sure. All we can do is to work her in as far as possible, and then when she swamps, pile out and scramble for the beach. Keep cool now, and don't jump until she swamps sure."

[205] The oiler took the oars. Over his shoulders he scanned the surf. "Captain," he said, "I think I'd better bring her about, and keep her head-on to the seas and back her in."

45. a vivid crimson color
46. **Acquiesce** ***(verb):*** to accept or agree to something

"All right, Billie," said the captain. "Back her in." The oiler swung the boat then and, seated in the stern, the cook and the correspondent were obliged to look over their shoulders to contemplate the lonely and indifferent shore.

The monstrous in-shore rollers heaved the boat high until the men were again enabled to see the white sheets of water scudding up the slanted beach. "We won't get in very close," said the captain. Each time a man could wrest his attention from the rollers, he turned his glance toward the shore, and in the expression of the eyes during this contemplation there was a singular quality. The correspondent, observing the others, knew that they were not afraid, but the full meaning of their glances was shrouded.

As for himself, he was too tired to grapple fundamentally with the fact. He tried to coerce his mind into thinking of it, but the mind was dominated at this time by the muscles, and the muscles said they did not care. It merely occurred to him that if he should drown it would be a shame.

There were no hurried words, no pallor, no plain agitation. The men simply looked at the shore. "Now, remember to get well clear of the boat when you jump," said the captain.

[210] Seaward the crest of a roller suddenly fell with a thunderous crash, and the long white comber[47] came roaring down upon the boat.

"Steady now," said the captain. The men were silent. They turned their eyes from the shore to the comber and waited. The boat slid up the incline, leaped at the furious top, bounced over it, and swung down the long back of the wave. Some water had been shipped and the cook bailed it out.

But the next crest crashed also. The tumbling boiling flood of white water caught the boat and whirled it almost perpendicular. Water swarmed in from all sides. The correspondent had his hands on the gunwale at this time, and when the water entered at that place he swiftly withdrew his fingers, as if he objected to wetting them.

The little boat, drunken with this weight of water, reeled and snuggled deeper into the sea.

"Bail her out, cook! Bail her out," said the captain.

[215] "All right, captain," said the cook.

"Now, boys, the next one will do for us, sure," said the oiler. "Mind to jump clear of the boat."

The third wave moved forward, huge, furious, implacable.[48] It fairly swallowed the dingey, and almost simultaneously the men tumbled into the sea. A piece of life-belt had lain in the bottom of the boat, and as the correspondent went overboard he held this to his chest with his left hand.

47. a long curling wave
48. **Implacable** ***(adjective):*** unable to be appeased

The January water was icy, and he reflected immediately that it was colder than he had expected to find it off the coast of Florida. This appeared to his dazed mind as a fact important enough to be noted at the time. The coldness of the water was sad; it was tragic. This fact was somehow so mixed and confused with his opinion of his own situation that it seemed almost a proper reason for tears. The water was cold.

When he came to the surface he was conscious of little but the noisy water. Afterward he saw his companions in the sea. The oiler was ahead in the race. He was swimming strongly and rapidly. Off to the correspondent's left, the cook's great white and corked back bulged out of the water, and in the rear the captain was hanging with his one good hand to the keel[49] of the overturned dingey.

[220] There is a certain immovable quality to a shore, and the correspondent wondered at it amid the confusion of the sea.

It seemed also very attractive, but the correspondent knew that it was a long journey, and he paddled leisurely. The piece of life-preserver lay under him, and sometimes he whirled down the incline of a wave as if he were on a hand-sled.

But finally he arrived at a place in the sea where travel was beset with difficulty. He did not pause swimming to inquire what manner of current had caught him, but there his progress ceased. The shore was set before him like a bit of scenery on a stage, and he looked at it and understood with his eyes each detail of it.

As the cook passed, much farther to the left, the captain was calling to him, "Turn over on your back, cook! Turn over on your back and use the oar."

"All right, sir." The cook turned on his back, and, paddling with an oar, went ahead as if he were a canoe.

[225] Presently the boat also passed to the left of the correspondent with the captain clinging with one hand to the keel. He would have appeared like a man raising himself to look over a board fence, if it were not for the extraordinary gymnastics of the boat. The correspondent marvelled that the captain could still hold to it.

They passed on, nearer to shore — the oiler, the cook, the captain — and following them went the water-jar, bouncing gaily over the seas.

The correspondent remained in the grip of this strange new enemy — a current. The shore, with its white slope of sand and its green bluff, topped with little silent cottages, was spread like a picture before him. It was very near to him then, but he was impressed as one who in a gallery looks at a scene from Brittany or Holland.

He thought: "I am going to drown? Can it be possible? Can it be possible? Can it be possible?" Perhaps an individual must consider his own death to be the final phenomenon of nature.

49. the lengthwise structure along the centerline at the bottom of a boat's hull

But later a wave perhaps whirled him out of this small deadly current, for he found suddenly that he could again make progress toward the shore. Later still, he was aware that the captain, clinging with one hand to the keel of the dingey, had his face turned away from the shore and toward him, and was calling his name. "Come to the boat! Come to the boat!"

[230] In his struggle to reach the captain and the boat, he reflected that when one gets properly wearied, drowning must really be a comfortable arrangement, a cessation of hostilities accompanied by a large degree of relief, and he was glad of it, for the main thing in his mind for some moments had been horror of the temporary agony. He did not wish to be hurt.

Presently he saw a man running along the shore. He was undressing with most remarkable speed. Coat, trousers, shirt, everything flew magically off him.

"Come to the boat," called the captain.

"All right, captain." As the correspondent paddled, he saw the captain let himself down to bottom and leave the boat. Then the correspondent performed his one little marvel of the voyage. A large wave caught him and flung him with ease and supreme speed completely over the boat and far beyond it. It struck him even then as an event in gymnastics, and a true miracle of the sea. An overturned boat in the surf is not a plaything to a swimming man.

The correspondent arrived in water that reached only to his waist, but his condition did not enable him to stand for more than a moment. Each wave knocked him into a heap, and the under-tow pulled at him.

[235] Then he saw the man who had been running and undressing, and undressing and running, come bounding into the water. He dragged ashore the cook, and then waded towards the captain, but the captain waved him away, and sent him to the correspondent. He was naked, naked as a tree in winter, but a halo was about his head, and he shone like a saint. He gave a strong pull, and a long drag, and a bully heave at the correspondent's hand. The correspondent, schooled in the minor formulæ, said: "Thanks, old man." But suddenly the man cried: "What's that?" He pointed a swift finger. The correspondent said: "Go."

In the shallows, face downward, lay the oiler. His forehead touched sand that was periodically, between each wave, clear of the sea.

The correspondent did not know all that transpired afterward. When he achieved safe ground he fell, striking the sand with each particular part of his body. It was as if he had dropped from a roof, but the thud was grateful to him.

It seems that instantly the beach was populated with men with blankets, clothes, and flasks, and women with coffee-pots and all the remedies sacred to their minds. The welcome of the land to the men from the sea was warm and generous, but a still and dripping shape was carried slowly up the beach, and the land's welcome for it could only be the different and sinister hospitality of the grave.

When it came night, the white waves paced to and fro in the moonlight, and the wind brought the sound of the great sea's voice to the men on shore, and they felt that they could then be interpreters.

The Open Boat by Stephen Crane is in the public domain.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. How is the first paragraph of the story important to the passage as a whole?
    A. It focuses on the danger of the ocean as insurmountable.
    B. It focuses on the ocean's importance over the sky and land, setting the sea as the primary setting.
    C. It establishes the ocean as the primary focus and antagonist of the survivors.
    D. It establishes the ocean as ugly and gray, as opposed to beautiful and blue.

2. How does paragraph 11 contribute to the development of the narrator's point of view?
    A. It shows the men's predicament from a different perspective, emphasizing the narrator's view that nature is ultimately good and beautiful.
    B. It shows the men's predicament from a different, more picturesque perspective, contrasting and emphasizing the terrible situation in which the men find themselves.
    C. It places the validity of the narrator's point of view into question, given how beautiful the scene looks from another angle.
    D. It widens the narrator's perspective to beyond the dinghy, suggesting the narrator is actually on the shore.

3. Which of the following best summarizes how the men interact with each other?
    A. The men work together like a well-oiled machine, each with assigned duties to stay alive.
    B. The men resent each other after being stuck on the dinghy for so long.
    C. The men maintain their old titles and hierarchies from the ship.
    D. The men love each other to the point of sacrificing themselves for one another.

4. In paragraph 44, how does the narrator describe their time at sea and the impact it has had on everyone, especially the correspondent?

5. "If I am going to be drowned — if I am going to be drowned — if I am going to be drowned, why, in the name of the seven mad gods who rule the sea, was I allowed to come thus far and contemplate sand and trees?â€? What does this repetition (in paragraph 71, paragraph 144, and paragraph 173) contribute to the tone and overall piece?

6. What does the incident with the shark in Part V reveal about the correspondent's and captain's points of view in this passage?
    A. The correspondent and captain were both terrified, but only the correspondent is willing to admit it.
    B. Both were rather indifferent to the shark; the correspondent was more concerned with being alone (or not being alone) than the shark.
    C. The shark prompts the captain to attempt rowing to shore, while the tired correspondent seems content with the predator circling them.
    D. Both accept the shark as a sign of their impending deaths at sea.

7. PART A: Which of the following best explains the meaning and significance of the poem quoted after paragraph 179?
    A. The poem describes a man dying in a foreign place, just as the crewmen have died at sea.
    B. The poem describes a soldier dying for a cause, in contrast to the ship suddenly sinking and the four survivors stranded in the ocean.
    C. The poem describes a man dying alone, which is how the correspondent feels even though he is surrounded by three other men.
    D. The poem describes a soldier dying, the meaning and impact of which never occurred to the correspondent before being himself confronted with the possibility of death.

8. PART B: How does the correspondent's attitude towards the soldier in the poem change?
    A. He becomes more aware of the soldier's death in the poem as a truly human thing, a description of suffering to which he was indifferent as a young man.
    B. He becomes less affected by the soldier's plight because of his own suffering.
    C. His attitude is equivalent to that of nature; he sees the poem now as an example of the cycle of life.
    D. His attitude changes as he can finally sympathize with the comrade of the dying soldier, just as he witnesses his own companions wasting away.

9. PART A: How does the description of the windmill in paragraphs 201-203 contribute to the central ideas of the text?
    A. The windmill represents the men, its propellers mimicking the men rowing, thus contributing to the idea of the men as more of machines when it comes to survival.
    B. The windmill represents the salvation of the men on the boat, contributing to the idea of a benevolent universe.
    C. The windmill is described as towering and disinterested, contributing to the idea of an indifferent universe.
    D. The windmill is described as monstrous and blind to the sea, implying that all of humanity is blinded to their plight and therefore cruel.

10. PART B: Which of the following quotes best supports the answer to Part A?
    A. "On the distant dunes were set many little black cottages, and a tall white windmill reared above them." (Paragraph 202)
    B. "This tower was a giant, standing with its back to the plight of the ants." (Paragraph 203)
    C. "The correspondent wondered if none ever ascended the tall wind-tower, and if then they never looked seaward." (Paragraph 203)
    D. "...the mind was dominated at this time by the muscles, and the muscles said they did not care." (Paragraph 208)

11. Which of the following best explains the author's purpose in naming only one character?
    A. Billie is the only character whose title doesn't represent the entirety of his character's identity.
    B. The author names him as a way of marking him as different, letting the audience know from the beginning that he is the protagonist.
    C. The author names him as a way of suggesting that he is an average man, so that his death underscores the randomness of nature and its indifference to tragedy.
    D. The author names the oiler Billie in order to reinforce the name's association with youth, making his death an even greater tragedy.

12. PART A: Select TWO choices from the list below that best identify the themes of the story.
    A. Man versus Nature
    B. Brotherhood or community
    C. Fate or destiny
    D. Grief and loss
    E. Faith or providence
    F. Hope and optimism

13. PART B: Which of the following passages best supports the answer to Part A?
    A. Paragraph 44
    B. Paragraph 71
    C. Paragraph 143
    D. Paragraph 175

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. "The Open Boat" is inspired by the author's own experience surviving a shipwreck. How, if at all, does this fact affect your reading of the short story?

2. Brotherhood is a key component to the men's behavior at sea. In the story, where do you see brotherhood at work? How does this component help people survive, both in dire situations and in everyday life?

3. In the context of the story, who is in control: man or nature? How do the men's perceptions of nature change throughout the story?

Name: _____ Class: _____

The Transformation of Arachne into a Spider

By Ovid
From Metamorphoses (Book Vi) ● 8 A.D.

Ovid (43 B.C.-17 A.D.) was a Roman poet well-known for his elaborate prose and fantastical imagery. Ovid was similar to his literary contemporary, Virgil, in that both authors played a part in reinventing classical poetry and mythology for Roman culture. Metamorphoses*, one of Ovid's most-read works, consists of a series of short stories and epic poems whose mythological characters undergo transformation in some way or another. As you read, take notes on Ovid's choice of figurative language and imagery.*

Pallas,[1] attending to the Muse's[2] song,
Approv'd the just resentment of their wrong;
And thus reflects: While tamely[3] I commend
Those who their injur'd deities[4] defend,
My own divinity affronted stands,
And calls aloud for justice at my hands;
Then takes the hint, asham'd to lag behind,
And on Arachne' bends her vengeful mind;
One at the loom[5]
so excellently skill'd,
That to the Goddess[6] she refus'd to yield.
Low was her birth, and small her native town,
She from her art alone obtain'd renown.
Idmon, her father, made it his employ,
To give the spungy fleece[7]
a purple dye:
Of vulgar strain her mother, lately dead,
With her own rank had been content to wed;
Yet she their daughter, tho' her time was spent
In a small hamlet,[8]
and of mean descent,
Thro' the great towns of Lydia gain'd a name,
And fill'd the neighb'ring countries with her fame.



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1. Pallas is another name for Minerva (Athena) the goddess of wisdom and the arts (such as weaving).
2. The Muses are the three goddesses of poetic inspiration.
3. **Tamely** ***(adverb):*** calmly
4. **Deity** ***(noun):*** god or goddess
5. An instrument used for weaving
6. The Goddess refers to Minerva, also known as the Roman goddess Athena.
7. A sheep's skin
8. A town

Oft,[9] to admire the niceness of her skill,
The Nymphs[10] would quit their fountain, shade, or hill:
Thither, from green Tymolus,[11] they repair,
And leave the vineyards, their peculiar care;
Thither, from fam'd Pactolus' golden stream,[12]
Drawn by her art, the curious Naiads[13] came.
Nor would the work, when finish'd, please so much,
As, while she wrought, to view each graceful touch;
Whether the shapeless wool in balls she wound,
Or with quick motion turn'd the spindle round,
Or with her pencil drew the neat design,
Pallas her mistress shone in every line.
This the proud maid with scornful air denies,
And ev'n the Goddess at her work defies;
Disowns her heav'nly mistress ev'ry hour,
Nor asks her aid, nor deprecates[14] her pow'r.
Let us, she cries, but to a tryal[15] come,
And, if she conquers, let her fix my doom.

The Goddess then a beldame's[16]
form put on,
With silver hairs her hoary[17]
temples shone;
Prop'd by a staff, she hobbles in her walk,
And tott'ring thus begins her old wives' talk.

Young maid attend, nor stubbornly despise
The admonitions of the old, and wise;
For age, tho' scorn'd, a ripe experience bears,
That golden fruit, unknown to blooming years:
Still may remotest fame your labours crown,
And mortals your superior genius own;
But to the Goddess yield, and humbly meek
A pardon for your bold presumption seek;
The Goddess will forgive. At this the maid,
With passion fir'd, her gliding shuttle stay'd;
And, darting vengeance with an angry look,
To Pallas in disguise thus fiercely spoke.

9. Often
10. Nymphs are mythological woodland fairies.
11. Tymolus refers to a certain mountain.
12. According to myth, Midas rid himself of his golden touch in the Pactolus river.
13. Naiads are mythological water fairies.
14. **Deprecate** ***(verb):*** to belittle, slight; in this context, to show humility
15. A trial or challenge
16. Old woman
17. Old and grey

Thou doating[18]
thing, whose idle babling tongue
But too well shews[19] the plague of living long;
Hence, and reprove, with this your sage[20] advice,
Your giddy daughter, or your awkward niece;
Know, I despise your counsel, and am still
A woman, ever wedded to my will;
And, if your skilful Goddess better knows,
Let her accept the tryal I propose.

She does, impatient Pallas strait replies,
And, cloath'd with heavenly light, sprung from her odd disguise.
The Nymphs, and virgins of the plain adore
The awful[21] Goddess, and confess her pow'r;
The maid alone stood unappall'd; yet show'd
A transient[22] blush, that for a moment glow'd,
Then disappear'd; as purple streaks adorn
The opening beauties of the rosy morn;
Till Phoebus[23] rising prevalently bright,
Allays the tincture[24]
with his silver light.
Yet she persists, and obstinately[25] great,
In hopes of conquest hurries on her fate.
The Goddess now the challenge waves no more,
Nor, kindly good, advises as before.
Strait to their posts appointed both repair,
And fix their threaded looms with equal care:
Around the solid beam the web is ty'd,
While hollow canes the parting warp divide;[26]
Thro' which with nimble flight the shuttles play,
And for the woof prepare a ready way;
The woof and warp unite, press'd by the toothy slay.

18. Senile
19. Shows
20. **Sage** ***(adjective):*** wise; used sarcastically in this case
21. **Awful** ***(adjective):*** (archaic) inspiring awe
22. **Transient** ***(adjective):*** momentary or brief
23. Phoebus is another name for the sun god (Apollo in Greek mythology). It is also a term used to refer literally to the sun.
24. Tinge of color
25. **Obstinately** ***(adverb):*** stubbornly
26. Warp, shuttles, woof, and slay are terms used in weaving; parts of the loom.

Thus both, their mantles button'd to their breast,
Their skilful fingers ply with willing haste,
And work with pleasure; while they chear[27] the eye
With glowing purple of the Tyrian dye:
Or, justly intermixing shades with light,
Their colourings insensibly unite.
As when a show'r transpierc'd[28]
with sunny rays,
Its mighty arch along the heav'n displays;
From whence a thousand diff'rent colours rise,
Whose fine transition cheats the clearest eyes;
So like the intermingled shading seems,
And only differs in the last extremes.
Then threads of gold both artfully dispose,
And, as each part in just proportion rose,
Some antique fable in their work disclose.

Pallas in figures wrought the heav'nly Pow'rs,
And Mars's[29] hill among th' Athenian tow'rs.
On lofty thrones twice six celestials[30]
sate,
Jove[31] in the midst, and held their warm debate;
The subject weighty, and well-known to fame,
From whom the city shou'd receive its name.
Each God by proper features was exprest,
Jove with majestick mein[32] excell'd the rest.
His three-fork'd mace the dewy sea-God shook,
And, looking sternly, smote the ragged rock;
When from the stone leapt forth a spritely steed,
And Neptune[33] claims the city for the deed.

Herself she blazons, with a glitt'ring spear,
And crested helm that veil'd her braided hair,
With shield, and scaly breast-plate, implements of war.
Struck with her pointed launce,[34] the teeming Earth
Seem'd to produce a new surprizing birth;
When, from the glebe,[35] the pledge of conquest sprung,
A tree pale-green with fairest olives hung.

27. Cheer
28. Penetrated
29. Mars is the god of war, also known as the Greek god Ares.
30. Gods
31. Jove is the mythological god of thunder and king of the gods; Roman name for Zeus.
32. **Mein** ***(noun):*** the outward manifestation of personality or attitude
33. Neptune is the mythological god of the sea, also known as Poseidon in Greek mythology.
34. A lance: a long weapon for thrusting with a wooden shaft and a pointed steel head
35. A “glebe” is a plot of land.

And then, to let her giddy rival learn
What just rewards such boldness was to earn,
Four tryals at each corner had their part,
Design'd in miniature, and touch'd with art.
Haemus in one, and Rodope of Thrace
Transform'd to mountains,[36] fill'd the foremost place;
Who claim'd the titles of the Gods above,
And vainly us'd the epithets[37] of Jove.
Another shew'd, where the Pigmaean dame,[38]
Profaning Juno's venerable name,
Turn'd to an airy crane, descends from far,
And with her Pigmy subjects wages war.
In a third part, the rage of Heav'n's great queen,
Display'd on proud Antigone,[39] was seen:
Who with presumptuous boldness dar'd to vye,
For beauty with the empress of the sky.
Ah! what avails her ancient princely race,
Her sire a king, and Troy her native place:
Now, to a noisy stork transform'd, she flies,
And with her whiten'd pinions cleaves the skies.
And in the last remaining part was drawn
Poor Cinyras[40] that seem'd to weep in stone;
Clasping the temple steps, he sadly mourn'd
His lovely daughters, now to marble turn'd.
With her own tree the finish'd piece is crown'd,
And wreaths of peaceful olive all the work surround.

36. In Greek mythology, King Haemus of Thrace compared himself and his wife Rhodope to Zeus and Hera (Jove and Juno). For this arrogance, the gods changed them into mountains.
37. **Epithet** ***(noun):*** an adjective or phrase expressing a quality characteristic of the person or thing mentioned
38. Oinoe refused to honor the goddess Hera/Juno and was turned into a crane.
39. Antigone of Troy claimed her hair was more beautiful than Hera/Juno's and was turned into a stork for her arrogance.
40. King Cinyras of Cyprus

Arachne drew the fam'd intrigues of Jove,
Chang'd to a bull to gratify his love;
How thro' the briny tide all foaming hoar,
Lovely Europa[41] on his back he bore.
The sea seem'd waving, and the trembling maid
Shrunk up her tender feet, as if afraid;
And, looking back on the forsaken strand,
To her companions wafts her distant hand.
Next she design'd Asteria's[42] fabled rape,
When Jove assum'd a soaring eagle's shape:
And shew'd how Leda[43] lay supinely press'd,
Whilst the soft snowy swan sate hov'ring o'er her breast,
How in a satyr's form the God beguil'd,
When fair Antiope[44] with twins he fill'd.
Then, like Amphytrion,[45] but a real Jove,
In fair Alcmena's[46] arms he cool'd his love.
In fluid gold to Danae's[47] heart he came,
Aegina[48] felt him in a lambent[49] flame.
He took Mnemosyne[50] in shepherd's make,
And for Deois was a speckled snake.

She made thee, Neptune, like a wanton[51] steer,[52]
Pacing the meads for love of Arne[53] dear;
Next like a stream, thy burning flame to slake,
And like a ram, for fair Bisaltis'[54] sake.
Then Ceres[55] in a steed your vigour try'd,
Nor cou'd the mare the yellow Goddess hide.
Next, to a fowl transform'd, you won by force
The snake-hair'd mother of the winged horse;
And, in a dolphin's fishy form, subdu'd
Melantho[56] sweet beneath the oozy flood.

41. Europa was the mother of King Minos of Crete. Zeus/Jove was enamoured with her and transformed into a bull to abduct her.
42. Asteria was the daughter of a Titan and desired by Jove/Zeus. She fleed from him, but he chased her as an eagle.
43. Leda was the wife of a Spartan king and seduced by Jove/Zeus in the form of a swan.
44. Jove/Zeus transformed into a satyr to seduce Antiope. She later gave birth to twins, one of whom was fathered by the god.
45. Amphytrion was a Thebean general and the son of the Alcaeus.
46. Alcmena was the mother of the hero Hercules/Heracles, son of Jove/Zeus.
47. Danae was the mother of the hero Perseus, son of Jove/Zeus. The god appeared to her in the form of a shower of gold.
48. Aegina was the mother of the hero king Aeacus, son of Jove/Zeus.
49. **Lambent** ***(adjective):*** glowing, gleaming, or flickering with a soft radiance
50. Mnemosyne was the personification of memory in Greek mythology, a Titan, and the mother of the Muses by Jove/Zeus.
51. **Wanton** ***(adjective):*** uncontrollable
52. A steer is an ox.
53. Arne gave birth to twins sired by Neptune/Poseidon in bull form.
54. Bisaltis was taken by Neptune/Poseidon in the form of a ram.
55. Ceres was a goddess of agriculture, a counterpart to the goddess Demeter. She was pursued by Neptune/Poseidon.
56. Melantho was the daughter of Deucalion and was seduced by Neptune/Poseidon as a dolphin.

All these the maid with lively features drew,
And open'd proper landskips to the view.
There Phoebus, roving like a country swain,
Attunes[57] his jolly pipe along the plain;
For lovely Isse's[58] sake in shepherd's weeds,
O'er pastures green his bleating flock he feeds,
There Bacchus,[59] imag'd like the clust'ring grape,
Melting bedrops Erigone's[60] fair lap;
And there old Saturn,[61] stung with youthful heat,
Form'd like a stallion, rushes to the feat.
Fresh flow'rs, which twists of ivy intertwine,
Mingling a running foliage, close the neat design.

This the bright Goddess passionately mov'd,
With envy saw, yet inwardly approv'd.
The scene of heav'nly guilt with haste she tore,
Nor longer the affront with patience bore;
A boxen shuttle in her hand she took,
And more than once Arachne's forehead struck.
Th' unhappy maid, impatient of the wrong,
Down from a beam her injur'd person hung;[62]
When Pallas, pitying her wretched state,
At once prevented, and pronounc'd her fate:
Live; but depend, vile wretch, the Goddess cry'd,
Doom'd in suspence for ever to be ty'd;
That all your race, to utmost date of time,
May feel the vengeance, and detest the crime.

Then, going off, she sprinkled her with juice,
Which leaves of baneful aconite[63] produce.
Touch'd with the pois'nous drug, her flowing hair
Fell to the ground, and left her temples bare;
Her usual features vanish'd from their place,
Her body lessen'd all, but most her face.
Her slender fingers, hanging on each side
With many joynts, the use of legs supply'd:
A spider's bag the rest, from which she gives
A thread, and still by constant weaving lives.

The Transformation of Arachne into a Spider by Ovid is in the public domain.

57. Harmonizes to
58. Isse, also known as Amphissa, was a lover of Phoebus/Apollo, who first seduced her as a shepherd.
59. Bacchus is the mythological god of wine and revelry, also known as the Greek god Dionysus.
60. Erigone was the daughter of Icarius of Athens. Icarius was cordial to Bacchus/Dionysus but was killed by his drunken shepherds. Erigone, upon finding her father, hanged herself and became the constellation Virgo.
61. Saturn is the mythological god of agriculture and commerce.
62. Arachne hangs herself after Pallas tears her weaving and hits Arachne.
63. Aconite is a type of poisonous root.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following best describes a central theme of the text?
    A. Revenge can drive people to do strange, cruel things.
    B. Confidence is needed in order to succeed.
    C. Talent is more innate than from practice.
    D. Faith is more important than humility.

2. PART B: Which of the following quotes best supports the answer to Part A?
    A. “That to the Goddess she refus'd to yield. / Low was her birth, and small her native town, / She from her art alone obtain'd renown.” (Lines 10-12)
    B. “Nor would the work, when finish'd, please so much, / As, while she wrought, to view each graceful touch; / Whether the shapeless wool in balls she wound, / Or with quick motion turn'd the spindle round, / Or with her pencil drew the neat design, / Pallas her mistress shone in every line.” (Lines 27-32)
    C. “Yet she persists, and obstinately great, / In hopes of conquest hurries on her fate. / The Goddess now the challenge waves no more, / Nor, kindly good, advises as before.” (Lines 73-76)
    D. “When Pallas, pitying her wretched state, / At once prevented, and pronounc'd her fate: / Live; but depend, vile wretch, the Goddess cry'd, / Doom'd in suspence for ever to be ty'd; / That all your race, to utmost date of time, / May feel the vengeance, and detest the crime.” (Lines 194-199)

3. PART A: Which of the following best describes why Pallas wants revenge on Arachne?
    A. Pallas believes Arachne has been claiming Pallas’s work as her own.
    B. Pallas is tired of Arachne’s challenges and wants to end their feud.
    C. Pallas wants revenge because Arachne weaves pictures of the gods’ follies rather than their glories.
    D. Pallas wants revenge because Arachne refuses to acknowledge the Muse’s or Pallas’s inspiration in her weaving.

4. PART B: Which of the following quotes best supports the answer to Part A?
    A. "Oft, to admire the niceness of her skill, / The Nymphs would quit their fountain, shade, or hill: / Thither, from green Tymolus, they repair, / And leave the vineyards, their peculiar care" (Lines 21-24)
    B. "Pallas her mistress shone in every line. / This the proud maid with scornful air denies, / And ev'n the Goddess at her work defies; / Disowns her heav'nly mistress ev'ry hour, / Nor asks her aid, nor deprecates her pow'r." (Lines 32-36)
    C. "Let us, she cries, but to a tryal come, / And, if she conquers, let her fix my doom." (Lines 37-38)
    D. "This the bright Goddess passionately mov'd, / With envy saw, yet inwardly approv'd. / The scene of heav'nly guilt with haste she tore, / Nor longer the affront with patience bore" (Lines 186-189)

5. PART A: Why does Pallas most likely present herself to Arachne as she does?
    A. Pallas disguises herself as an old woman to see how young Arachne treats her elders.
    B. Pallas disguises herself as an old woman to give Arachne a chance to yield to the goddess and ask for forgiveness.
    C. Pallas disguises herself to trick Arachne into thinking she is a harmless old woman so she has the element of surprise.
    D. Pallas disguises herself to trick Arachne into insulting the gods, not knowing that she was actually a goddess.

6. PART B: Which of the following quotes best supports the answer to Part A?
    A. "The Goddess then a beldame's form put on, / With silver hairs her hoary temples shone" (Lines 39-40)
    B. "Young maid attend, nor stubbornly despise / The admonitions of the old, and wise" (Lines 43-44)
    C. "But to the Goddess yield, and humbly meek / A pardon for your bold presumption seek; / The Goddess will forgive." (Lines 49-51)
    D. "And, if your skilful Goddess better knows, / Let her accept the tryal I propose. / She does, impatient Pallas strait replies, / And, cloath'd with heavenly light, sprung from her odd disguise." (Lines 61-64)

7. PART A: In stanza 7, to what does the speaker compare Pallas and Arachne's works?
    A. Glowing light in many different forms
    B. The formation of a rainbow
    C. Quick strikes of lightning
    D. The emergence of the sun from a storm

8. PART B: Which of the following quotes best supports the answer to Part A?
    A. "Thus both, their mantles button'd to their breast, / Their skilful fingers ply with willing haste, / And work with pleasure; while they chear the eye / With glowing purple of the Tyrian dye" (Lines 84-87)
    B. "Or, justly intermixing shades with light, / Their colourings insensibly unite" (Lines 88-89)
    C. "As when a show'r transpierc'd with sunny rays, / Its mighty arch along the heav'n displays; / From whence a thousand diff'rent colours rise" (Lines 90-92)
    D. "Then threads of gold both artfully dispose, / And, as each part in just proportion rose, / Some antique fable in their work disclose." (Lines 96-98)

9. Compare the imagery both Pallas and Arachne weave into their work. How do these images develop the myth's overall meaning? Cite evidence in your answer.

10. Which of the following best summarizes the culmination of Pallas' revenge?

    A. Pallas accuses Arachne of cheating, and for this Pallas decides to turn her into a venomous spider.
    B. Pallas declares herself the winner, even though Arachne clearly won; to make sure Arachne does not challenge her again, Pallas turns her into a spider.
    C. Arachne wins the challenge and Pallas, bitter over losing, offers her a gift for her weaving; Arachne accepts and is turned into a spider, so that she may spin thread forever.
    D. Arachne hangs herself in response to Pallas's envy and abuse, but pitying her Pallas keeps her alive; Pallas then transforms her into a spider to complete her vengeance.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Transformation is a theme that constantly recurs in mythology from all different cultures. What might be significant about the theme of transformation?

2. Can you think of modern-day stories that involve transformation or disguise as a central theme?

3. How are the gods portrayed in Greek and Roman mythology? What can we learn about ourselves from these portrayals? Do you believe they reflect human beings?

4. Consider the way Ovid portrayed Minerva (Athena) and Arachne. Whose side is he on?

5. It is clear that, throughout time, human beings have been drawn to mythological portrayals. Some have suggested that humans used mythology to explain scientific phenomena beyond our grasp. Why else are we drawn to mythology? What can we learn about ourselves from our attraction to mythology?

6. In your opinion, was Minerva's act of revenge justified? Why or why not? When -- if ever -- is revenge justified? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Name: _____ Class: _____

Ozymandias

By Percy Bysshe Shelley
1818

Percy Bysshe Shelley, who lived from 1792-1822, was an important poet during a literary and artistic period that's known as the era of English Romanticism. He is regarded by some as one of the most influential poets in the English language. Ozymandias is one of his best-known works. As you read, take notes on contrasting images in the poem.

I met a traveller from an antique[1] land
Who said: "Two vast and trunkless legs of stone
Stand in the desert... Near them, on the sand,
Half sunk, a shattered visage[2] lies, whose frown,
And wrinkled lip, and sneer of cold command,
Tell that its sculptor well those passions read
Which yet survive, stamped on these lifeless things,
The hand that mocked them, and the heart that fed:
And on the pedestal these words appear:
'My name is Ozymandias,[3] king of kings:
Look on my works, ye Mighty, and despair!'
Nothing beside remains. Round the decay
Of that colossal[4] wreck, boundless and bare
The lone and level sands stretch far away."



"Ramesseum in Egypt, The Ozymandias Colossus:" by Christopher Michel is licensed under CC BY 2.0.

"Ozymandias" by Percy Bysshe Shelley (1818) is in the public domain.

1. ancient
2. **Visage** ***(noun):*** a person's face, with reference to their expression
3. Ozymandias is another name for the pharaoh Ramses II who ruled Ancient Egypt from 1279-1213 BC.
4. **Colossal** ***(adjective):*** extremely large

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which statement best expresses the theme of this poem?
    A. Ancient ruins are an important part of history.
    B. People are easily corrupted by pride.
    C. Be wary of the stories travelers tell.
    D. Power and greatness will not last forever.

2. PART B: Which section from the text best develops the theme identified in PART A?
    A. "I met a traveller from an antique land / Who said: 'Two vast and trunkless legs of stone / Stand in the desert…'" (Lines 1-3)
    B. "And wrinkled lip, and sneer of cold command, / Tell that its sculptor well those passions read / Which yet survive, stamped on these lifeless things," (Lines 5-7)
    C. "And on the pedestal these words appear: / My name is Ozymandias, king of kings" (Lines 9-10)
    D. "Look on my works, ye Mighty, and despair! / Nothing beside remains. Round the decay" (Lines 11-12)

3. What is the effect of the speaker hearing about this statue from someone else as opposed to seeing it with his own eyes?
    A. It helps emphasize how the story has been passed on and the reader should doubt the reliability of the description.
    B. It emphasizes how powerful the king was and how much his legend continues to impact culture.
    C. It helps emphasize how the story is a tale that is being passed on to the reader, indicating that there is a message to be heeded.
    D. It demonstrates the speaker's own susceptibility to the influence of others.

4. For what purpose did the author include the inscription on the statue, "Look on my works, ye Mighty, and despair!" (Line 11)?
    A. It lets the reader know that Ozymandias was a cruel leader.
    B. It emphasizes the contrast between the king's arrogance and the ruin his statue has become.
    C. It demonstrates the negative attitude the sculptor had about the king.
    D. It compares Ozymandias to other famous kings by alluding to a classic Arthurian legend.

5. How does the author use irony to develop the theme of the poem? Cite evidence from the text to support your response.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. How do we evaluate a leader's legacy in history? In this poem, a sculptor set out to craft a lasting memory of Ozymandias by creating a statue. How are statues seen as an important part of our history and what does it mean to be honored with a statue?

2. In Shelley's poem Ozymandias' statue has the inscription, "Look on my works, ye Mighty, and despair!" yet there is nothing but sand and ruins. How much control do we have over how we are remembered in the future? What could Ozymandias have done while he lived that might've helped towards the preservation of his statue?

3. From what is indicated in Shelly's poem, do you think Ozymandias was a great leader? What makes a great leader? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Name: _____ Class: _____

Excerpt from Walden: "The Ponds"

By Henry David Thoreau
1854

Henry David Thoreau (1817-1862) was an American author, essayist, and philosopher. He was one of the major figures of Transcendentalism, a movement that valued the spiritual over the material. The following excerpt comes from his best-known work, Walden*, in which he reflects upon his two years spent living in the wilderness near Walden Pond in Massachusetts. As you read, take notes on the words Thoreau uses to describe the scene before him.*

[1] It is a soothing employment, on one of those fine days in the fall when all the warmth of the sun is fully appreciated, to sit on a stump on such a height as this, overlooking the pond, and study the dimpling circles which are incessantly[1] inscribed on its otherwise invisible surface amid the reflected skies and trees. Over this great expanse there is no disturbance but it is thus at once gently smoothed away and assuaged, as, when a vase of water is jarred, the trembling circles seek the shore and all is smooth again. Not a fish can leap or an insect fall on the pond but it is thus reported in circling dimples, in lines of beauty, as it were the constant welling up of its fountain, the gentle pulsing of its life, the heaving of its breast. The thrills of joy and thrills of pain are undistinguishable. How peaceful the phenomena of the lake! Again the works of man shine as in the spring. Ay, every leaf and twig and stone and cobweb sparkles now at mid-afternoon as when covered with dew in a spring morning. Every motion of an oar or an insect produces a flash of light; and if an oar falls, how sweet the echo!



"Pond" by Josh is licensed under CC BY-NC 2.0

In such a day, in September or October, Walden is a perfect forest mirror, set round with stones as precious to my eye as if fewer or rarer. Nothing so fair, so pure, and at the same time so large, as a lake, perchance, lies on the surface of the earth. Sky water. It needs no fence. Nations come and go without defiling it. It is a mirror which no stone can crack, whose quicksilver will never wear off, whose gilding Nature continually repairs; no storms, no dust, can dim its surface ever fresh; — a mirror in which all impurity presented to it sinks, swept and dusted by the sun's hazy brush, — this the light dust-cloth, — which retains no breath that is breathed on it, but sends its own to float as clouds high above its surface, and be reflected in its bosom still.

A field of water betrays the spirit that is in the air. It is continually receiving new life and motion from above. It is intermediate in its nature between land and sky. On land only the grass and trees wave, but the water itself is rippled by the wind. I see where the breeze dashes across it by the streaks or flakes of light. It is remarkable that we can look down on its surface. We shall, perhaps, look down thus on the surface of air at length, and mark where a still subtler spirit sweeps over it.

1. **Incessant** ***(adjective):*** continuing without pause or interruption

Walden by Henry David Thoreau (1854) is in the public domain.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: What is the meaning of “assuaged” as it is used in paragraph 1?
    A. calmed
    B. alerted
    C. reflected
    D. muted

2. PART B: Which phrase from paragraph 1 provides context for the meaning of “assuaged”?
    A. “fully appreciated”
    B. “smooth again”
    C. “welling up”
    D. “circling dimples”

3. PART A: What is Thoreau’s purpose in the passage from "Walden"?
    A. to describe his reasons for visiting Walden Pond and its surroundings
    B. to argue for the preservation and reclamation of Walden Pond in the face of human intrusion
    C. to explain why most people are not able to appreciate the beauty of nature
    D. to describe the permanence of a natural scene

4. PART B: Select TWO quotations that most clearly reveal Thoreau’s purpose in the passage.
    A. “It is a soothing employment, on one of those fine days in the fall when all the warmth of the sun is fully appreciated, to sit on a stump on such a height as this, overlooking the pond” (Paragraph 1)
    B. “Over this great expanse there is no disturbance but it is thus at once gently smoothed away and assuaged” (Paragraph 1)
    C. “Not a fish can leap or an insect fall on the pond but it is thus reported in circling dimples, in lines of beauty” (Paragraph 1)
    D. “In such a day, in September or October, Walden is a perfect forest mirror, set round with stones as precious to my eye as if fewer or rarer.” (Paragraph 2)
    E. “It is a mirror which no stone can crack, whose quicksilver will never wear off, whose gilding Nature continually repairs” (Paragraph 2)
    F. “It is intermediate in its nature between land and sky.” (Paragraph 3)

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. In the text, Thoreau describes Walden pond as “a mirror which no stone can crack” (Paragraph 2). In what ways are humans altering, or “cracking,” nature? How do you think Thoreau would feel about the state of nature today?

2. In the text, Thoreau appreciates the simple scene of Walden Pond. Describe a simple scene or occurrence in nature that you find beautiful. How can you take the time to appreciate the beauty of nature more often?

3. How can slowing down and observing nature help us appreciate the world we live in? How is nature important to our understanding of the world?

To earn trust for autonomous vehicles, company gives them "virtual eyes"

By Peter Holley, Washington Post on 09.10.18
Word Count **614**
Level **MAX**



To create trust between pedestrians and self-driving vehicles, Jaguar Land Rover has developed a driverless pod with eyes that signal the vehicle's intent to human observers. Photo: Jaguar Land Rover

One of the biggest challenges facing car companies developing driverless vehicles has little do with sophisticated robotics or laser technology.

Instead, they must engineer something far more amorphous but no less important: human trust, the kind that is communicated when human drivers and pedestrians make eye contact at a crosswalk.

Surveys indicate that large portions of the public harbor deep reservations about the safety of self-driving technology, so Jaguar Land Rover enlisted cognitive psychologists to learn "how vehicle behavior affects human confidence in new technology," the British automaker said in a news release.

Their solution: virtual eyes, a large, cartoonish pair that bring to mind the plastic googly eyes you probably glued onto projects in elementary school.

The eyes have been fitted to autonomous vehicles known as "intelligent pods." Devised by a team of engineers, the eyes seek out nearby pedestrians before "looking" directly at them — silently signaling that the vehicle sees them and plans to remain stationary so they can pass, the company said.

Before and after the interaction, engineers record trust levels to determine whether human test subjects experienced sufficient levels of confidence in the pod, the company said. So far more than 500 people have been observed interacting with the expressive vehicles, but the company hasn't released details about the interactions.

"It's second nature to glance at the driver of the approaching vehicle before stepping into the road," Pete Bennett, future mobility research manager at Jaguar Land Rover, said in a statement. "Understanding how this translates in tomorrow's more automated world is important."

Other industries have applied eyes to robots as well. The industrial robot Baxter has a tablet-like face with eyes designed to communicate the robot's intentions to nearby human workers, such as concentration when the machine is working or sadness when it's broken.

People are uneasy about not only interacting with but riding inside self-driving vehicles. An American Automobile Association study this year found that 63 percent of U.S. drivers report feeling afraid to ride in a fully self-driving vehicle, down from 78 percent a year earlier.

Male drivers and millennials are most trusting of autonomous technology, with only half reporting fear of riding inside a fully autonomous car, according to AAA, which has begun urging automakers to educate consumers about autonomous transportation. Even though human error causes more than 90 percent of crashes, most drivers consider their driving skills better than average and are leery of handing control over to a machine.

"Americans are starting to feel more comfortable with the idea of self-driving vehicles," AAA Automotive Engineering and Industry Relations Director Greg Brannon said in February. "Compared to just a year ago, AAA found that 20 million more U.S. drivers would trust a self-driving vehicle to take them for a ride."

Jaguar Land River is not the only company exploring how to broadcast messages between autonomous vehicles and pedestrians.

This summer a Mountain View, California-based startup known as Drive.ai launched a pilot program in Frisco, Texas, in the Dallas-Fort Worth metroplex. The bright orange vehicles autonomously ferry people around a geo-fenced office-park complex where about 10,000 people work, eat and shop.

The words "self-driving vehicle" wrap around their Nissan NV200 vans, and the vehicles include exterior panels with messages — such as "waiting for you to cross" — to take the place of a human driver making eye contact or gesturing with a pedestrian at a crosswalk.

Company officials have pointed out that self-driving cars still "don't understand certain complex situations such as a construction worker communicating using hand gestures."

Jaguar Land Rover's intelligent pods have yet to venture into the real world and instead operate on a "fabricated street scene in Coventry," the company said.

Quiz

1 Read the following paragraphs from the article.

> *The eyes have been fitted to autonomous vehicles known as "intelligent pods." Devised by a team of engineers, the eyes seek out nearby pedestrians before "looking" directly at them — silently signaling that the vehicle sees them and plans to remain stationary so they can pass, the company said.*
>
> *The words "self-driving vehicle" wrap around their Nissan NV200 vans, and the vehicles include exterior panels with messages — such as "waiting for you to cross" — to take the place of a human driver making eye contact or gesturing with a pedestrian at a crosswalk.*

Which of the following conclusions can be drawn from these paragraphs?

(A) Self-driving car companies are testing several different ways for the vehicles to interact with and acknowledge pedestrians.

(B) Self-driving car companies have determined that placing fake eyes on the vehicles appeals to many pedestrians.

(C) Self-driving cars are likely to be seen on the road more frequently now that they have been approved by psychologists.

(D) Self-driving cars are much safer now than they were in the past and will soon be available for sale to the public.

2 Which of the following claims does the author support the LEAST in the article?

(A) Human drivers are more dangerous than self-driving vehicles.

(B) More Americans approve of self-driving vehicles now than in the past.

(C) Companies have begun testing out self-driving vehicles.

(D) Pedestrians like to make eye contact with drivers to ensure their safety.

3 How did concern about the safety of driverless cars affect car manufacturers' design of their vehicles?

(A) People's concern that driverless cars would result in unsafe driving conditions was caused by driverless car manufacturers' decision to market their vehicles to male drivers and millennials.

(B) People's concern that driverless cars would present an additional danger to pedestrians was caused by driverless car manufacturers' failure to program the vehicles to navigate construction zones.

(C) People's concern that driverless cars would not stop for pedestrians led driverless car manufacturers to place virtual eyes on the vehicles that would reassure pedestrians that it was safe to cross the road.

(D) People's concern that driverless cars would lead to more car accidents led driverless car manufacturers to place virtual eyes in the vehicles to monitor their driving and report back to the companies.

4 Read the following two summaries of the article.

1. *Automated technology is the newest innovation, ranging from self-driving cars to robots that can perform tasks. As a result of very informative feedback from a recent survey, developers have implemented interactive features on their automated technology. Now, driverless cars and industrial robots can communicate with humans and convey emotion.*
2. *Automated technology such as driverless cars and robots that can perform tasks is being developed and tested. Surveys conducted by AAA indicated reservations about the safety of self-driving cars. Therefore, research was done to incorporate interactive elements within the technology that would relay the technology's awareness of the people around it.*

Which option provides an accurate, objective summary of the article, and why?

(A) Option 1; it highlights how well automated technology can mimic human actions.

(B) Option 1; it emphasizes the important role of automated technology in the modern world.

(C) Option 2; it outlines the overall reaction to automated technology and companies' responses to it.

(D) Option 2; it explains how automated technology senses and avoids dangerous situations.

Name: _____ Class: _____

Excerpt from Frankenstein; or the Modern Prometheus

By Mary Shelley
1823

Mary Shelley (1797-1851) was an English novelist, short story writer, and dramatist, best known for her gothic novel, Frankenstein*. In the novel, Victor Frankenstein, a brilliant scientist, succeeds in creating life in his laboratory, only to be horrified by his own creation. The novel begins with a series of letters written by an explorer, who eventually brings Frankenstein onto his ship. As you read, take notes on the speaker's feelings about his journey.*

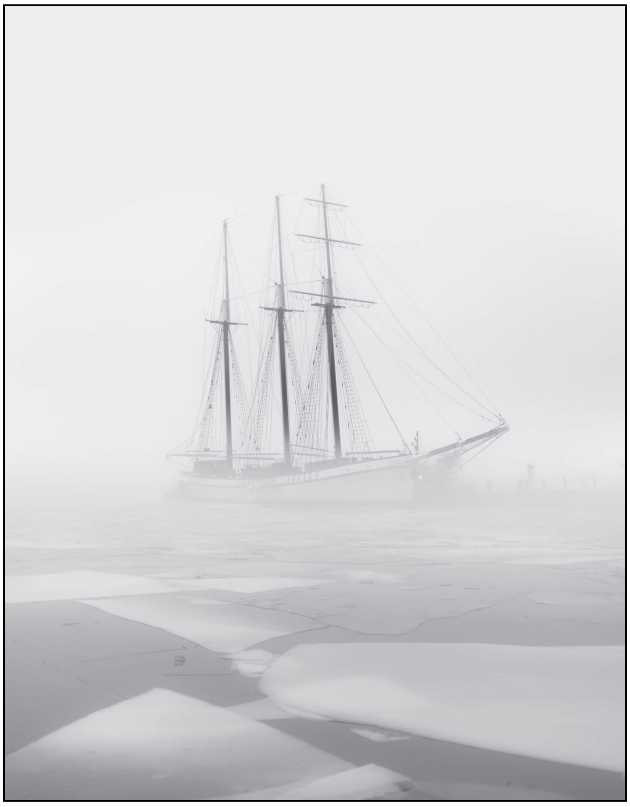
[1] LETTER III.

To Mrs. Saville, England.

July 7th, 17—

My dear Sister,

[5] I write a few lines in haste to say that I am safe — and well advanced on my voyage. This letter will reach England by a merchantman[1] now on its homeward voyage from Archangel; more fortunate than I, who may not see my native land, perhaps, for many years. I am, however, in good spirits: my men are bold and apparently firm of purpose, nor do the floating sheets of ice that continually pass us, indicating the dangers of the region towards which we are advancing, appear to dismay them. We have already reached a very high latitude; but it is the height of summer, and although not so warm as in England, the southern gales,[2] which blow us speedily towards those shores which I so ardently desire to attain, breathe a degree of renovating[3] warmth which I had not expected.



"Foggy Ship" by Filip Mros is licensed under CC0

No incidents have hitherto befallen us that would make a figure in a letter. One or two stiff gales and the springing of a leak are accidents which experienced navigators scarcely remember to record, and I shall be well content if nothing worse happen to us during our voyage.

1. a commercial ship
2. a strong wind
3. a term that has the archaic meaning "to refresh; reinvigorate"

Adieu,[4] my dear Margaret. Be assured that for my own sake, as well as yours, I will not rashly encounter danger. I will be cool, persevering, and prudent.[5]

But success *shall* crown my endeavours. Wherefore not? Thus far I have gone, tracing a secure way over the pathless seas, the very stars themselves being witnesses and testimonies of my triumph. Why not still proceed over the untamed yet obedient element? What can stop the determined heart and resolved will of man?

My swelling heart involuntarily pours itself out thus. But I must finish. Heaven bless my beloved sister!

[10] R.W.

LETTER IV.

To Mrs. Saville, England

August 5th, 17—

So strange an accident has happened to us that I cannot forbear recording it, although it is very probable that you will see me before these papers can come into your possession.

[15] Last Monday (July 31st) we were nearly surrounded by ice, which closed in the ship on all sides, scarcely leaving her the sea-room in which she floated. Our situation was somewhat dangerous, especially as we were compassed round by a very thick fog. We accordingly lay to,[6] hoping that some change would take place in the atmosphere and weather.

About two o'clock the mist cleared away, and we beheld, stretched out in every direction, vast and irregular plains of ice, which seemed to have no end. Some of my comrades groaned, and my own mind began to grow watchful with anxious thoughts, when a strange sight suddenly attracted our attention and diverted our solicitude[7] from our own situation. We perceived a low carriage, fixed on a sledge and drawn by dogs, pass on towards the north, at the distance of half a mile; a being which had the shape of a man, but apparently of gigantic stature, sat in the sledge and guided the dogs. We watched the rapid progress of the traveller with our telescopes until he was lost among the distant inequalities of the ice.

This appearance excited our unqualified[8] wonder. We were, as we believed, many hundred miles from any land; but this apparition[9] seemed to denote that it was not, in reality, so distant as we had supposed. Shut in, however, by ice, it was impossible to follow his track, which we had observed with the greatest attention.

4. goodbye
5. **Prudent** ***(adjective):*** acting with or showing care and thought for the future
6. to bring a ship into the wind and keep stationary
7. care or concern for something
8. **Unqualified** ***(adjective):*** without reservation or limitation; total
9. a ghostlike image of a person

About two hours after this occurrence we heard the ground sea, and before night the ice broke and freed our ship. We, however, lay to until the morning, fearing to encounter in the dark those large loose masses which float about after the breaking up of the ice. I profited of this time to rest for a few hours.

In the morning, however, as soon as it was light, I went upon deck and found all the sailors busy on one side of the vessel, apparently talking to someone in the sea. It was, in fact, a sledge, like that we had seen before, which had drifted towards us in the night on a large fragment of ice. Only one dog remained alive; but there was a human being within it whom the sailors were persuading to enter the vessel.

"Frankenstein; or the Modern Prometheus" by Mary Shelley (1823) is in the public domain.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: The full title of Mary Shelley's novel is Frankenstein; or the Modern Prometheus. The subtitle refers to Prometheus, a mythological figure who symbolizes both the nobility of the quest for knowledge and the danger of overreaching in that quest. In the passage from Frankenstein, how do the two ideas symbolized by Prometheus interact and build on one other?
    A. R.W. possesses advanced geographic knowledge as a result of his explorations, but he has sacrificed personal happiness to gain that knowledge.
    B. R.W. believes firmly in his ability to achieve his goals, but he is challenged by the natural world he seeks to conquer.
    C. R.W. is extremely educated about his surroundings, but he makes a costly mistake about his location within those surroundings.
    D. R.W. is the only member of his crew to care about science for its own sake, but he overestimates what science can accomplish.

2. PART B: Select the TWO quotations that, taken together, best support the answer to Part A?
    A. "I am, however, in good spirits: my men are bold, and apparently firm of purpose" (Paragraph 1)
    B. "I shall be well content if nothing worse happen to us during our voyage." (Paragraph 2)
    C. "But success shall crown my endeavours." (Paragraph 4)
    D. "it is very probable that you will see me before these papers can come into your possession." (Paragraph 6)
    E. "This appearance excited our unqualified wonder." (Paragraph 9)
    F. "Shut in, however, by ice, it was impossible to follow his track, which we had observed with the greatest attention." (Paragraph 9)

3. PART A: Mrs. Saville's brother uses the word "ardently" to describe his desire to reach an unexplored land. What does the word "ardently" mean in this context?
    A. anxiously
    B. passionately
    C. greedily
    D. religiously

4. PART B: Which quotation from the passage best supports the answer to Part A?
    A. "indicating the dangers of the region towards which we are advancing" (Paragraph 1)
    B. "for my own sake, all well as yours, I will not rashly encounter." (Paragraph 3)
    C. "the very stars themselves being witnesses and testimonies" (Paragraph 4)
    D. "What can stop the determined heart and resolved will of man?" (Paragraph 4)

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. In the text, an explorer discusses the progress of his journey in letters to his sister. How is the relationship between man and nature depicted in the letters? What obstacles does nature pose to the explorer and his men? Describe a time when nature or weather prevented you from doing something you wanted or needed to do.

2. In the excerpt, the explorer is confident in his ability to reach his destination. Why are confidence and determination important qualities for an explorer? What are other important traits that you think an explorer should possess?

Name: _____ Class: _____

We Grow Accustomed to the Dark

By Emily Dickinson
c. 1862

Emily Dickinson (1830-1886) was an American poet who lived a mostly introverted, secluded life, maintaining friendships through written letters. She wrote over 1800 poems in her seclusion, most of which were published after her death. As you read, take notes on the meaning of "darkness" throughout the poem.

We grow accustomed to the Dark –
When light is put away –
As when the Neighbor holds the Lamp
To witness her Goodbye –

A Moment – We uncertain step
For newness of the night –
Then – fit our Vision to the Dark –
And meet the Road – erect –

And so of larger – Darknesses –
Those Evenings of the Brain –
When not a Moon disclose a sign –
Or Star – come out – within –

The Bravest – grope a little –
And sometimes hit a Tree
Directly in the Forehead –
But as they learn to see –

Either the Darkness alters –
Or something in the sight
Adjusts itself to Midnight –
And Life steps almost straight.



"Moon" by Ana Sofia Guerreirinho is licensed under CC BY-NC-ND 2.0

We Grow Accustomed to the Dark by Emily Dickinson is in the public domain.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. Which of the following best describe the speaker's point of view?
    A. The speaker's point of view is that of the neighbor walking at night.
    B. The speaker's point of view is that of a group of people discussing darkness and death.
    C. The speaker's point of view is that of someone participating in the events described in the poem.
    D. The speaker's point of view is that of a removed or distant narrator who speaks for humanity.

2. How does the word choice in stanzas 4-5 affect the tone of the poem?
    A. The words "learn" and "Adjusts" shift the tone from uncertain to hopeful as the speaker affirms the ability for people to withstand difficulty.
    B. The phrase "hit a tree" makes the tone even more serious and tragic as the speaker considers the pain that darkness causes.
    C. The phrase "learn to see" shifts the tone from gloomy to more joyful when the speaker realizes that darkness initiates a learning process.
    D. The words "Either" and "alters" make the tone even more mysterious as the speaker reveals the disorienting effect that darkness can have.

3. Which statement best expresses a theme in the poem?
    A. A strong support system is necessary to overcome adversity.
    B. Gaining confidence with a new task requires independence and attention to detail.
    C. It takes time and courage to endure unfamiliar circumstances.
    D. Friends can inspire us to embrace the mystery of the unknown.

4. How does the author use symbolism to develop the theme of the poem? Cite evidence from the text in your answer.

5. How does the poem's stylistic form (i.e. punctuation and capitalization) contribute to its meaning?

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Dickinson is known for her unconventional use of capitalization. As you read the poem again, make notes about Dickinson's use of capitalization. What patterns do you notice? How does her capitalization help you understand the poem?

2. Re-read your answer to Question 2. What is your strongest argument for choosing the answer you did? Be prepared to make a case for your answer in a class debate.

3. Can a poem have multiple interpretations? Explain your answer.

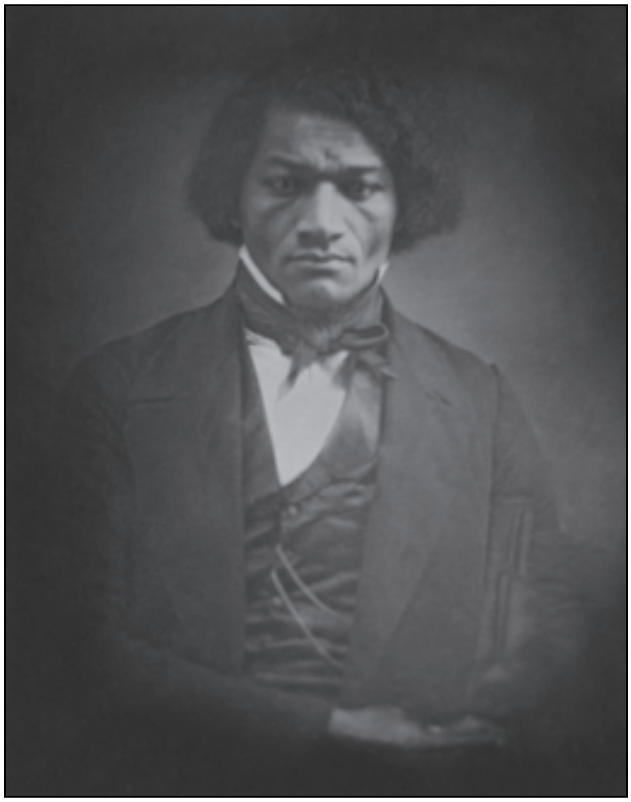
Name: _____ Class: _____

The Narrative of the Life of Frederick Douglass: Excerpt from Chapter 11

By Frederick Douglass
1845

Frederick Douglass (1818 –1895) was born a slave but became a social reformer, abolitionist, orator, writer, and statesman. As a child, Douglass began learning to read and write with the help of his master's wife, Lucretia Auld. Understanding the value of education, he continued to teach himself. After Douglass escaped from slavery, he became a leader of the abolitionist movement, gaining note for his dazzling oratory and incisive antislavery writings. He stood as a living counter-example to slaveholders' arguments that slaves lacked the intellectual capacity to function as independent American citizens. As you read the story of his escape, keep track of how Douglass describes his feelings about finally becoming a free man.

Chapter XI



"Frederick Douglass c.1850" by Unknown is in the public domain.

[1] I now come to that part of my life during which I planned, and finally succeeded in making, my escape from slavery. But before narrating any of the peculiar circumstances, I deem it proper to make known my intention not to state all the facts connected with the transaction. My reasons for pursuing this course may be understood from the following: First, were I to give a minute statement of all the facts, it is not only possible, but quite probable, that others would thereby be involved in the most embarrassing difficulties. Secondly, such a statement would most undoubtedly induce greater vigilance on the part of slaveholders than has existed heretofore[1] among them; which would, of course, be the means of guarding a door whereby some dear brother bondman[2] might escape his galling[3] chains. I deeply regret the necessity that impels me to suppress anything of importance connected with my experience in slavery. It would afford me great pleasure indeed, as well as materially add to the interest of my narrative, were I at liberty to gratify a curiosity, which I know exists in the minds of many, by an accurate statement of all the facts pertaining to my most fortunate escape. But I must deprive myself of this pleasure, and the curious of the gratification which such a statement would afford. I would allow myself to suffer under the greatest imputations[4] which evil-minded men might suggest, rather than exculpate[5] myself, and thereby run the hazard of closing the slightest avenue by which a brother slave might clear himself of the chains and fetters[6] of slavery.

1. **Heretofore** ***(adverb):*** before this time; until now
2. **Bondman** ***(noun):*** slave; a man bound to service without wages

I have never approved of the very public manner in which some of our western friends have conducted what they call the *underground railroad*,[7] but which I think, by their open declarations, has been made most emphatically the *upper-ground railroad*. I honor those good men and women for their noble daring, and applaud them for willingly subjecting themselves to bloody persecution, by openly avowing[8] their participation in the escape of slaves. I, however, can see very little good resulting from such a course, either to themselves or the slaves escaping; while, upon the other hand, I see and feel assured that those open declarations are a positive evil to the slaves remaining, who are seeking to escape. They do nothing towards enlightening the slave, whilst they do much towards enlightening the master. They stimulate him to greater watchfulness, and enhance his power to capture his slave. We owe something to the slave south of the line as well as to those north of it; and in aiding the latter on their way to freedom, we should be careful to do nothing which would be likely to hinder the former from escaping from slavery. I would keep the merciless slaveholder profoundly ignorant of the means of flight adopted by the slave. I would leave him to imagine himself surrounded by myriads[9] of invisible tormentors, ever ready to snatch from his infernal[10] grasp his trembling prey. Let him be left to feel his way in the dark; let darkness commensurate[11] with his crime hover over him; and let him feel that at every step he takes, in pursuit of the flying bondman, he is running the frightful risk of having his hot brains dashed out by an invisible agency. Let us render the tyrant no aid; let us not hold the light by which he can trace the footprints of our flying brother. But enough of this. I will now proceed to the statement of those facts, connected with my escape, for which I am alone responsible, and for which no one can be made to suffer but myself.

3. **Galling** ***(adjective):*** causing someone to feel angry or annoyed; markedly irritating
4. **Imputations** ***(noun):*** attributing something dishonest or criminal; accusation
5. **Exculpate** ***(verb):*** to clear from fault or guilt
6. **Fetters** ***(noun):*** something that confines; chains or shackles for feet
7. The "Underground Railroad" was a network of secret routes and safe houses used by 19th-century enslaved people of African descent in the United States in efforts to escape to free states and Canada.
8. **Avowing** ***(verb):*** to declare or state something in a public way
9. **Myriads** ***(noun):*** a very great number of persons
10. **Infernal** ***(adjective):*** hellish; diabolical
11. **Commensurate** ***(verb):*** to be equal or similar in size, amount, or degree

In the early part of the year 1838, I became quite restless. I could see no reason why I should, at the end of each week, pour the reward of my toil into the purse of my master. When I carried to him my weekly wages, he would, after counting the money, look me in the face with a robber-like fierceness, and ask, "Is this all?" He was satisfied with nothing less than the last cent. He would, however, when I made him six dollars, sometimes give me six cents, to encourage me. It had the opposite effect. I regarded it as a sort of admission of my right to the whole. The fact that he gave me any part of my wages was proof, to my mind, that he believed me entitled to the whole of them. I always felt worse for having received any thing; for I feared that the giving me a few cents would ease his conscience, and make him feel himself to be a pretty honorable sort of robber. My discontent grew upon me. I was ever on the look-out for means of escape; and, finding no direct means, I determined to try to hire my time, with a view of getting money with which to make my escape. In the spring of 1838, when Master Thomas came to Baltimore to purchase his spring goods, I got an opportunity, and applied to him to allow me to hire my time. He unhesitatingly refused my request, and told me this was another stratagem[12] by which to escape. He told me I could go nowhere but that he could get me; and that, in the event of my running away, he should spare no pains in his efforts to catch me. He exhorted[13] me to content myself, and be obedient. He told me, if I would be happy, I must lay out no plans for the future. He said, if I behaved myself properly, he would take care of me. Indeed, he advised me to complete thoughtlessness of the future, and taught me to depend solely upon him for happiness. He seemed to see fully the pressing necessity of setting aside my intellectual nature, in order to contentment in slavery. But in spite of him, and even in spite of myself, I continued to think, and to think about the injustice of my enslavement, and the means of escape.

12. **Stratagem** ***(noun):*** a trick or plan for deceiving an enemy or for achieving a goal
13. **Exhorted** ***(verb):*** to give warning

About two months after this, I applied to Master Hugh for the privilege of hiring my time. He was not acquainted with the fact that I had applied to Master Thomas, and had been refused. He too, at first, seemed disposed[14] to refuse; but, after some reflection, he granted me the privilege, and proposed the following terms: I was to be allowed all my time, make all contracts with those for whom I worked, and find my own employment; and, in return for this liberty, I was to pay him three dollars at the end of each week; find myself in calking tools, and in board and clothing. My board was two dollars and a half per week. This, with the wear and tear of clothing and calking tools, made my regular expenses about six dollars per week. This amount I was compelled to make up, or relinquish the privilege of hiring my time. Rain or shine, work or no work, at the end of each week the money must be forthcoming, or I must give up my privilege. This arrangement, it will be perceived, was decidedly in my master's favor. It relieved him of all need of looking after me. His money was sure. He received all the benefits of slaveholding without its evils; while I endured all the evils of a slave, and suffered all the care and anxiety of a freeman. I found it a hard bargain. But, hard as it was, I thought it better than the old mode of getting along. It was a step towards freedom to be allowed to bear the responsibilities of a freeman, and I was determined to hold on upon it. I bent myself to the work of making money. I was ready to work at night as well as day, and by the most untiring perseverance and industry, I made enough to meet my expenses, and lay up a little money every week. I went on thus from May till August. Master Hugh then refused to allow me to hire my time longer. The ground for his refusal was a failure on my part, one Saturday night, to pay him for my week's time. This failure was occasioned by my attending a camp meeting[15] about ten miles from Baltimore. During the week, I had entered into an engagement with a number of young friends to start from Baltimore to the camp ground early Saturday evening; and being detained by my employer, I was unable to get down to Master Hugh's without disappointing the company. I knew that Master Hugh was in no special need of the money that night. I therefore decided to go to camp meeting, and upon my return pay him the three dollars. I staid[16] at the camp meeting one day longer than I intended when I left. But as soon as I returned, I called upon him to pay him what he considered his due. I found him very angry; he could scarce restrain his wrath. He said he had a great mind to give me a severe whipping. He wished to know how I dared go out of the city without asking his permission. I told him I hired my time and while I paid him the price which he asked for it, I did not know that I was bound to ask him when and where I should go. This reply troubled him; and, after reflecting a few moments, he turned to me, and said I should hire my time no longer; that the next thing he should know of, I would be running away. Upon the same plea, he told me to bring my tools and clothing home forthwith. I did so; but instead of seeking work, as I had been accustomed to do previously to hiring my time, I spent the whole week without the performance of a single stroke of work. I did this in retaliation. Saturday night, he called upon me as usual for my week's wages. I told him I had no wages; I had done no work that week. Here we were upon the point of coming to blows. He raved, and swore his determination to get hold of me. I did not allow myself a single word; but was resolved, if he laid the weight of his hand upon me, it should be blow for blow. He did not strike me, but told me that he would find me in constant employment in future. I thought the matter over during the next day, Sunday, and finally resolved upon the third day of September, as the day upon which I would make a second attempt to secure my freedom. I now had three weeks during which to prepare for my journey. Early on Monday morning, before Master Hugh had time to make any engagement for me, I went out and got employment of Mr. Butler, at his ship-yard near the drawbridge, upon what is called the City Block, thus making it unnecessary for him to seek employment for me. At the end of the week, I brought him between eight and nine dollars. He seemed very well pleased, and asked why I did not do the same the week before. He little knew what my plans were. My object in working steadily was to remove any suspicion he might entertain of my intent to run away; and in this I succeeded admirably. I suppose he thought I was never better satisfied with my condition than at the very time during which I was planning my escape. The second week passed, and again I carried him my full wages; and so well pleased was he, that he gave me twenty-five

cents, (quite a large sum for a slaveholder to give a slave,) and bade[17] me to make a good use of it. I told him I would.

[5] Things went on without very smoothly indeed, but within there was trouble. It is impossible for me to describe my feelings as the time of my contemplated start drew near. I had a number of warmhearted friends in Baltimore, — friends that I loved almost as I did my life, — and the thought of being separated from them forever was painful beyond expression. It is my opinion that thousands would escape from slavery, who now remain, but for the strong cords of affection that bind them to their friends. The thought of leaving my friends was decidedly the most painful thought with which I had to contend. The love of them was my tender point, and shook my decision more than all things else. Besides the pain of separation, the dread and apprehension of a failure exceeded what I had experienced at my first attempt. The appalling defeat I then sustained returned to torment me. I felt assured that, if I failed in this attempt, my case would be a hopeless one—it would seal my fate as a slave forever. I could not hope to get off with any thing less than the severest punishment, and being placed beyond the means of escape. It required no very vivid imagination to depict the most frightful scenes through which I should have to pass, in case I failed. The wretchedness of slavery, and the blessedness of freedom, were perpetually before me. It was life and death with me. But I remained firm, and, according to my resolution, on the third day of September, 1838, I left my chains, and succeeded in reaching New York without the slightest interruption of any kind. How I did so,—what means I adopted,—what direction I travelled, and by what mode of conveyance,—I must leave unexplained, for the reasons before mentioned.

14. **Disposed** ***(verb):*** having a specific attitude toward something; likely to do something
15. “Camp meetings” were religious meetings held in tents or out in the open, usually lasting several days.
16. An archaic form of “stayed”
17. **Bade** ***(verb):*** (past tense of bid) to express or tell

I have been frequently asked how I felt when I found myself in a free State. I have never been able to answer the question with any satisfaction to myself. It was a moment of the highest excitement I ever experienced. I suppose I felt as one may imagine the unarmed mariner to feel when he is rescued by a friendly man-of-war[18] from the pursuit of a pirate. In writing to a dear friend, immediately after my arrival at New York, I said I felt like one who had escaped a den of hungry lions. This state of mind, however, very soon subsided; and I was again seized with a feeling of great insecurity and loneliness. I was yet liable to be taken back, and subjected to all the tortures of slavery. This in itself was enough to damp the ardor[19] of my enthusiasm. But the loneliness overcame me. There I was in the midst of thousands, and yet a perfect stranger; without home and without friends, in the midst of thousands of my own brethren—children of a common Father, and yet I dared not to unfold to any one of them my sad condition. I was afraid to speak to any one for fear of speaking to the wrong one, and thereby falling into the hands of money-loving kidnappers, whose business it was to lie in wait for the panting fugitive, as the ferocious beasts of the forest lie in wait for their prey. The motto which I adopted when I started from slavery was this—"Trust no man!" I saw in every white man an enemy, and in almost every colored man cause for distrust. It was a most painful situation; and, to understand it, one must needs experience it, or imagine himself in similar circumstances. Let him be a fugitive slave in a strange land—a land given up to be the hunting-ground for slaveholders—whose inhabitants are legalized kidnappers—where he is every moment subjected to the terrible liability of being seized upon by his fellowmen, as the hideous crocodile seizes upon his prey!—I say, let him place himself in my situation—without home or friends—without money or credit—wanting shelter, and no one to give it—wanting bread, and no money to buy it,—and at the same time let him feel that he is pursued by merciless men-hunters, and in total darkness as to what to do, where to go, or where to stay,—perfectly helpless both as to the means of defense and means of escape,—in the midst of plenty, yet suffering the terrible gnawings of hunger,—in the midst of houses, yet having no home,—among fellow-men, yet feeling as if in the midst of wild beasts, whose greediness to swallow up the trembling and half-famished fugitive is only equalled by that with which the monsters of the deep swallow up the helpless fish upon which they subsist,—I say, let him be placed in this most trying situation,—the situation in which I was placed,—then, and not till then, will he fully appreciate the hardships of, and know how to sympathize with, the toil-worn and whip-scarred fugitive slave.

Thank Heaven, I remained but a short time in this distressed situation. I was relieved from it by the humane hand of *Mr. David Ruggles*, whose vigilance, kindness, and perseverance, I shall never forget. I am glad of an opportunity to express, as far as words can, the love and gratitude I bear him. Mr. Ruggles is now afflicted with blindness, and is himself in need of the same kind offices which he was once so forward in the performance of toward others. I had been in New York but a few days, when Mr. Ruggles sought me out, and very kindly took me to his boarding-house at the corner of Church and Lespenard Streets. Mr. Ruggles was then very deeply engaged in the memorable *Darg* case,[20] as well as attending to a number of other fugitive slaves, devising ways and means for their successful escape; and, though watched and hemmed in on almost every side, he seemed to be more than a match for his enemies.

18. **Man of war** ***(noun):*** a British war ship
19. **Ardor** ***(noun):*** with great passion
20. The "Darg Case of 1938" involved a Virginian slaveholder, John P. Darg, who brought one of his slaves to New York with him. David Ruggles involved himself and was severely punished and imprisoned as a result.

Very soon after I went to Mr. Ruggles, he wished to know of me where I wanted to go; as he deemed it unsafe for me to remain in New York. I told him I was a calker, and should like to go where I could get work. I thought of going to Canada; but he decided against it, and in favor of my going to New Bedford, thinking I should be able to get work there at my trade. At this time, Anna,* my intended wife, came on; for I wrote to her immediately after my arrival at New York, (notwithstanding my homeless, houseless, and helpless condition,) informing her of my successful flight, and wishing her to come on forthwith[21]. In a few days after her arrival, Mr. Ruggles called in the Rev. J. W. C. Pennington, who, in the presence of Mr. Ruggles, Mrs. Michaels, and two or three others, performed the marriage ceremony, and gave us a certificate, of which the following is an exact copy:—

> *"This may certify, that I joined together in holy matrimony Frederick Johnson** and Anna Murray, as man and wife, in the presence of Mr. David Ruggles and Mrs. Michaels."*
>
> *JAMES W. C. PENNINGTON*
>
> *"New York, Sept. 15, 1838"*
>
> **She was free.*
>
> ***I had changed my name from Frederick Bailey to that of Johnson.*

Upon receiving this certificate, and a five-dollar bill from Mr. Ruggles, I shouldered one part of our baggage, and Anna took up the other, and we set out forthwith to take passage on board of the steamboat John W. Richmond for Newport, on our way to New Bedford. Mr. Ruggles gave me a letter to a Mr. Shaw in Newport, and told me, in case my money did not serve me to New Bedford, to stop in Newport and obtain further assistance; but upon our arrival at Newport, we were so anxious to get to a place of safety, that, notwithstanding[22] we lacked the necessary money to pay our fare, we decided to take seats in the stage, and promise to pay when we got to New Bedford. We were encouraged to do this by two excellent gentlemen, residents of New Bedford, whose names I afterward ascertained[23] to be Joseph Ricketson and William C. Taber. They seemed at once to understand our circumstances, and gave us such assurance of their friendliness as put us fully at ease in their presence.

[10] It was good indeed to meet with such friends, at such a time. Upon reaching New Bedford, we were directed to the house of Mr. Nathan Johnson, by whom we were kindly received, and hospitably provided for. Both Mr. and Mrs. Johnson took a deep and lively interest in our welfare. They proved themselves quite worthy of the name of abolitionists.[24] When the stage-driver found us unable to pay our fare, he held on upon our baggage as security for the debt. I had but to mention the fact to Mr. Johnson, and he forthwith advanced the money.

21. **Forthwith** ***(adjective):*** immediately
22. **Notwithstanding** ***(conjunction):*** in spite of the fact that
23. **Ascertained** ***(verb):*** to learn with certainty
24. **Abolitionists** ***(noun):*** persons who supported the ending of slavery within the United States, especially that of African-Americans; advocates and supporters of the anti-slavery movement

We now began to feel a degree of safety, and to prepare ourselves for the duties and responsibilities of a life of freedom. On the morning after our arrival at New Bedford, while at the breakfast-table, the question arose as to what name I should be called by. The name given me by my mother was, "Frederick Augustus Washington Bailey." I, however, had dispensed with the two middle names long before I left Maryland so that I was generally known by the name of "Frederick Bailey." I started from Baltimore bearing the name of "Stanley." When I got to New York, I again changed my name to "Frederick Johnson," and thought that would be the last change. But when I got to New Bedford, I found it necessary again to change my name. The reason of this necessity was, that there were so many Johnsons in New Bedford, it was already quite difficult to distinguish between them. I gave Mr. Johnson the privilege of choosing me a name, but told him he must not take from me the name of "Frederick." I must hold on to that, to preserve a sense of my identity. Mr. Johnson had just been reading the "Lady of the Lake," and at once suggested that my name be "Douglass." From that time until now I have been called "Frederick Douglass;" and as I am more widely known by that name than by either of the others, I shall continue to use it as my own.

I was quite disappointed at the general appearance of things in New Bedford. The impression which I had received respecting the character and condition of the people of the north, I found to be singularly erroneous. I had very strangely supposed, while in slavery, that few of the comforts, and scarcely any of the luxuries, of life were enjoyed at the north, compared with what were enjoyed by the slaveholders of the south. I probably came to this conclusion from the fact that northern people owned no slaves. I supposed that they were about upon a level with the non-slaveholding population of the south. I knew *they* were exceedingly poor, and I had been accustomed to regard their poverty as the necessary consequence of their being non-slaveholders. I had somehow imbibed the opinion that, in the absence of slaves, there could be no wealth, and very little refinement. And upon coming to the north, I expected to meet with a rough, hard-handed, and uncultivated population, living in the most Spartan-like simplicity, knowing nothing of the ease, luxury, pomp, and grandeur of southern slaveholders. Such being my conjectures,[25] any one acquainted with the appearance of New Bedford may very readily infer how palpably I must have seen my mistake.

In the afternoon of the day when I reached New Bedford, I visited the wharves,[26] to take a view of the shipping. Here I found myself surrounded with the strongest proofs of wealth. Lying at the wharves, and riding in the stream, I saw many ships of the finest model, in the best order, and of the largest size. Upon the right and left, I was walled in by granite warehouses of the widest dimensions, stowed to their utmost capacity with the necessaries and comforts of life. Added to this, almost every body seemed to be at work, but noiselessly so, compared with what I had been accustomed to in Baltimore. There were no loud songs heard from those engaged in loading and unloading ships. I heard no deep oaths or horrid curses on the laborer. I saw no whipping of men; but all seemed to go smoothly on. Every man appeared to understand his work, and went at it with a sober, yet cheerful earnestness, which betokened[27] the deep interest which he felt in what he was doing, as well as a sense of his own dignity as a man. To me this looked exceedingly strange. From the wharves I strolled around and over the town, gazing with wonder and admiration at the splendid churches, beautiful dwellings, and finely-cultivated gardens; evincing[28] an amount of wealth, comfort, taste, and refinement, such as I had never seen in any part of slaveholding Maryland.

25. **Conjectures** ***(noun):*** an opinion without sufficient proof; a guess
26. **Wharves** ***(noun):*** (plural for wharf) a flat structure that is built along the shore of a river, ocean, etc., so that ships can load and unload cargo or passengers
27. **Betokened** ***(verb):*** to give evidence of; show
28. **Evincing** ***(verb):*** to show clearly

Every thing looked clean, new, and beautiful. I saw few or no dilapidated houses, with poverty-stricken inmates; no half-naked children and barefooted women, such as I had been accustomed to see in Hillsborough, Easton, St. Michael's, and Baltimore. The people looked more able, stronger, healthier, and happier, than those of Maryland. I was for once made glad by a view of extreme wealth, without being saddened by seeing extreme poverty. But the most astonishing as well as the most interesting thing to me was the condition of the colored people, a great many of whom, like myself, had escaped thither[29] as a refuge from the hunters of men. I found many, who had not been seven years out of their chains, living in finer houses, and evidently enjoying more of the comforts of life, than the average of slaveholders in Maryland. I will venture to assert, that my friend Mr. Nathan Johnson (of whom I can say with a grateful heart, "I was hungry, and he gave me meat; I was thirsty, and he gave me drink; I was a stranger, and he took me in") lived in a neater house; dined at a better table; took, paid for, and read, more newspapers; better understood the moral, religious, and political character of the nation,—than nine tenths of the slaveholders in Talbot county Maryland. Yet Mr. Johnson was a working man. His hands were hardened by toil, and not his alone, but those also of Mrs. Johnson. I found the colored people much more spirited than I had supposed they would be. I found among them a determination to protect each other from the blood-thirsty kidnapper, at all hazards. Soon after my arrival, I was told of a circumstance which illustrated their spirit. A colored man and a fugitive slave were on unfriendly terms. The former was heard to threaten the latter with informing his master of his whereabouts. Straightway a meeting was called among the colored people, under the stereotyped notice, "Business of importance!" The betrayer was invited to attend. The people came at the appointed hour, and organized the meeting by appointing a very religious old gentleman as president, who, I believe, made a prayer, after which he addressed the meeting as follows: *"Friends, we have got him here, and I would recommend that you young men just take him outside the door, and kill him!"* With this, a number of them bolted at him; but they were intercepted by some more timid than themselves, and the betrayer escaped their vengeance, and has not been seen in New Bedford since. I believe there have been no more such threats, and should there be hereafter, I doubt not that death would be the consequence.

[15] I found employment, the third day after my arrival, in stowing a sloop with a load of oil. It was new, dirty, and hard work for me; but I went at it with a glad heart and a willing hand. I was now my own master. It was a happy moment, the rapture of which can be understood only by those who have been slaves. It was the first work, the reward of which was to be entirely my own. There was no Master Hugh standing ready, the moment I earned the money, to rob me of it. I worked that day with a pleasure I had never before experienced. I was at work for myself and newly-married wife. It was to me the starting-point of a new existence. When I got through with that job, I went in pursuit of a job of calking; but such was the strength of prejudice against color, among the white calkers, that they refused to work with me, and of course I could get no employment. *(I am told that colored persons can now get employment at calking in New Bedford—a result of anti-slavery effort.)*

Finding my trade of no immediate benefit, I threw off my calking habiliments[30], and prepared myself to do any kind of work I could get to do. Mr. Johnson kindly let me have his wood-horse and saw, and I very soon found myself a plenty of work. There was no work too hard—none too dirty. I was ready to saw wood, shovel coal, carry wood, sweep the chimney, or roll oil casks,—all of which I did for nearly three years in New Bedford, before I became known to the anti-slavery world.

29. **Thither** ***(adverb):*** to that place; there
30. **Habiliments** ***(noun):*** items characteristic of a specific occupation or activity

In about four months after I went to New Bedford, there came a young man to me, and inquired if I did not wish to take the "Liberator."[31] I told him I did; but, just having made my escape from slavery, I remarked that I was unable to pay for it then. I, however, finally became a subscriber to it. The paper came, and I read it from week to week with such feelings as it would be quite idle for me to attempt to describe. The paper became my meat and my drink. My soul was set all on fire. Its sympathy for my brethren in bonds—its scathing denunciations of slaveholders—its faithful exposures of slavery—and its powerful attacks upon the upholders of the institution—sent a thrill of joy through my soul, such as I had never felt before!

I had not long been a reader of the "Liberator," before I got a pretty correct idea of the principles, measures and spirit of the anti-slavery reform. I took right hold of the cause. I could do but little; but what I could, I did with a joyful heart, and never felt happier than when in an anti-slavery meeting. I seldom had much to say at the meetings, because what I wanted to say was said so much better by others. But, while attending an anti-slavery convention at Nantucket, on the 11th of August, 1841, I felt strongly moved to speak, and was at the same time much urged to do so by Mr. William C. Coffin, a gentleman who had heard me speak in the colored people's meeting at New Bedford. It was a severe cross, and I took it up reluctantly. The truth was, I felt myself a slave, and the idea of speaking to white people weighed me down. I spoke but a few moments, when I felt a degree of freedom, and said what I desired with considerable ease. From that time until now, I have been engaged in pleading the cause of my brethren—with what success, and with what devotion, I leave those acquainted with my labors to decide.

The Narrative of the Life of Frederick Douglass: Excerpt from Chapter 11 by Frederick Douglass is in the public domain.

31. "The Liberator" (1831-1865) was an anti-slavery newspaper founded by William Lloyd Garrison.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: As it is used in paragraph 1, the phrase "closing the slightest avenue" means:
   A. to close or block off a street
   B. putting an end to slavery once and for all
   C. to prevent slaves from using existing routes of escape
   D. to make slave-owners more aware of the efforts to free slaves

2. PART B: Explain the answer to Part A, citing evidence from the text as support.

3. Explain Frederick Douglass' feeling regarding the "Underground Railroad." Are his feelings positive or negative? Cite details from the text to support your response.

4. Summarize Douglass' feelings upon arriving in New York in paragraph 6. How does Douglass use figurative language in this paragraph to convey his emotions?

5. Which of the following represents a central idea of the narrative?
   A. To truly be free, one must free himself both physically and mentally from the restraints of slavery.
   B. The Underground Railroad was the best option for slaves to become free.
   C. Slaves must change their names to hide their identity.
   D. When escaping persecution, one must refrain from trusting others.

6. PART A: What is ironic about Douglass finally being a free man?
   A. Douglass makes many friends, even though he left his friends when he escaped.
   B. Douglass encounters men who hunt fugitive slaves, making it difficult for him to enjoy his freedom.
   C. Douglass must continue working as a caulker just as he did as a slave.
   D. Upon entering into freedom, Douglass does not feel he is a free man.

7. PART B: Explain your answer to Part A. Support your response with details from the text.

8. PART A: Which of the following best describes the significance of Douglass' introduction to "The Liberator"?
    A. It introduced him to the plight of slaves in the south.
    B. It introduced him to the anti-slavery movement in the north.
    C. It provided him with knowledge of the anti-slavery movement, as well as a purpose and voice within the movement.
    D. He wrote for the paper, so he was able to practice his reading and writing skills.

9. PART B: Which of the following quotes best supports your answer to Part A?
    A. "The paper came, and I read it from week to week with such feelings as it would be quite idle for me to attempt to describe." (Paragraph 17)
    B. "I had not long been a reader of the "Liberator," before I got a pretty correct idea of the principles, measures and spirit of the anti-slavery reform. I took right hold of the cause." (Paragraph 18)
    C. "Its sympathy for my brethren in bonds—its scathing denunciations of slaveholders—its faithful exposures of slavery—and its powerful attacks upon the upholders of the institution—sent a thrill of joy through my soul, such as I had never felt before!" (Paragraph 17)
    D. "The paper became my meat and my drink. My soul was set all on fire" (Paragraph 17)

10. How does the author use figurative language within the text? How does the figurative language further develop the central idea within the narrative? Provide details from the text to support your response.

11. Explain the role education played in Douglass life and his journey to ultimate freedom. How does this contribute to the central idea? Provide details from the text to support your response.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Think about the institution of slavery. Why do you think slave owners forbade slaves from learning to read and write? Explain your answer.

2. What does it mean to be free?

3. In order to escape slavery, Frederick Douglass had to leave everything and everyone he knew. What other challenges did Frederick Douglass face after he escaped?

4. What is Frederick Douglass' legacy? How will he be remembered? Explain your answer.

Name: _____ Class: _____

President Roosevelt's First Fireside Chat

The Banking Crisis

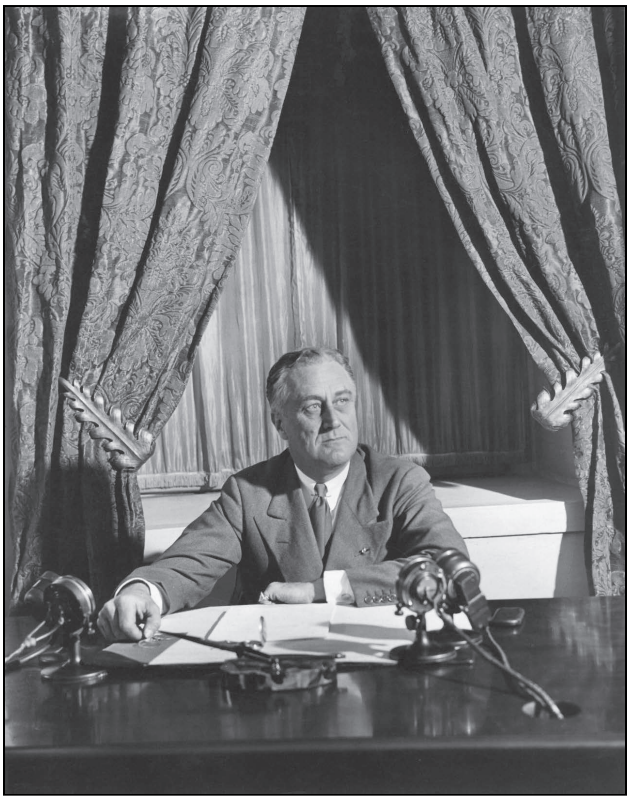
By President Franklin D. Roosevelt
1933

On March 12, 1933, President Franklin D. Roosevelt addressed the American people for the first time over a radiobroadcast. President Roosevelt uses this platform to explain the causes and results of the banking crisis that followed the stock market crash during the Great Depression. As you read, take notes of what President Roosevelt's purpose is throughout his address and what he is asking American citizens to do following the reopening of the banks.

[1] My friends:

I want to talk for a few minutes with the people of the United States about banking — to talk with the comparatively few who understand the mechanics of banking, but more particularly with the overwhelming majority of you who use banks for the making of deposits and the drawing of checks.

I want to tell you what has been done in the last few days, and why it was done, and what the next steps are going to be. I recognize that the many proclamations from State capitols and from Washington, the legislation, the Treasury regulations, and so forth, couched for the most part in banking and legal terms, ought to be explained for the benefit of the average citizen. I owe this, in particular, because of the fortitude[1] and the good temper with which everybody has accepted the inconvenience and hardships of the banking holiday.[2] And I know that when you understand what we in Washington have been about, I shall continue to have your cooperation as fully as I have had your sympathy and your help during the past week.



"President Franklin D. Roosevelt Broadcasting his First Fireside Chat Regarding the Banking Crisis, from the White House, Washington, D.C." by National Archives and Records Administration is in the public domain.

1. **Fortitude** ***(noun):*** courage in pain of adversity
2. On March 6, 1933, President Roosevelt ordered the suspension of all banking transactions in an attempt to stabilize the banking system.

First of all, let me state the simple fact that when you deposit money in a bank, the bank does not put the money into a safe deposit vault. It invests your money in many different forms of credit — in bonds, in commercial paper, in mortgages and in many other kinds of loans. In other words, the bank puts your money to work to keep the wheels of industry and of agriculture turning around. A comparatively small part of the money that you put into the bank is kept in currency — an amount which in normal times is wholly sufficient to cover the cash needs of the average citizen. In other words, the total amount of all the currency in the country is only a comparatively small proportion of the total deposits in all the banks of the country.

[5] What, then, happened during the last few days of February and the first few days of March? Because of undermined confidence on the part of the public, there was a general rush by a large portion of our population to turn bank deposits into currency or gold — a rush so great that the soundest banks couldn't get enough currency to meet the demand. The reason for this was that on the spur of the moment it was, of course, impossible to sell perfectly sound assets of a bank and convert them into cash, except at panic prices far below their real value. By the afternoon of March third, a week ago last Friday, scarcely a bank in the country was open to do business. Proclamations closing them, in whole or in part, had been issued by the Governors in almost all the states. It was then that I issued the proclamation providing for the national bank holiday, and this was the first step in the Government's reconstruction of our financial and economic fabric.

The second step, last Thursday, was the legislation promptly and patriotically passed by the Congress confirming my proclamation and broadening my powers so that it became possible in view of the requirement of time to extend the holiday and lift the ban of that holiday gradually in the days to come. This law also gave authority to develop a program of rehabilitation of our banking facilities. And I want to tell our citizens in every part of the Nation that the national Congress — Republicans and Democrats alike — showed by this action a devotion to public welfare and a realization of the emergency and the necessity for speed that it is difficult to match in all our history.

The third stage has been the series of regulations permitting the banks to continue their functions to take care of the distribution of food and household necessities and the payment of payrolls.

This bank holiday, while resulting in many cases in great inconvenience, is affording us the opportunity to supply the currency necessary to meet the situation. Remember that no sound bank is a dollar worse off than it was when it closed its doors last week. Neither is any bank which may turn out not to be in a position for immediate opening. The new law allows the twelve Federal Reserve Banks[3] to issue additional currency on good assets and thus the banks that reopen will be able to meet every legitimate call. The new currency is being sent out by the Bureau of Engraving and Printing[4] in large volume to every part of the country. It is sound currency because it is backed by actual, good assets.

Another question you will ask is this: Why are all the banks not to be reopened at the same time? The answer is simple and I know you will understand it: Your Government does not intend that the history of the past few years shall be repeated. We do not want and will not have another epidemic of bank failures.

3. Federal Reserve Banks were established in 1913 by the U.S. Congress. A Federal Reserve Bank is a regional bank and part of the Federal Reserve System (the central banking system of the United States).
4. The Bureau of Engraving and Printing is a government agency within the United States Department of Treasury, responsible for producing paper money.

[10] As a result, we start tomorrow, Monday, with the opening of banks in the twelve Federal Reserve Bank cities — those banks, which on first examination by the Treasury, have already been found to be all right. That will be followed on Tuesday by the resumption of all other functions by banks already found to be sound in cities where there are recognized clearing houses. That means about two hundred and fifty cities of the United States. In other words, we are moving as fast as the mechanics of the situation will allow us.

On Wednesday and succeeding days, banks in smaller places all through the country will resume business, subject, of course, to the Government's physical ability to complete its survey It is necessary that the reopening of banks be extended over a period in order to permit the banks to make applications for the necessary loans, to obtain currency needed to meet their requirements, and to enable the Government to make common sense checkups.

Please let me make it clear to you that if your bank does not open the first day you are by no means justified in believing that it will not open. A bank that opens on one of the subsequent[5] days is in exactly the same status as the bank that opens tomorrow.

I know that many people are worrying about State banks that are not members of the Federal Reserve System. There is no occasion for that worry. These banks can and will receive assistance from member banks and from the Reconstruction Finance Corporation.[6] And, of course, they are under the immediate control of the State banking authorities. These State banks are following the same course as the National banks except that they get their licenses to resume business from the State authorities, and these authorities have been asked by the Secretary of the Treasury to permit their good banks to open up on the same schedule as the national banks. And so I am confident that the State Banking Departments will be as careful as the national Government in the policy relating to the opening of banks and will follow the same broad theory.

It is possible that when the banks resume a very few people who have not recovered from their fear may again begin withdrawals. Let me make it clear to you that the banks will take care of all needs, except, of course, the hysterical demands of hoarders, and it is my belief that hoarding during the past week has become an exceedingly unfashionable pastime in every part of our nation. It needs no prophet to tell you that when the people find that they can get their money — that they can get it when they want it for all legitimate purposes — the phantom of fear will soon be laid. People will again be glad to have their money where it will be safely taken care of and where they can use it conveniently at any time. I can assure you, my friends, that it is safer to keep your money in a reopened bank than it is to keep it under the mattress.

[15] The success of our whole national program depends, of course, on the cooperation of the public — on its intelligent support and its use of a reliable system.

Remember that the essential accomplishment of the new legislation is that it makes it possible for banks more readily to convert their assets into cash than was the case before. More liberal provision has been made for banks to borrow on these assets at the Reserve Banks and more liberal provision has also been made for issuing currency on the security of these good assets. This currency is not fiat currency. It is issued only on adequate security, and every good bank has an abundance of such security.

5. **Subsequent** ***(adjective):*** coming after something in time; following
6. A corporation in the United States that provided financial support to state and local governments, including loans to banks.

One more point before I close. There will be, of course, some banks unable to reopen without being reorganized. The new law allows the Government to assist in making these reorganizations quickly and effectively and even allows the Government to subscribe to at least a part of any new capital that may be required.

I hope you can see, my friends, from this essential recital of what your Government is doing that there is nothing complex, nothing radical in the process.

We have had a bad banking situation. Some of our bankers had shown themselves either incompetent or dishonest in their handling of the people's funds. They had used the money entrusted to them in speculations and unwise loans. This was, of course, not true in the vast majority of our banks, but it was true in enough of them to shock the people of the United States, for a time, into a sense of insecurity and to put them into a frame of mind where they did not differentiate, but seemed to assume that the acts of a comparative few had tainted them all. And so it became the Government's job to straighten out this situation and do it as quickly as possible. And that job is being performed.

[20] I do not promise you that every bank will be reopened or that individual losses will not be suffered, but there will be no losses that possibly could be avoided; and there would have been more and greater losses had we continued to drift. I can even promise you salvation for some, at least, of the sorely presses banks. We shall be engaged not merely in reopening sound banks but in the creation of more sound banks through reorganization.

It has been wonderful to me to catch the note of confidence from all over the country. I can never be sufficiently grateful to the people for the loyal support that they have given me in their acceptance of the judgment that has dictated our course, even though all our processes may not have seemed clear to them.

After all, there is an element in the readjustment of our financial system more important than currency, more important than gold, and that is the confidence of the people themselves. Confidence and courage are the essentials of success in carrying out our plan. You people must have faith; you must not be stampeded by rumors or guesses. Let us unite in banishing fear. We have provided the machinery to restore our financial system, and it is up to you to support and make it work.

It is your problem, my friends, your problem no less than it is mine.

Together we cannot fail.

"President Roosevelt's First Fireside Chat: The Banking Crisis" by President Franklin D. Roosevelt (1933) is in the public domain.

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: What does President Roosevelt hope to achieve with his address to the public?
    A. He wants to contrast his economic policies with the failed policies of previous American presidents.
    B. He wants the public to learn from their mistakes and be more responsible with their money in the future.
    C. He wants to ensure that the public doesn't cause another crisis by withdrawing too much money when the banks reopen.
    D. He wants the public to allow the banks to continue to invest their money so that America's economy remains the same.

2. PART B: Which section from the text best supports the answer to Part A?
    A. "First of all, let me state the simple fact that when you deposit money in a bank, the bank does not put the money into a safe deposit vault. It invests your money in many different forms of credit — in bonds, in commercial paper, in mortgages and in many other kinds of loans." (Paragraph 4)
    B. "Because of undermined confidence on the part of the public, there was a general rush by a large portion of our population to turn bank deposits into currency or gold — a rush so great that the soundest banks couldn't get enough currency to meet the demand." (Paragraph 5)
    C. "I hope you can see, my friends, from this essential recital of what your Government is doing that there is nothing complex, nothing radical in the process." (Paragraph 18)
    D. "Confidence and courage are the essentials of success in carrying out our plan. You people must have faith; you must not be stampeded by rumors or guesses." (Paragraph 22)

3. PART A: What is the meaning of "couched" as it is used in paragraph 3?
    A. speak a specific way
    B. act dismissively
    C. discuss thoroughly
    D. speak ambiguously

4. PART B: Which detail from the text best supports the answer to Part A?
    A. "to talk with the comparatively few who understand the mechanics of banking," (Paragraph 2)
    B. "for the most part in banking and legal terms, ought to be explained for the benefit of the average citizen." (Paragraph 3)
    C. "I owe this, in particular, because of the fortitude and the good temper with which everybody has accepted the inconvenience and hardships of the banking holiday." (Paragraph 3)
    D. "let me state the simple fact that when you deposit money in a bank, the bank does not put the money into a safe deposit vault." (Paragraph 4)

5. PART A: How does paragraph 5 contribute to the development of ideas in the text?
    A. It criticizes citizens for not knowing how banks work.
    B. It blames citizens for the bank failures.
    C. It reassures citizens that the bank failures are a temporary setback.
    D. It explains to the average citizen why the banks failed.

6. PART B: Which quote from the text best supports the answer to Part A?
    A. “In other words, the total amount of all the currency in the country is only a comparatively small proportion of the total deposits in all the banks of the country.” (Paragraph 4)
    B. “Because of undermined confidence on the part of the public, there was a general rush by a large portion of our population to turn bank deposits into currency or gold — a rush so great that the soundest banks couldn’t get enough currency to meet the demand.” (Paragraph 5)
    C. “It was then that I issued the proclamation providing for the national bank holiday, and this was the first step in the Government’s reconstruction of our financial and economic fabric.” (Paragraph 5)
    D. “the legislation promptly and patriotically passed by the Congress confirming my proclamation and broadening my powers so that it became possible in view of the requirement of time to extend the holiday and lift the ban of that holiday gradually in the days to come.” (Paragraph 6)

7. Describe the central idea of President Roosevelt’s speech using supporting evidence from the text.

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. How did "confidence" and "courage" help stabilize the United States' banking system?

2. In the context of the speech, how has America changed over time? What additional economic crisis has America seen since the Great Depression? How can these problems be avoided in the future? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

3. In the context of the text, why do people succeed? What does President Roosevelt believe is necessary to succeed as a nation during trying times? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

4. In the context of the text, how does fear drive action? What did the public fear would happen if they didn't withdraw their money? How could this fear have been avoided?

To Build A Fire

By Jack London on 02.10.20
Word Count **7,125**
Level **MAX**



At the man's heels trotted a dog, a big native husky, the proper wolf-dog, grey-coated and without any visible or temperamental difference from its brother, the wild wolf. Photo: Jose Carlos Ichiro/Unsplash

Day had broken cold and grey, exceedingly cold and grey, when the man turned aside from the main Yukon trail and climbed the high earthbank, where a dim and little-travelled trail led eastward through the fat spruce timberland. It was a steep bank, and he paused for breath at the top, excusing the act to himself by looking at his watch. It was nine o'clock. There was no sun nor hint of sun, though there was not a cloud in the sky. It was a clear day, and yet there seemed an intangible pall over the face of things, a subtle gloom that made the day dark, and that was due to the absence of sun. This fact did not worry the man. He was used to the lack of sun. It had been days since he had seen the sun, and he knew that a few more days must pass before that cheerful orb, due south, would just peep above the skyline and dip immediately from view.

The man flung a look back along the way he had come. The Yukon lay a mile wide and hidden under three feet of ice. On top of this ice were as many feet of snow. It was all pure white, rolling in gentle undulations where the ice-jams of the freeze-up had formed. North and south, as far as his eye could see, it was unbroken white, save for a dark hairline that curved and twisted from around the spruce-covered island to the south, and that curved and twisted away into the north, where it

disappeared behind another spruce-covered island. This dark hairline was the trail—the main trail—that led south five hundred miles to the Chilcoot Pass, Dyea, and saltwater; and that led north seventy miles to Dawson, and still on to the north a thousand miles to Nulato, and finally to St. Michael on the Bering Sea, a thousand miles and half a thousand more.

But all this—the mysterious, far-reaching hairline trail, the absence of sun from the sky, the tremendous cold, and the strangeness and weirdness of it all—made no impression on the man. It was not because he was long used to it. He was a newcomer in the land, a chechaquo, and this was his first winter. The trouble with him was that he was without imagination. He was quick and alert in the things of life, but only in the things, and not in the significances. Fifty degrees below zero meant eighty-odd degrees of frost. Such fact impressed him as being cold and uncomfortable, and that was all. It did not lead him to meditate upon his frailty as a creature of temperature, and upon man's frailty in general, able only to live within certain narrow limits of heat and cold; and from there on it did not lead him to the conjectural field of immortality and man's place in the universe. Fifty degrees below zero stood for a bite of frost that hurt and that must be guarded against by the use of mittens, ear-flaps, warm moccasins, and thick socks. Fifty degrees below zero was to him just precisely fifty degrees below zero. That there should be anything more to it than that was a thought that never entered his head.

As he turned to go on, he spat speculatively. There was a sharp, explosive crackle that startled him. He spat again. And again, in the air, before it could fall to the snow, the spittle crackled. He knew that at fifty below spittle crackled on the snow, but this spittle had crackled in the air. Undoubtedly it was colder than fifty below—how much colder he did not know. But the temperature did not matter. He was bound for the old claim on the left fork of Henderson Creek, where the boys were already. They had come over across the divide from the Indian Creek country, while he had come the roundabout way to take a look at the possibilities of getting out logs in the spring from the islands in the Yukon. He would be into camp by six o'clock; a bit after dark, it was true, but the boys would be there, a fire would be going, and a hot supper would be ready. As for lunch, he pressed his hand against the protruding bundle under his jacket. It was also under his shirt, wrapped up in a handkerchief and lying against the naked skin. It was the only way to keep the biscuits from freezing. He smiled agreeably to himself as he thought of those biscuits, each cut open and sopped in bacon grease, and each enclosing a generous slice of fried bacon.

He was surprised, however, at the cold.

He plunged in among the big spruce trees. The trail was faint. A foot of snow had fallen since the last sled had passed over, and he was glad he was without a sled, traveling light. In fact, he carried nothing but the lunch wrapped in the handkerchief. He was surprised, however, at the cold. It certainly was cold, he concluded, as he rubbed his numbed nose and cheek-bones with his mittened hand. He was a warm-whiskered man, but the hair on his face did not protect the high cheek-bones and the eager nose that thrust itself aggressively into the frosty air.

At the man's heels trotted a dog, a big native husky, the proper wolf-dog, grey-coated and without any visible or temperamental difference from its brother, the wild wolf. The animal was depressed by the tremendous cold. It knew that it was no time for traveling. Its instinct told it a truer tale than was told to the man by the man's judgment. In reality, it was not merely colder than fifty below zero; it was colder than sixty below, than seventy below. It was seventy-five below zero. Since the freezing-point is thirty-two above zero, it meant that one hundred and seven degrees of

frost obtained. The dog did not know anything about thermometers. Possibly in its brain there was no sharp consciousness of a condition of very cold such as was in the man's brain. But the brute had its instinct. It experienced a vague but menacing apprehension that subdued it and made it slink along at the man's heels, and that made it question eagerly every unwonted movement of the man as if expecting him to go into camp or to seek shelter somewhere and build a fire. The dog had learned fire, and it wanted fire, or else to burrow under the snow and cuddle its warmth away from the air.

The frozen moisture of its breathing had settled on its fur in a fine powder of frost, and especially were its jowls, muzzle, and eyelashes whitened by its crystalled breath. The man's red beard and mustache were likewise frosted, but more solidly, the deposit taking the form of ice and increasing with every warm, moist breath he exhaled. Also, the man was chewing tobacco, and the muzzle of ice held his lips so rigidly that he was unable to clear his chin when he expelled the juice. The result was that a crystal beard of the color and solidity of amber was increasing its length on his chin. If he fell down it would shatter itself, like glass, into brittle fragments. But he did not mind the appendage. It was the penalty all tobacco-chewers paid in that country, and he had been out before in two cold snaps. They had not been so cold as this, he knew, but by the spirit thermometer at Sixty Mile he knew they had been registered at fifty below and at fifty-five.

He held on through the level stretch of woods for several miles, crossed a wide flat of dark tussocks, and dropped down a bank to the frozen bed of a small stream. This was Henderson Creek, and he knew he was ten miles from the forks. He looked at his watch. It was ten o'clock. He was making four miles an hour, and he calculated that he would arrive at the forks at half-past twelve. He decided to celebrate that event by eating his lunch there.

The dog dropped in again at his heels, with a tail drooping discouragement, as the man swung along the creek-bed. The furrow of the old sled-trail was plainly visible, but a dozen inches of snow covered the marks of the last runners. In a month no man had come up or down that silent creek. The man held steadily on. He was not much given to thinking, and just then particularly he had nothing to think about save that he would eat lunch at the forks and that at six o'clock he would be in camp with the boys. There was nobody to talk to and, had there been, speech would have been impossible because of the ice-muzzle on his mouth. So he continued monotonously to chew tobacco and to increase the length of his amber beard.

Once in a while, the thought reiterated itself that it was very cold and that he had never experienced such cold. As he walked along he rubbed his cheek-bones and nose with the back of his mittened hand. He did this automatically, now and again changing hands. But rub as he would, the instant he stopped his cheek-bones went numb, and the following instant the end of his nose went numb. He was sure to frost his cheeks; he knew that, and experienced a pang of regret that he had not devised a nose-strap of the sort Bud wore in cold snaps. Such a strap passed across the cheeks, as well, and saved them. But it didn't matter much, after all. What were frosted cheeks? A bit painful, that was all; they were never serious.

Empty as the man's mind was of thoughts, he was keenly observant, and he noticed the changes in the creek, the curves and bends and timber-jams, and always he sharply noted where he placed his feet. Once, coming around a bend, he shied abruptly, like a startled horse, curved away from the place where he had been walking, and retreated several paces back along the trail. The creek he knew was frozen clear to the bottom—no creek could contain water in that arctic winter—but he

knew also that there were springs that bubbled out from the hillsides and ran along under the snow and on top of the ice of the creek. He knew that the coldest snaps never froze these springs, and he knew likewise their danger. They were traps. They hid pools of water under the snow that might be three inches deep, or three feet. Sometimes a skin of ice half an inch thick covered them, and in turn, was covered by the snow. Sometimes there were alternate layers of water and ice-skin, so that when one broke through he kept on breaking through for a while, sometimes wetting himself to the waist.

That was why he had shied in such panic. He had felt the give under his feet and heard the crackle of a snow-hidden ice-skin. And to get his feet wet in such a temperature meant trouble and danger. At the very least it meant delay, for he would be forced to stop and build a fire, and under its protection to bare his feet while he dried his socks and moccasins. He stood and studied the creek-bed and its banks, and decided that the flow of water came from the right. He reflected awhile, rubbing his nose and cheeks, then skirted to the left, stepping gingerly and testing the footing for each step. Once clear of the danger, he took a fresh chew of tobacco and swung along at his four-mile gait.

In the course of the next two hours, he came upon several similar traps. Usually, the snow above the hidden pools had a sunken, candied appearance that advertised the danger. Once again, however, he had a close call; and once, suspecting danger, he compelled the dog to go on in front. The dog did not want to go. It hung back until the man shoved it forward, and then it went quickly across the white, unbroken surface. Suddenly it broke through, floundered to one side, and got away to firmer footing. It had wet its forefeet and legs, and almost immediately the water that clung to it turned to ice. It made quick efforts to lick the ice off its legs, then dropped down in the snow and began to bite out the ice that had formed between the toes. This was a matter of instinct. To permit the ice to remain would mean sore feet. It did not know this. It merely obeyed the mysterious prompting that arose from the deep crypts of its being. But the man knew, having achieved a judgment on the subject, and he removed the mitten from his right hand and helped tear out the ice-particles. He did not expose his fingers more than a minute, and was astonished at the swift numbness that smote them. It certainly was cold. He pulled on the mitten hastily and beat the hand savagely across his chest.

He was pleased at the speed he had made.

At twelve o'clock the day was at its brightest. Yet the sun was too far south on its winter journey to clear the horizon. The bulge of the earth intervened between it and Henderson Creek, where the man walked under a clear sky at noon and cast no shadow. At half-past twelve, to the minute, he arrived at the forks of the creek. He was pleased at the speed he had made. If he kept it up, he would certainly be with the boys by six. He unbuttoned his jacket and shirt and drew forth his lunch. The action consumed no more than a quarter of a minute, yet in that brief moment the numbness laid hold of the exposed fingers. He did not put the mitten on, but, instead, struck the fingers a dozen sharp smashes against his leg. Then he sat down on a snow-covered log to eat. The sting that followed upon the striking of his fingers against his leg ceased so quickly that he was startled, he had had no chance to take a bite of biscuit. He struck the fingers repeatedly and returned them to the mitten, baring the other hand for the purpose of eating. He tried to take a mouthful, but the ice-muzzle prevented. He had forgotten to build a fire and thaw out. He chuckled at his foolishness, and as he chuckled he noted the numbness creeping into the exposed fingers. Also, he noted that the stinging which had first come to his toes when he sat down was

already passing away. He wondered whether the toes were warm or numbed. He moved them inside the moccasins and decided that they were numbed.

He pulled the mitten on hurriedly and stood up. He was a bit frightened. He stamped up and down until the stinging returned into the feet. It certainly was cold, was his thought. That man from Sulphur Creek had spoken the truth when telling how cold it sometimes got in the country. And he had laughed at him at the time! That showed one must not be too sure of things. There was no mistake about it, it was cold. He strode up and down, stamping his feet and threshing his arms, until reassured by the returning warmth. Then he got out matches and proceeded to make a fire. From the undergrowth, where high water of the previous spring had lodged a supply of seasoned twigs, he got his firewood. Working carefully from a small beginning, he soon had a roaring fire, over which he thawed the ice from his face and in the protection of which he ate his biscuits. For the moment the cold of space was outwitted. The dog took satisfaction in the fire, stretching out close enough for warmth and far enough away to escape being singed.

When the man had finished, he filled his pipe and took his comfortable time over a smoke. Then he pulled on his mittens, settled the ear-flaps of his cap firmly about his ears, and took the creek trail up the left fork. The dog was disappointed and yearned back toward the fire. This man did not know cold. Possibly all the generations of his ancestry had been ignorant of cold, of real cold, of cold one hundred and seven degrees below freezing-point. But the dog knew; all its ancestry knew, and it had inherited the knowledge. And it knew that it was not good to walk abroad in such fearful cold. It was the time to lie snug in a hole in the snow and wait for a curtain of cloud to be drawn across the face of outer space whence this cold came. On the other hand, there was keen intimacy between the dog and the man. The one was the toil-slave of the other, and the only caresses it had ever received were the caresses of the whiplash and of harsh and menacing throat-sounds that threatened the whiplash. So the dog made no effort to communicate its apprehension to the man. It was not concerned in the welfare of the man; it was for its own sake that it yearned back toward the fire. But the man whistled, and spoke to it with the sound of whiplashes, and the dog swung in at the man's heels and followed after.

The man took a chew of tobacco and proceeded to start a new amber beard. Also, his moist breath quickly powdered with white his mustache, eyebrows, and lashes. There did not seem to be so many springs on the left fork of the Henderson, and for half an hour the man saw no signs of any. And then it happened. At a place where there were no signs, where the soft, unbroken snow seemed to advertise solidity beneath, the man broke through. It was not deep. He wetted himself half-way to the knees before he floundered out to the firm crust.

He was angry, and cursed his luck aloud. He had hoped to get into camp with the boys at six o'clock, and this would delay him an hour, for he would have to build a fire and dry out his foot-gear. This was imperative at that low temperature—he knew that much; and he turned aside to the bank, which he climbed. On top, tangled in the underbrush about the trunks of several small spruce trees, was a high-water deposit of dry firewood—sticks and twigs principally, but also larger portions of seasoned branches and fine, dry, last-year's grasses. He threw down several large pieces on top of the snow. This served for a foundation and prevented the young flame from drowning itself in the snow it otherwise would melt. The flame he got by touching a match to a small shred of birch-bark that he took from his pocket. This burned even more readily than paper. Placing it on the foundation, he fed the young flame with wisps of dry grass and with the tiniest dry twigs.

He worked slowly and carefully, keenly aware of his danger. Gradually, as the flame grew stronger, he increased the size of the twigs with which he fed it. He squatted in the snow, pulling the twigs out from their entanglement in the brush and feeding directly to the flame. He knew there must be no failure. When it is seventy-five below zero, a man must not fail in his first attempt to build a fire —that is, if his feet are wet. If his feet are dry, and he fails, he can run along the trail for half a mile and restore his circulation. But the circulation of wet and freezing feet cannot be restored by running when it is seventy-five below. No matter how fast he runs, the wet feet will freeze the harder.

All this the man knew. The old-timer on Sulphur Creek had told him about it the previous fall, and now he was appreciating the advice. Already all sensation had gone out of his feet. To build the fire he had been forced to remove his mittens, and the fingers had quickly gone numb. His pace of four miles an hour had kept his heart pumping blood to the surface of his body and to all the extremities. But the instant he stopped, the action of the pump eased down. The cold of space smote the unprotected tip of the planet, and he, being on that unprotected tip, received the full force of the blow. The blood of his body recoiled before it. The blood was alive, like the dog, and like the dog it wanted to hide away and cover itself up from the fearful cold. So long as he walked four miles an hour, he pumped that blood, willy-nilly, to the surface; but now it ebbed away and sank down into the recesses of his body. The extremities were the first to feel its absence. His wet feet froze the faster, and his exposed fingers numbed the faster, though they had not yet begun to freeze. Nose and cheeks were already freezing, while the skin of all his body chilled as it lost its blood.

But he was safe. Toes and nose and cheeks would be only touched by the frost, for the fire was beginning to burn with strength. He was feeding it with twigs the size of his finger. In another minute he would be able to feed it with branches the size of his wrist, and then he could remove his wet foot-gear, and, while it dried, he could keep his naked feet warm by the fire, rubbing them at first, of course, with snow. The fire was a success. He was safe. He remembered the advice of the old-timer on Sulphur Creek, and smiled. The old-timer had been very serious in laying down the law that no man must travel alone in the Klondike after fifty below. Well, here he was; he had had the accident; he was alone; and he had saved himself. Those old-timers were rather womanish, some of them, he thought. All a man had to do was to keep his head, and he was all right. Any man who was a man could travel alone. But it was surprising, the rapidity with which his cheeks and nose were freezing. And he had not thought his fingers could go lifeless in so short a time. Lifeless they were, for he could scarcely make them move together to grip a twig, and they seemed remote from his body and from him. When he touched a twig, he had to look and see whether or not he had hold of it. The wires were pretty well down between him and his finger-ends.

All of which counted for little. There was the fire, snapping and crackling and promising life with every dancing flame. He started to untie his moccasins. They were coated with ice; the thick German socks were like sheaths of iron half-way to the knees; and the moccasin strings were like rods of steel all twisted and knotted as by some conflagration. For a moment he tugged with his numbed fingers, then, realizing the folly of it, he drew his sheath-knife.

He should not have built the fire under the spruce tree.

But before he could cut the strings, it happened. It was his own fault or, rather, his mistake. He should not have built the fire under the spruce tree. He should have built it in the open. But it had

been easier to pull the twigs from the brush and drop them directly on the fire. Now the tree under which he had done this carried a weight of snow on its boughs. No wind had blown for weeks, and each bough was fully freighted. Each time he had pulled a twig he had communicated a slight agitation to the tree—an imperceptible agitation, so far as he was concerned, but an agitation sufficient to bring about the disaster. High up in the tree one bough capsized its load of snow. This fell on the boughs beneath, capsizing them. This process continued, spreading out and involving the whole tree. It grew like an avalanche, and it descended without warning upon the man and the fire, and the fire was blotted out! Where it had burned was a mantle of fresh and disordered snow.

The man was shocked. It was as though he had just heard his own sentence of death. For a moment he sat and stared at the spot where the fire had been. Then he grew very calm. Perhaps the old-timer on Sulphur Creek was right. If he had only had a trail-mate he would have been in no danger now. The trail-mate could have built the fire. Well, it was up to him to build the fire over again, and this second time there must be no failure. Even if he succeeded, he would most likely lose some toes. His feet must be badly frozen by now, and there would be some time before the second fire was ready.

Such were his thoughts, but he did not sit and think them. He was busy all the time they were passing through his mind, he made a new foundation for a fire, this time in the open; where no treacherous tree could blot it out. Next, he gathered dry grasses and tiny twigs from the high-water flotsam. He could not bring his fingers together to pull them out, but he was able to gather them by the handful. In this way, he got many rotten twigs and bits of green moss that were undesirable, but it was the best he could do. He worked methodically, even collecting an armful of the larger branches to be used later when the fire gathered strength. And all the while the dog sat and watched him, a certain yearning wistfulness in its eyes, for it looked upon him as the fire-provider, and the fire was slow in coming.

When all was ready, the man reached in his pocket for a second piece of birch-bark. He knew the bark was there, and, though he could not feel it with his fingers, he could hear its crisp rustling as he fumbled for it. Try as he would, he could not clutch hold of it. And all the time, in his consciousness, was the knowledge that each instant his feet were freezing. This thought tended to put him in a panic, but he fought against it and kept calm. He pulled on his mittens with his teeth, and threshed his arms back and forth, beating his hands with all his might against his sides. He did this sitting down, and he stood up to do it; and all the while the dog sat in the snow, its wolf-brush of a tail curled around warmly over its forefeet, its sharp wolf-ears pricked forward intently as it watched the man. And the man as he beat and threshed with his arms and hands, felt a great surge of envy as he regarded the creature that was warm and secure in its natural covering.

After a time he was aware of the first far-away signals of sensation in his beaten fingers. The faint tingling grew stronger till it evolved into a stinging ache that was excruciating, but which the man hailed with satisfaction. He stripped the mitten from his right hand and fetched forth the birch-bark. The exposed fingers were quickly going numb again. Next he brought out his bunch of sulphur matches. But the tremendous cold had already driven the life out of his fingers. In his effort to separate one match from the others, the whole bunch fell in the snow. He tried to pick it out of the snow, but failed. The dead fingers could neither touch nor clutch. He was very careful. He drove the thought of his freezing feet; and nose, and cheeks, out of his mind, devoting his whole soul to the matches. He watched, using the sense of vision in place of that of touch, and when he saw his fingers on each side the bunch, he closed them—that is, he willed to close them,

for the wires were drawn, and the fingers did not obey. He pulled the mitten on the right hand, and beat it fiercely against his knee. Then, with both mittened hands, he scooped the bunch of matches, along with much snow, into his lap. Yet he was no better off.

After some manipulation, he managed to get the bunch between the heels of his mittened hands. In this fashion, he carried it to his mouth. The ice crackled and snapped when by a violent effort he opened his mouth. He drew the lower jaw in, curled the upper lip out of the way, and scraped the bunch with his upper teeth in order to separate a match. He succeeded in getting one, which he dropped on his lap. He was no better off. He could not pick it up. Then he devised a way. He picked it up in his teeth and scratched it on his leg. Twenty times he scratched before he succeeded in lighting it. As it flamed he held it with his teeth to the birch-bark. But the burning brimstone went up his nostrils and into his lungs, causing him to cough spasmodically. The match fell into the snow and went out.

The old-timer on Sulphur Creek was right, he thought in the moment of controlled despair that ensued: after fifty below, a man should travel with a partner. He beat his hands but failed in exciting any sensation. Suddenly he bared both hands, removing the mittens with his teeth. He caught the whole bunch between the heels of his hands. His arm muscles not being frozen enabled him to press the hand-heels tightly against the matches. Then he scratched the bunch along his leg. It flared into flame, seventy sulphur matches at once! There was no wind to blow them out. He kept his head to one side to escape the strangling fumes, and held the blazing bunch to the birch-bark. As he so held it, he became aware of sensation in his hand. His flesh was burning. He could smell it. Deep down below the surface he could feel it. The sensation developed into pain that grew acute. And still he endured it, holding the flame of the matches clumsily to the bark that would not light readily because his own burning hands were in the way, absorbing most of the flame.

At last, when he could endure no more, he jerked his hands apart. The blazing matches fell sizzling into the snow, but the birch-bark was alight. He began laying dry grasses and the tiniest twigs on the flame. He could not pick and choose, for he had to lift the fuel between the heels of his hands. Small pieces of rotten wood and green moss clung to the twigs, and he bit them off as well as he could with his teeth. He cherished the flame carefully and awkwardly. It meant life, and it must not perish. The withdrawal of blood from the surface of his body now made him begin to shiver, and he grew more awkward. A large piece of green moss fell squarely on the little fire. He tried to poke it out with his fingers, but his shivering frame made him poke too far, and he disrupted the nucleus of the little fire, the burning grasses and tiny twigs separating and scattering. He tried to poke them together again, but in spite of the tenseness of the effort, his shivering got away with him, and the twigs were hopelessly scattered. Each twig gushed a puff of smoke and went out. The fire-provider had failed. As he looked apathetically about him, his eyes chanced on the dog, sitting across the ruins of the fire from him, in the snow, making restless, hunching movements, slightly lifting one forefoot and then the other, shifting its weight back and forth on them with wistful eagerness.

The sight of the dog put a wild idea into his head. He remembered the tale of the man, caught in a blizzard, who killed a steer and crawled inside the carcass, and so was saved. He would kill the dog and bury his hands in the warm body until the numbness went out of them. Then he could build another fire. He spoke to the dog, calling it to him; but in his voice was a strange note of fear that frightened the animal, who had never known the man to speak in such a way before. Something was the matter, and its suspicious nature sensed danger. It knew not what danger but somewhere,

somehow, in its brain arose an apprehension of the man. It flattened its ears down at the sound of the man's voice, and its restless, hunching movements and the liftings and shiftings of its forefeet became more pronounced, but it would not come to the man. He got on his hands and knees and crawled toward the dog. This unusual posture again excited suspicion, and the animal sidled mincingly away.

The man sat up in the snow for a moment and struggled for calmness. Then he pulled on his mittens, by means of his teeth, and got upon his feet. He glanced down at first in order to assure himself that he was really standing up, for the absence of sensation in his feet left him unrelated to the earth. His erect position in itself started to drive the webs of suspicion from the dog's mind; and when he spoke peremptorily, with the sound of whip-lashes in his voice, the dog rendered its customary allegiance and came to him. As it came within reaching distance, the man lost his control. His arms flashed out to the dog, and he experienced genuine surprise when he discovered that his hands could not clutch, that there was neither bend nor feeling in the fingers. He had forgotten for the moment that they were frozen and that they were freezing more and more. All this happened quickly, and before the animal could get away, he encircled its body with his arms. He sat down in the snow, and in this fashion held the dog, while it snarled and whined and struggled.

But it was all he could do, hold its body encircled in his arms and sit there. He realized that he could not kill the dog. There was no way to do it. With his helpless hands he could neither draw nor hold his sheath-knife nor throttle the animal. He released it, and it plunged wildly away, with tail between its legs, and still snarling. It halted forty feet away and surveyed him curiously, with ears sharply pricked forward. The man looked down at his hands in order to locate them, and found them hanging on the ends of his arms. It struck him as curious that one should have to use his eyes in order to find out where his hands were. He began threshing his arms back and forth, beating the mittened hands against his sides. He did this for five minutes, violently, and his heart pumped enough blood up to the surface to put a stop to his shivering. But no sensation was aroused in the hands. He had an impression that they hung like weights on the ends of his arms, but when he tried to run the impression down, he could not find it.

A certain fear of death, dull and oppressive, came to him. This fear quickly became poignant as he realized that it was no longer a mere matter of freezing his fingers and toes, or of losing his hands and feet, but that it was a matter of life and death with the chances against him. This threw him into a panic, and he turned and ran up the creek-bed along the old, dim trail. The dog joined in behind and kept up with him. He ran blindly, without intention, in fear such as he had never known in his life. Slowly, as he plowed and floundered through the snow, he began to see things again—the banks of the creek, the old timber-jams, the leafless aspens, and the sky. The running made him feel better. He did not shiver. Maybe, if he ran on, his feet would thaw out; and, anyway, if he ran far enough, he would reach camp and the boys. Without doubt, he would lose some fingers and toes and some of his face; but the boys would take care of him, and save the rest of him when he got there. And at the same time, there was another thought in his mind that said he would never get to the camp and the boys; that it was too many miles away, that the freezing had too great a start on him, and that he would soon be stiff and dead. This thought he kept in the background and refused to consider. Sometimes it pushed itself forward and demanded to be heard, but he thrust it back and strove to think of other things.

It struck him as curious that he could run at all on feet so frozen that he could not feel them when they struck the earth and took the weight of his body. He seemed to himself to skim along above the surface and to have no connection with the earth. Somewhere he had once seen a winged Mercury, and he wondered if Mercury felt as he felt when skimming over the earth.

His theory of running until he reached camp and the boys had one flaw in it: he lacked the endurance. Several times he stumbled, and finally he tottered, crumpled up, and fell. When he tried to rise, he failed. He must sit and rest, he decided, and next time he would merely walk and keep on going. As he sat and regained his breath, he noted that he was feeling quite warm and comfortable. He was not shivering, and it even seemed that a warm glow had come to his chest and trunk. And yet, when he touched his nose or cheeks, there was no sensation. Running would not thaw them out. Nor would it thaw out his hands and feet. Then the thought came to him that the frozen portions of his body must be extending. He tried to keep this thought down, to forget it, to think of something else; he was aware of the panicky feeling that it caused, and he was afraid of the panic. But the thought asserted itself, and persisted, until it produced a vision of his body totally frozen. This was too much, and he made another wild run along the trail. Once he slowed down to a walk, but the thought of the freezing extending itself made him run again.

He was losing in his battle with the frost.

And all the time the dog ran with him, at his heels. When he fell down a second time, it curled its tail over its forefeet and sat in front of him facing him curiously eager and intent. The warmth and security of the animal angered him, and he cursed it till it flattened down its ears appeasingly. This time the shivering came more quickly upon the man. He was losing in his battle with the frost. It was creeping into his body from all sides. The thought of it drove him on, but he ran no more than a hundred feet, when he staggered and pitched headlong. It was his last panic. When he had recovered his breath and control, he sat up and entertained in his mind the conception of meeting death with dignity. However, the conception did not come to him in such terms. His idea of it was that he had been making a fool of himself, running around like a chicken with its head cut off—such was the simile that occurred to him. Well, he was bound to freeze anyway, and he might as well take it decently. With this new-found peace of mind came the first glimmerings of drowsiness. A good idea, he thought, to sleep off to death. It was like taking an anæsthetic. Freezing was not so bad as people thought. There were lots worse ways to die.

He pictured the boys finding his body the next day. Suddenly he found himself with them, coming along the trail and looking for himself. And, still with them, he came around a turn in the trail and found himself lying in the snow. He did not belong with himself any more, for even then he was out of himself, standing with the boys and looking at himself in the snow. It certainly was cold, was his thought. When he got back to the States he could tell the folks what real cold was. He drifted on from this to a vision of the old-timer on Sulphur Creek. He could see him quite clearly, warm and comfortable, and smoking a pipe.

"You were right, old hoss; you were right," the man mumbled to the old-timer of Sulphur Creek.

Then the man drowsed off into what seemed to him the most comfortable and satisfying sleep he had ever known. The dog sat facing him and waiting. The brief day drew to a close in a long, slow twilight. There were no signs of a fire to be made, and, besides, never in the dog's experience had it known a man to sit like that in the snow and make no fire. As the twilight drew on, its eager

yearning for the fire mastered it, and with a great lifting and shifting of forefeet, it whined softly, then flattened its ears down in anticipation of being chidden by the man. But the man remained silent. Later, the dog whined loudly. And still later it crept close to the man and caught the scent of death. This made the animal bristle and back away. A little longer it delayed, howling under the stars that leaped and danced and shone brightly in the cold sky. Then it turned and trotted up the trail in the direction of the camp it knew, where were the other food-providers and fire-providers.

Quiz

1 How does the setting of the story affect the development of the theme?

(A) The quiet surroundings reveal a theme of quiet contemplation about life.

(B) The cold environment contrasts with the theme of love for one's companions.

(C) The desolate surroundings emphasize the theme of man against nature.

(D) The snowy environment suggests a theme of rebirth from the bleakness of winter.

2 Which statement would be MOST important to include in an objective summary of the story?

(A) The man's dog sits far enough from the fire to avoid being singed.

(B) The man carries only a biscuit filled with bacon that he will eat for lunch.

(C) The man dreams of seeing the boys after he finishes his journey.

(D) Snow falling from the tree above him extinguishes the man's fire.

3 The dog mostly stays behind the man throughout the story.

What does this MOST LIKELY reveal about him?

(A) He is worried the man will attempt to kill him.

(B) He is reliant on the man for safety and warmth.

(C) He hopes the man will drop food along the way.

(D) He understands the man is in danger of freezing.

4 Which answer choice BEST explains how the man falling through the ice affects the development of the plot?

(A) It introduces a life or death situation he must try to overcome.

(B) It emphasizes that the man should listen to the advice of the old-timer.

(C) It shows that the dog was right to avoid walking on the ice.

(D) It suggests that the man's matches will be too wet to start a fire.

2 degrees, flies planes, author, works at NASA. His age? 17

By Collin Binkley, Associated Press on 11.11.15
Word Count **721**
Level **MAX**



This August 2015 photo provided by Shu Chien shows her son, Moshe Kai Cavalin, at their home in San Gabriel, California. Shu Chien via AP

BOSTON — Moshe Kai Cavalin has two college degrees, but he's too young to vote. He flies airplanes, but he's too young to drive a car alone.

Life is filled with contrasts for Cavalin, a 17-year-old from San Gabriel, California, who has dashed by major milestones as his age seems to lag behind. He graduated from community college at age 11. Four years later, he had a bachelor's degree in math from the University of California, Los Angeles.

This year, he started online classes to get a master's degree in cybersecurity through the Boston area's Brandeis University. He decided to postpone that pursuit for a couple of terms, though, while he helps NASA develop surveillance technology for airplanes and drones.

Between all that, he has racked up an exhausting list of extracurricular feats. He just published his second book, drawing on his experience being bullied and stories he's heard from others. He plans

to have his airplane pilot's license by the year's end. At his family's home near Los Angeles, he has a trove of trophies from martial arts tournaments.

Still, Cavalin insists that he's more ordinary than people think. He credits his parents for years of focused instruction balanced by the freedom to pick his after-school activities. His eclectic interests stem from his cultural heritage, he said, with a mother from Taiwan and a father from Brazil.

"My case isn't that special. It's just a combination of parenting and motivation and inspiration," he says after a recent shift at NASA's Armstrong Flight Research Center in Edwards, California. "I tend to not compare myself that often to other people. I just try to do the best I can."

His parents say he was always a quick study. At 4 months, he pointed to a jet in the sky and said the Chinese word for airplane, his first word. Cavalin hit the limits of his home schooling after studying trigonometry at age 7. Then his mom started driving him to community college.

"I think most people just think he's a genius. They believe it just comes naturally," said Daniel Judge, a professor of mathematics who taught Cavalin for two years at East Los Angeles College. "He actually worked harder than, I think, any other student I've ever had."

But his rapid rise hasn't been without twists. Early in college, he dreamed of being an astrophysicist. When he started taking advanced physics classes, though, his interest waned. His fascination in cryptography led him toward computer science.

That has been a better fit, Cavalin said. He was surprised when NASA called to offer work after rejecting him in the past because of his age. Ricardo Arteaga, his boss and mentor at NASA, says Cavalin was perfect for a project that combines math, computers and aircraft technology.

"I needed an intern who knew software and knew mathematical algorithms," Arteaga says. "And I also needed a pilot who could fly it on a Cessna."

In the office, Cavalin is a quiet worker with a subtle sense of humor, Arteaga says. They laugh about the stuff scientists laugh about. His daily work at NASA has included running simulations of airplanes and drones that are headed for collision, and then finding ways to route them to safety.

"He's really sharp in mathematics," Arteaga says. "What we're trying to bring out more is his intuitive skills."

In conversation, Cavalin speaks with the even cadence and diction of someone who chooses his words with care. He's unflappable, at least until he discusses his distaste for being called a certain word: "One word I don't take too kindly is genius," he said. "Genius is just kind of taking it too far."

After he finishes his master's from Brandeis, Cavalin hopes to get a master's in business at the Massachusetts Institute of Technology. Later, he wants to start his own cybersecurity company.

For now, though, he's counting down the days until his 18th birthday, when he'll be able to get a full driver's license under California law. Living away from home to work at NASA, he relies on his landlord for rides to the grocery store, or he takes a taxi. His older colleagues drive him to work every day.

As for the other teenage stuff, Cavalin says he'll wait until he gets his doctorate to find a girlfriend. He's only half-joking.

Quiz

1 According to the article, each of the following was important for Moshe's success EXCEPT:

(A) parental support

(B) trying new things

(C) being highly motivated

(D) staying focused on one field

2 Fill in the blank in the sentence below.

The author of the article portrays Moshe as .....

(A) smart yet unfocused.

(B) brilliant yet humble.

(C) young and energetic.

(D) bold and overconfident.

3 Fill in the blank in the sentence below.

By including the final two paragraphs of the article, the author .....

(A) analyzes Moshe's professional accomplishments.

(B) implies that Moshe did not enjoy living with his parents.

(C) investigates how Moshe's work has affected his love life.

(D) distinguishes between Moshe's professional and personal life.

4 How do the first two paragraphs engage readers in the article?

(A) by explaining why Moshe is so unusual

(B) by explaining when Moshe graduated from college

(C) by explaining when Moshe will be old enough to vote

(D) by explaining why Moshe is so good at math

Japanese-American leagues help girls get the jump on prep basketball

By Samantha Masunaga, Los Angeles Times on 11.24.15
Word Count **1,122**
Level **MAX**



Mark Keppel High School's Lauren Saiki drives to the basket during a game against Redondo Union in Long Beach, California, March 21, 2015. Cheryl A. Guerrero/Los Angeles Times/TNS

LOS ANGELES — Standing just 5-foot-3, Lauren Saiki was sometimes the smallest player on the basketball court. But her signature thread-the-needle passes and heady ball-handling propelled the point guard and her teams from Alhambra's Mark Keppel High School to four consecutive playoff appearances, capped by last season's run to the Division II state championship game, a first for the school.

Saiki, 18, has earned a basketball scholarship to West Virginia.

For all this, she can credit the fundamentals she learned while playing for more than a decade in a Japanese-American basketball league.

"That helped build my foundation," Saiki said. "... I really fell in love with basketball."

Also known as Asian leagues or JA leagues, these organizations — which take up many weekend hours for participants — have been the starting point for many successful high school and now

even college careers, particularly for young women.

Keppel is a consistent contender, even though the average height of its players is usually 5-foot-4 or -5. All but one of the girls on Keppel's team last season played in a Japanese-American basketball league. Three of Saiki's teammates have known her since they were 5, growing up on the same team, Tigers Elite.

Rough estimates put the total of youth and adult players in such leagues in California in the several thousands. There are other Japanese-American leagues — bowling, baseball, volleyball — but none are as popular as basketball.

Teams come from a variety of organizations — service clubs, Buddhist temples, community centers — and have so many young participants that a few Japanese-American churches in Los Angeles chose to cancel Sunday school.

Southern California's Japanese-American community is smaller than its Chinese, Vietnamese or Korean counterparts. Although cities such as Gardena and Torrance have more Japanese-American residents than most, there is no sprawling hub for Japanese-Americans similar to the huge swath of the San Gabriel Valley populated by Chinese-Americans, or Westminster and Garden Grove for Vietnamese-Americans.

"Right now, it seems like basketball is the only thing that holds the community together, like the third and fourth generations," said George Imamura, past president of the South Bay F.O.R. Junior Sports Association, the largest Japanese-American basketball organization in Southern California. "That's why I think it's so important that if that's all we have right now, to keep it going."

The legacy of these teams motivates families like the Sugiyamas to make the 30-mile drive from their home in Torrance to Alhambra for basketball. On a Sunday morning earlier this spring, Claire Sugiyama was in the Alhambra High gym bleachers with about a dozen parents and grandparents to watch her daughter Sarah play with the Tigerettes Pulelehua sixth-grade team.

Sarah comes from a long line of Tigers: Her grandfather was a founder of the Tigers Youth Club, and her father, who coaches the team, also played basketball with the organization.

"He just felt she needed to play with Tigers," Claire Sugiyama said. "She was born with stripes."

The Japanese American Optimist (JAO) Club girls' league began about 50 years ago to give children of Japanese-American descent the opportunity to play basketball at a time when they were not allowed to play elsewhere, said Leland Lau, league commissioner. When he became commissioner about 20 years ago, there were about 50 girls' teams. Today, there are nearly 130.

"It's a factory of point guards," he said.

The leagues' success in getting girls onto high school teams has even attracted non-Asian players, Lau said. The high intermarriage rate in the Japanese-American community is also a factor in the leagues' increasing diversity.

Competition can be fierce, said Kiki Yang, 18, a four-year starter at Pasadena Poly High and three-time winner of the Prep League's most-valuable-player award.

Yang, who will play at Claremont McKenna College next season, learned to play basketball with the Pasadena Bruins when she was in second grade.

“It gave me more confidence,” she said. “It exposes you to the sport and allows you to make friends from different schools.”

The strength of these friendships convinced Kylie Fujioka to transfer to Keppel for her senior year. “There were a lot of closer schools, but the entire varsity team, I’ve known them since elementary school through Asian league,” said Fujioka, who will play for California State University, Monterey Bay in the fall. “Even though I had never played with them before, I had spent my entire life playing against them.”

Kayla Sato, 17, credits the skills she learned on her F.O.R. basketball team with helping her make varsity at West Torrance High School.

“This community is like a family,” said Sato, who will play next year at Westmont College in Santa Barbara, Calif. “Through one connection, there were so many doors.”

Sato’s West Torrance team won a California Interscholastic Federation Southern Section title this year, as did North and South Torrance highs, all of which have rosters filled with JAO players. Early training in the leagues often teaches players to be quick and nimble ball-handlers and accurate outside shooters.

Saiki’s Keppel teammate, Kelli Kamida, set a Southern Section record last season with 16 three-pointers in one game.

Girls who want more competition often will join club teams to improve their skills before high school. Although basketball is a sport that places a premium on height, the lack of it has not been an impediment for Japanese-American girls, Lau said.

Many of the JAO league’s best-known alumni are shorter point guards such as Jamie Hagiya, a former USC point guard who is 5-foot-3, or Natalie Nakase, who played for UCLA and stands just under 5-foot-2. Nakase became the first female head coach in Japan’s top professional men’s basketball league, and now serves as the Clippers’ assistant video coordinator.

Confidence is key, said Monica Hang, an alum of the leagues who played in college and is now coach of the Los Angeles Valley College women’s basketball team.

“Being 5-foot-2 in JAO doesn’t mean you’re a guard,” she said. “Sometimes you have to play the forward or center position so it makes you into a complete basketball player. It taught me how to be 5-foot-2 and play as if I was 6-foot-2.”

That confidence will be important for Saiki as she heads to West Virginia.

“I’m nervous because it’s big-time basketball, but I’m pretty excited because it’s a great experience,” she said. “I’m going to meet a lot of different people and have different experiences than what I’ve had growing up on the West Coast.”

But before she moves 2,500 miles away, she’ll have to graduate and say goodbye to her teammates.

“It’s going to be a bittersweet moment, of course,” Saiki said. “Growing up with them … it’s going to be a lot different. I’ll probably stay in touch with them a lot.”

Quiz

1 Read the first four paragraphs of the article. How does Saiki's experience help develop a key idea of the article?

(A) Her experience in the Japanese-American league provides an example of how sports in general can influence kids' lives.

(B) Her experience in the Japanese-American league shows how the sport builds camaraderie within the Japanese-American community.

(C) Her experience in the Japanese-American league illustrates how being involved with the league can contribute to later achievements in basketball.

(D) Her experience in the Japanese-American league demonstrates how participation in the sport leads to bonding among different groups of people.

2 Which sentence best summarizes the significance of the basketball league in the Japanese-American community?

(A) The league, originally a response to segregation, is now primarily responsible for creating professional opportunities for Japanese-American athletes.

(B) The league, originally a response to segregation, has become a source of bonding, tradition and opportunity for Japanese-Americans.

(C) The Japanese-American basketball league currently provides Japanese-Americans with the best opportunity to then advance in other leagues.

(D) The Japanese-American basketball league continues to evolve to meet the unique needs of the current generation of young athletes.

3 The article is PRIMARILY organized around:.

(A) the ways that the Japanese-American league has shaped perceptions of Japanese-Americans

(B) a series of historical vignettes about the evolution of the Japanese-American league

(C) the various personal experiences of people who are involved with the Japanese-American league

(D) an analysis of similarities and differences between the Japanese-American league and the broader American context

4 Read the final four paragraphs of the article. Which statement BEST evaluates the conclusion of the article with relevant justification?

(A) The conclusion is engaging because it connects back to the beginning of the article and evokes Saiki's future.

(B) The conclusion is anti-climatic because it ends on a note of sadness rather than emphasizing the more positive aspects of basketball.

(C) The conclusion is satisfying because it resolves all the major questions about Saiki's future in basketball.

(D) The conclusion is distracting because it reveals that Saiki is leaving her home community and moving 2,500 miles away.

Fishing lures a hit for small-town teen entrepreneurs

By Michael Pearce, The Wichita Eagle on 07.31.17
Word Count **1,026**
Level **MAX**



Five styles of plastic lures (left) and two kinds of jigs (right) are currently sold by Gabe Backhus and his teen-owned Double B Baits, in Herington, Kansas. The company also sells t-shirts, hats and hoodies. Photo: Michael Pearce/Wichita Eagle/TNS

HERINGTON, Kansas — Three 16-year-olds from this Kansas town just beat about 90 percent of the competition at a national high school business class convention in California.

The business model they designed for their fishing-lure company was up against those of many older students, some from private schools in major U.S. cities, at the Future Business Leaders of America conference in Anaheim, California.

Now, the teens are back in Kansas with the goal of growing the company by improving the product, packaging, promotions and sales in retail stores and online.

Even beyond the next school year, Gabe Backhus, McKenzie Shippy and Emilie Roe are talking about ways this business experience will help them through college and into adult careers.

The business, Double B Baits, is living up to its company slogan of "Kickin' Bass & Takin' Names," according to the teacher who is helping them.

"This is really very impressive, what they're accomplishing," said Lisa Beye, a business teacher at Herington High School. "These kids are gaining so much great experience from this project."

Backhus began fishing with his dad when he was 2. By the time he was 10 he was entering youth bass tournaments around central Kansas. It wasn't long until he started thinking about making his own fishing lures.

"I just wanted to be fishing something better than what everybody else had," said Backhus, a tall, lanky kid who loses his shyness when the talk turns to bass fishing and bass lures. "My mom gave me a lure-making kit for Christmas one year and I started making plastics. Things just grew from there."

Rather than copying what was already being made, Backhus looked for ways to make his lures more attractive to fish.

His plastic lures, which include imitation crawdads and wormlike senkos, look and smell like something a bass would want to eat.

"I'd heard when a bass bites, that tasting some scent will get them to hold onto it longer," Backhus said, "so I found some scents online and mix it into the baits. I also soak the baits in scent before I put them into a package."

In a workshop at his rural Herington home, Backhus has continued to experiment. He tests his creations at a 26-acre lake that's literally in his backyard.

The desire to sell some of his creations was a natural progression of his ideas, Backhus said. He knew who to turn to for help.

Last school year he enrolled in Project Management, a business class taught by Beye. Backhus and Beye sought other students who could add talents to a company they named Double B Baits.

Shippy signed on as marketing manager; Roe joined the team to help with accounting.

"I've just given them suggestions and ideas," Beye said. "They've been the ones who've taken ideas and really run with them. They've worked hard."

Beye said the project got a boost when Chris Barnes, owner of a local grocery store, offered advice on pricing and marketing.

"The timing was really great, because he was wanting to start selling some fishing equipment, since no place in town was at that time," said Beye. "He was one of the first businesses to stock the Double B Baits." Tammie Roe, Emilie's mother and an accountant, lent her expertise to the business plan used to pilot the business.

One of the company's biggest home runs came with the idea of marketing T-shirts and hoodies with the business logo and "Kickin' Bass & Takin' Names" slogan.

"I told them they have to get that one approved by the principal. I wasn't going to do it," Beye said. "They did, and I think every kid in school has at least a shirt. It was amazing to see how many kids stood in line to buy those things. This summer they started selling hats with just the logo, but it seems like I'm seeing them all over town."

Much of the school year the students worked to improve the business plan they used to place third in the Kansas Future Business Leaders of America competition. In California, they made it to the round of 14 finalists out of 112 schools. They weren't called for the final 10.

Now students and teacher are working to increase demand for the lure line, which includes swim and football jigs, and plastic senkos, craws, finesse worms, mud bugs and flukes. Backhus has some improvements in mind, and hopes more anglers take advantage of the custom-made side of the business.

"If they have a particular color they like and can't find, I'd be glad to work with them and produce what they're looking for," said Backhus. "I'm pretty sure we can make about anything."

Lures average about $6 a package, and all profit goes to Backhus. Shippy and Roe will be rewarded with scholarship money when they graduate in two years.

Shippy said she's fine with that arrangement and feels she is getting paid for her efforts in other ways.

"Getting to talk to so many people in so many places has really made me branch out. Just the whole experience of going to California and presenting our business plan to so many people was really good for me," Shippy said. "I know everything I'm learning is going to help me in the future."

She said that could include applying to colleges and for scholarships and a possible career in sports marketing.

Backhus hopes to keep the company going, and growing, through his college career. His current ambition is to head to Kansas State, become a member of the school's national championship bass fishing team and major in fish or wildlife management.

Beye has confidence he'll succeed.

"Even a year ago I don't think he could have done what he did at the national competition, to get up and talk with people like that," she said. "Of course there's a lot he doesn't know, but if he stays with this there will probably be opportunity after opportunity. [In California] we had so many people come up and talk to the kids, and encourage them. I think there are plenty of people who will support young entrepreneurs out there."

Quiz

1 Read the paragraphs from the article.

Beye said the project got a boost when Chris Barnes, owner of a local grocery store, offered advice on pricing and marketing.

"The timing was really great, because he was wanting to start selling some fishing equipment, since no place in town was at that time," said Beye. "He was one of the first businesses to stock the Double B Baits." Tammie Roe, Emilie's mother and an accountant, lent her expertise to the business plan used to pilot the business.

What conclusion can be drawn from these paragraphs?

(A) Beye worked hard to seek out adults in the community who would work with the young business.

(B) It is unlikely the business would have made it if Barnes had been unwilling to help with pricing.

(C) The business became successful because Barnes and Roe began running it themselves for the kids.

(D) Gabe Backhus' business was able to grow thanks to a combination of luck and experienced support.

2 Which statement would Lisa Beye MOST LIKELY agree with? Which selection from the article BEST supports your answer?

1. *The students deserve all the credit for working to make Double B Baits a success.*
2. *Double B Baits will definitely continue to be successful after the students graduate.*

(A) option 1; "This is really very impressive, what they're accomplishing," said Lisa Beye, a business teacher at Herington High School.

(B) option 1; "I've just given them suggestions and ideas," Beyes said. "They've been the ones who've taken ideas and really run with them. They've worked hard."

(C) option 2; "It was amazing to see how many kids stood in line to buy those things. This summer they started selling hats with just the logo, but it seems like I'm seeing them all over town."

(D) option 2; "Of course there's a lot he doesn't know, but if he stays with this there will probably be opportunity after opportunity."

3 HOW did Backhus' lure business grow over time?

(A) At first, Backhus was not successful at selling his lures to many fishermen. Then, he took a class at school and learned to make better lures. Finally, his teacher and friends helped him join Future Business Leaders of America.

(B) At first, Backhus sold lures made by himself and his father online. Then, he got the idea to begin selling lures and shirts to his classmates. Finally, a teacher offered to introduce him to other students who were interested in lures.

(C) At first, Backhus was making lures out of plastic from a kit his mother gave him. Then, he got the idea to add color and scent to attract bass. Finally, other fishermen saw that he was successful in bass-fishing tournaments.

(D) At first, Backhus simply wanted to make better baits for himself. Then, he enrolled in a business class at school and found help. Finally, hard work led to more sales and a place in the Future Business Leaders of America competition.

4 Which of the following ideas did the author develop LEAST in the article about the teen entrepreneurs?

(A) how well they performed at a national competition

(B) how well they work together and communicate

(C) how they believe the business will help their futures

(D) how they plan to improve and increase demand

A Pair of Silk Stockings

By Kate Chopin on 02.05.20
Word Count **1,975**
Level **MAX**



"It was a long time since Mrs. Sommers had been fitted with gloves." Photo: Chicago History Museum/Getty Images

Editor's Note: American writer Kate Chopin wrote the short story "A Pair of Silk Stockings" in April 1896. The story was published in 1897. Chopin is known for writing stories about women who lived in the late 19th century and their roles in society. This story takes place over a single day. A young mother wanders through town with some unexpected extra money in hand. She spends the extra funds on herself, rather than on her family as she had originally planned.

Little Mrs. Sommers one day found herself the unexpected possessor of $15. It seemed to her a very large amount of money, and the way in which it stuffed and bulged her worn old porte-monnaie gave her a feeling of importance such as she had not enjoyed for years.

The question of investment was one that occupied her greatly. For a day or two she walked about apparently in a dreamy state, but really absorbed in speculation and calculation. She did not wish to act hastily, to do anything she might afterward regret. But it was during the still hours of the night when she lay awake revolving plans in her mind that she seemed to see her way clearly toward a proper and judicious use of the money.

A dollar or two should be added to the price usually paid for Janie's shoes, which would insure their lasting an appreciable time longer than they usually did. She would buy so and so many yards of percale for new shirt waists for the boys and Janie and Mag. She had intended to make the old ones do by skillful patching. Mag should have another gown. She had seen some beautiful patterns, veritable bargains in the shop windows. And still there would be left enough for new stockings—two pairs apiece—and what darning that would save for a while! She would get caps for the boys and sailor-hats for the girls. The vision of her little brood looking fresh and dainty and new for once in their lives excited her and made her restless and wakeful with anticipation.

The neighbors sometimes talked of certain "better days" that little Mrs. Sommers had known before she had ever thought of being Mrs. Sommers. She herself indulged in no such morbid retrospection. She had no time — no second of time to devote to the past. The needs of the present absorbed her every faculty. A vision of the future like some dim, gaunt monster sometimes appalled her, but luckily tomorrow never comes.

Mrs. Sommers was one who knew the value of bargains; who could stand for hours making her way inch by inch toward the desired object that was selling below cost. She could elbow her way if need be; she had learned to clutch a piece of goods and hold it and stick to it with persistence and determination till her turn came to be served, no matter when it came.

But that day she was a little faint and tired. She had swallowed a light luncheon — no! when she came to think of it, between getting the children fed and the place righted, and preparing herself for the shopping bout, she had actually forgotten to eat any luncheon at all!

She sat herself upon a revolving stool before a counter that was comparatively deserted, trying to gather strength and courage to charge through an eager multitude that was besieging breastworks of shirting and figured lawn. An all-gone limp feeling had come over her and she rested her hand aimlessly upon the counter. She wore no gloves. By degrees she grew aware that her hand had encountered something very soothing, very pleasant to touch. She looked down to see that her hand lay upon a pile of silk stockings. A placard near by announced that they had been reduced in price from $2.50 to $1.98; and a young girl who stood behind the counter asked her if she wished to examine their line of silk hosiery. She smiled, just as if she had been asked to inspect a tiara of diamonds with the ultimate view of purchasing it. But she went on feeling the soft, sheeny luxurious things — with both hands now, holding them up to see them glisten, and to feel them glide serpent-like through her fingers.

Two hectic blotches came suddenly into her pale cheeks. She looked up at the girl.

"Do you think there are any eights-and-a-half among these?"

There were any number of eights-and-a-half. In fact, there were more of that size than any other. Here was a light-blue pair; there were some lavender; some all black; and various shades of tan and gray. Mrs. Sommers selected a black pair and looked at them very long and closely. She pretended to be examining their texture, which the clerk assured her was excellent.

"A dollar and ninety-eight cents," she mused aloud. "Well, I'll take this pair." She handed the girl a $5 bill and waited for her change and for her parcel. What a very small parcel it was! It seemed lost in the depths of her shabby old shopping-bag.

Mrs. Sommers after that did not move in the direction of the bargain counter. She took the elevator, which carried her to an upper floor into the region of the ladies' waiting-rooms. Here, in a retired corner, she exchanged her cotton stockings for the new silk ones which she had just bought. She was not going through any acute mental process or reasoning with herself, nor was she striving to explain to her satisfaction the motive of her action. She was not thinking at all. She seemed for the time to be taking a rest from that laborious and fatiguing function and to have abandoned herself to some mechanical impulse that directed her actions and freed her of responsibility.

How good was the touch of the raw silk to her flesh! She felt like lying back in the cushioned chair and reveling for a while in the luxury of it. She did for a little while. Then she replaced her shoes, rolled the cotton stockings together and thrust them into her bag. After doing this she crossed straight over to the shoe department and took her seat to be fitted.

She was fastidious. The clerk could not make her out; he could not reconcile her shoes with her stockings, and she was not too easily pleased. She held back her skirts and turned her feet one way and her head another way as she glanced down at the polished, pointed-tipped boots. Her foot and ankle looked very pretty. She could not realize that they belonged to her and were a part of herself. She wanted an excellent and stylish fit, she told the young fellow who served her, and she did not mind the difference of a dollar or two more in the price so long as she got what she desired.

It was a long time since Mrs. Sommers had been fitted with gloves. On rare occasions when she had bought a pair they were always "bargains," so cheap that it would have been preposterous and unreasonable to have expected them to be fitted to the hand.

Now she rested her elbow on the cushion of the glove counter, and a pretty, pleasant young creature, delicate and deft of touch, drew a long-wristed "kid" over Mrs. Sommers's hand. She smoothed it down over the wrist and buttoned it neatly, and both lost themselves for a second or two in admiring contemplation of the little symmetrical gloved hand. But there were other places where money might be spent.

There were books and magazines piled up in the window of a stall a few paces down the street. Mrs. Sommers bought two high-priced magazines such as she had been accustomed to read in the days when she had been accustomed to other pleasant things. She carried them without wrapping. As well as she could she lifted her skirts at the crossings. Her stockings and boots and well fitting gloves had worked marvels in her bearing — had given her a feeling of assurance, a sense of belonging to the well-dressed multitude.

She was very hungry. Another time she would have stilled the cravings for food until reaching her own home, where she would have brewed herself a cup of tea and taken a snack of anything that was available. But the impulse that was guiding her would not suffer her to entertain any such thought. There was a restaurant at the corner. She had never entered its doors; from the outside she had sometimes caught glimpses of spotless damask and shining crystal, and soft-stepping waiters serving people of fashion.

When she entered her appearance created no surprise, no consternation, as she had half feared it might. She seated herself at a small table alone, and an attentive waiter at once approached to take her order. She did not want a profusion; she craved a nice and tasty bite — a half dozen blue-

points, a plump chop with cress, a something sweet — a creme-frappee, for instance; a glass of Rhine wine, and after all a small cup of black coffee.

While waiting to be served she removed her gloves very leisurely and laid them beside her. Then she picked up a magazine and glanced through it, cutting the pages with a blunt edge of her knife. It was all very agreeable. The damask was even more spotless than it had seemed through the window, and the crystal more sparkling. There were quiet ladies and gentlemen, who did not notice her, lunching at the small tables like her own. A soft, pleasing strain of music could be heard, and a gentle breeze, was blowing through the window. She tasted a bite, and she read a word or two, and she sipped the amber wine and wiggled her toes in the silk stockings. The price of it made no difference. She counted the money out to the waiter and left an extra coin on his tray, whereupon he bowed before her as before a princess of royal blood.

There was still money in her purse, and her next temptation presented itself in the shape of a matinee poster.

It was a little later when she entered the theatre, the play had begun and the house seemed to her to be packed. But there were vacant seats here and there, and into one of them she was ushered, between brilliantly dressed women who had gone there to kill time and eat candy and display their gaudy attire. There were many others who were there solely for the play and acting. It is safe to say there was no one present who bore quite the attitude which Mrs. Sommers did to her surroundings. She gathered in the whole — stage and players and people in one wide impression, and absorbed it and enjoyed it. She laughed at the comedy and wept — she and the gaudy woman next to her wept over the tragedy. And they talked a little together over it. And the gaudy woman wiped her eyes and sniffled on a tiny square of filmy, perfumed lace and passed little Mrs. Sommers her box of candy.

The play was over, the music ceased, the crowd filed out. It was like a dream ended. People scattered in all directions. Mrs. Sommers went to the corner and waited for the cable car.

A man with keen eyes, who sat opposite to her, seemed to like the study of her small, pale face. It puzzled him to decipher what he saw there. In truth, he saw nothing — unless he were wizard enough to detect a poignant wish, a powerful longing that the cable car would never stop anywhere, but go on and on with her forever.

Quiz

1 Which decision leads to a shift in the development of the plot?

(A) Mrs. Sommers changes into the silk stockings she purchased.

(B) Mrs. Sommers enters a theater to watch a matinee performance.

(C) Mrs. Sommers sits at a counter a notices a pile of silk stockings.

(D) Mrs. Sommers eats lunch by herself in a fancy restaurant.

2 How are Mrs. Sommers's motivations developed over the course of the story?

(A) She transitions from being frugal to savoring a life of extravagant spending.

(B) She becomes ashamed of the money she spent on items she did not need.

(C) She starts to worry the people around her are unimpressed with her appearance.

(D) She begins to worry that the money she came into will be gone before she knows it.

3 Read the following sentence from the story.

She smoothed it down over the wrist and buttoned it neatly, and both lost themselves for a second or two in admiring contemplation of the little symmetrical gloved hand.

What is the BEST definition of the word “contemplation” as it is used above?

(A) expectation

(B) reflection

(C) misgiving

(D) apprehension

4 Read the following words and phrases from the story.

reveling for a while in the luxury of it

delicate and deft of touch

caught glimpses of spotless damask and shining crystal

eat candy and display their gaudy attire

How do these words and phrases develop the tone of the story?

(A) They establish an arrogant tone that is developed as Mrs. Sommers spends her money.

(B) They create an envious tone as Mrs. Sommers compares herself to other women she encounters.

(C) They build a luxurious tone that is developed as Mrs. Sommers experiences a lavish lifestyle.

(D) They generate a nostalgic tone as Mrs. Sommers thinks back to a special day in her life.

Can’t keep your New Year’s resolutions? Try being kind to yourself

By Kristin Neff, The Conversation on 01.01.20
Word Count **1,310**
Level **MAX**



Image 1. A student practices mindful breathing during the Mindful Studies class at Wilson High School in Portland, Oregon. Mindfulness is part of self-compassion, which can help to achieve goals and overcome failure. Photo: AP /Gosia Wozniacka/File.

Many of us will start out the New Year by making a list of resolutions – changes we want to make to be happier such as eating better, volunteering more often, being a more attentive spouse and so on. But, as we know, we will often fail. After a few failures we will typically give up and go back to our old habits.

Why is it so hard to stick to resolutions that require us to make effective or lasting changes?

I would argue the problem isn't that we try and we fail – the problem is how we treat ourselves when we fail. I study self-compassion, and my research and that of others show that how we relate to personal failure – with kindness or harsh self-judgment – is incredibly important for building resilience.

From early childhood, we are taught that we must succeed at all costs. What most of us aren't taught is how to fail successfully so we can change and grow.

One of the best ways to deal with failure is to have self-compassion.

What Exactly Is Self-Compassion?

I define self-compassion as having three main components: self-kindness, common humanity and mindfulness. Self-kindness refers to the tendency to be caring, understanding and supportive toward ourselves when we fail or make mistakes rather than being harshly critical or judgmental.



Common humanity involves recognizing that all humans are imperfect, and connecting our own flawed condition to the shared human condition so we can have a greater perspective on our shortcomings.

Mindfulness involves being aware of the pain associated with failure in a clear and balanced manner so that we neither ignore nor obsess about our faults. The three together combine to create a self-compassionate frame of mind.

A large body of research shows that self-compassion results in greater emotional well-being. One of the most consistent findings in this research is that greater self-compassion is linked to less depression, anxiety and stress.

In addition to reducing such negative mind states, self-compassion appears to enhance positive mind states such as optimism, gratitude and curiosity. By meeting one's suffering with the warm embrace of self-compassion, positive feelings such as happiness are generated at the same time that negative emotions are alleviated.

Self-compassion has been found to be an important source of coping and resilience in the face of various life stressors such as divorce, chronic health conditions or military combat. It also reduces body dissatisfaction and even leads to healthier eating behavior (relevant to many New Year's resolutions!).

Misgivings About Self-Compassion

If self-compassion is so good for us, why aren't we kinder to ourselves?

Perhaps the biggest block to self-compassion is the belief that it will undermine our motivation. In parenting circles, we no longer hold to the adage "spare the rod spoil the child." When it comes to our own selves, however, many of us think that sparing the rod of harsh self-criticism will turn us into lazy, self-indulgent ne'er-do-wells. This theme constantly comes up in the workshops I teach.

Of course, the dynamics that go into motivating our children and motivating ourselves are quite similar. Let's say your teenage son were to come home with a failing English grade. You have two ways to motivate him to try harder and do better next time.

You could admonish him and tell him how stupid he is and that you are ashamed of him. The other option is, knowing how upset he is, you could give him a hug and gently ask him how you could support him in doing better next time. This type of caring, encouraging response would help your son maintain his self-confidence and feel emotionally supported. The same goes for how we respond to ourselves when we fail.

How Does Self-Compassion Increase Motivation?

A growing body of research indicates that self-compassion is linked to greater motivation. Self-compassion has been associated with increased personal initiative – the desire to reach one's full potential.

Self-compassionate people are also more likely to adopt "mastery goals," which focus on learning and mastering material to increase competence, and less likely to adopt "performance goals," which are primarily concerned with succeeding to make a favorable impression on others.

While self-compassionate people have performance standards that are as high as those who are harshly self-critical, they don't get as upset when they don't reach their goals. As a result, self-compassionate people have less performance anxiety and engage in fewer self-defeating behaviors such as procrastination.

Not only are self-compassionate people less likely to fear failure, but when they do fail they're more likely to pick themselves up and try again.

A series of experiments by psychologists Juliana Breines and Serena Chen from the University of California at Berkeley examined whether helping undergraduate students to be more self-compassionate would impact their motivation to change.

In one study, participants were asked to recall a recent action they felt guilty about – cheating on an exam, lying to a romantic partner, saying something harmful, etc. – something that still made them feel bad when they thought about it.

Next, they were randomly assigned to one of three conditions. In the self-compassion condition, participants were instructed to write to themselves for three minutes from the perspective of a compassionate and understanding friend.

The second condition had people write about all their positive qualities, and the third about a hobby they enjoyed. These two control conditions helped to differentiate self-compassion from positive self-talk and positive mood in general.

The researchers found that participants who were helped to be self-compassionate about their recent transgressions reported being more motivated to apologize for the harm done and more committed to not repeating the behavior than those in the control conditions.

Sustaining Motivation Through Kindness

Another study in this same series of experiments explored whether self-compassion would directly translate into greater efforts to learn after failure. Students were given a difficult vocabulary test they all did poorly on.

One group of students was given an instruction to be self-compassionate about their failure. The instruction said: "If you had difficulty with the test you just took, you're not alone. It's common for students to have difficulty with tests like this. If you feel bad about how you did, try not to be too hard on yourself."

Another group was given a self-esteem boost, which said:

"If you had difficulty with the test you just took, try not to feel bad about yourself – you must be intelligent if you got into Berkeley!"

The third group of participants was given no additional instructions.

The students were next told that they would receive a second vocabulary test and were given a list of words and definitions they could study for as long as they wanted before taking it. Study time was used as a measure of improvement motivation.



The students who were told to be self-compassionate after failing the first test spent more time studying than those in the other two conditions. Study time was linked to how well participants actually performed on the test. These findings suggest that being kind to yourself when you fail or make mistakes gives you the emotional support needed to try your best, and to keep trying even when discouraged.

Kindness is the engine that drives us to keep trying even after we fall flat on our face. So this New Year, when you make and inevitably break your resolutions, instead of beating yourself up and then giving up, try being kind to yourself. In the long run, you'll be more likely to succeed.

Kristin Neff is an associate professor of educational psychology at the University of Texas at Austin.

Quiz

1 Which idea did the author develop LEAST in this article about self-compassion?

(A) the role of three main components in developing a compassionate mindset

(B) the relationship that exists between self-compassion and motivation

(C) the way compassion affects body dissatisfaction and eating behaviors

(D) the contrast between self-compassionate and self-critical individuals

2 Which answer choice accurately summarizes the results of different studies on self-compassion?

(A) One study found that participants who practiced self-compassion after bad behavior were more likely to apologize or improve their behavior in the future. Another study found that those who practiced self-compassion after failing a difficult test were more likely to study hard, but no more likely to pass the next test.

(B) One study found that participants who were given a specific statement about self-compassion were more successful than those who were told to write to themselves as compassionate and understanding friend. Another study found that specific statements made no difference as long as self-compassion was emphasized.

(C) One study found that participants who wrote to themselves from the perspective of a compassionate friend were more motivated to apologize for bad behavior, while another found that those given instructions to be self-compassionate improved test scores. Both studies showed self-compassionate groups to be more likely to improve their behavior than control groups.

(D) One study found that participants who thought about a previous misdeed were more likely to write letters apologizing for their bad behavior, while another found that those given self-esteem boosting statements felt more self-compassion. Both studies showed self-compassionate groups to be more likely to improve their behavior than control groups.

3 The author uses a mostly calm and understanding tone throughout the article.

In which selection does the author use a more disapproving tone to emphasize a point?

(A) By meeting one’s suffering with the warm embrace of self-compassion, positive feelings such as happiness are generated at the same time that negative emotions are alleviated.

(B) When it comes to our own selves, however, many of us think that sparing the rod of harsh self-criticism will turn us into lazy, self-indulgent ne'er-do-wells. This theme constantly comes up in the workshops I teach.

(C) This type of caring, encouraging response would help your son maintain his self-confidence and feel emotionally supported. The same goes for how we respond to ourselves when we fail.

(D) Another study in this same series of experiments explored whether self-compassion would directly translate into greater efforts to learn after failure.

4 Read the sentence from the section "How Does Self-Compassion Increase Motivation?"

Self-compassionate people are also more likely to adopt “mastery goals,” which focus on learning and mastering material to increase competence, and less likely to adopt “performance goals,” which are primarily concerned with succeeding to make a favorable impression on others.

How does this sentence contribute to the effectiveness of the author's argument overall?

(A) It uses a statistic to demonstrate the danger of focusing on performance rather than mastery when taking tests.

(B) It uses a specific study to establish the author's credibility on the relationship between self-compassion and mastery.

(C) It uses a comparison to increase the reader's emotional motivation to adopt goals that will draw more compassion from others.

(D) It uses a contrast to develop the logical conclusion that self-compassion increases personal initiative that leads to success.

Happiness can be a prime predictor of whether we'll find success in life

By Mark Williamson, The Guardian, adapted by Newsela staff on 07.20.18
Word Count **1,193**
Level **MAX**



Image 1. Fans of the French soccer team Red Star celebrate a victory. Photo by Christophe Simon/AFP/Getty Images

Does happiness matter? People react to this question in surprisingly different ways. Some suggest that there are far more significant things to worry about; others see happiness as vitally important and something that every human being ultimately wants in life. To explore this conundrum, we need to start by looking at what happiness actually means.

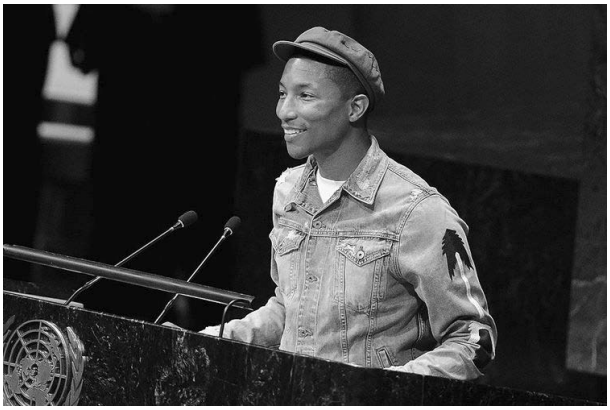
Happiness relates to how we feel, but it is more than just a passing mood. We are emotional beings and experience a wide range of feelings on a daily basis. Negative emotions – such as fear and anger – help us to get away from danger or defend ourselves. And positive emotions – such as enjoyment and hope – help us to connect with others and build our capacity to cope when things go wrong.

Trying to live a happy life is not about denying negative emotions or pretending to feel joyful all the time. We all encounter adversity and it's completely natural for us to feel anger, sadness, frustration and other negative emotions as a result. To suggest otherwise would be to deny part of the human condition.

Happiness is about being able to make the most of the good times – but also to cope effectively with the inevitable bad times, in order to experience the best possible life overall. Or, in the words of the biochemist turned Buddhist monk Matthieu Ricard: "Happiness is a deep sense of flourishing, not a mere pleasurable feeling or fleeting emotion but an optimal state of being."

Happiness Influences Many Aspects Of Life

One popular misconception about happiness is that happy people are somehow more likely to be lazy or ineffective. In fact research shows the opposite is true: happiness doesn't just feel good, it actually leads to a wide range of benefits for our performance, health, relationships and more.



For example, economists at Warwick University showed different groups of people either a positive film clip or a neutral film clip and then asked them to carry out standard workplace tasks under paid conditions. The people who were primed to feel happy were 11 percent more productive than their peers, even after controlling for age, IQ and other factors. Similarly, researchers at Wharton Business School found that companies with happy employees outperform the stock market year on year and a team at University College London has discovered that people who are happy as young adults go on to earn more than their peers later in life.

In health care, doctors who are happy have been found to make faster and more accurate diagnoses, even when this happiness was induced simply by giving them the small gift of a sugary sweet. In education, schools that focus on children's social and emotional well-being experience significant gains in academic attainment as well as improvements in pupil behavior. Happiness has also been linked to better decision-making and improved creativity.

So, rather than success being the key to happiness, research shows that happiness could in fact be the key to success.

Research Reveals Overall Benefits To Society

But it doesn't just help us function better: happiness also brings substantial benefits for society as a whole. For example, a review of more than 160 studies found "clear and compelling evidence" that happier people have better overall health and live longer than their less happy peers. They are around half as likely to catch the cold virus and have a 50 percent lower risk of experiencing a cardiovascular event such as a heart attack or stroke.

Happier people are also less likely to engage in risky behavior – for example, they are more likely to wear seat belts and less likely to be involved in road accidents. Happier people are even more financially responsible, tending to save more and have more control over their expenditures.

But perhaps most importantly of all, people who are happier are more likely to make a positive contribution to society. In particular, they are more likely to vote, do voluntary work and participate in public activities. They also have a greater respect for law and order and offer more help to others.

There is even evidence that happiness is contagious, so that happier people help others around them to become happier, too. An extensive study in the British Medical Journal followed people over 20 years and found that their happiness affected others in their networks across "three degrees of separation." In other words, how happy we are has a measurable impact on the mood of our friend's friend's friend.

When it comes to the happiness of society as a whole, however, the sad truth is that in recent decades we have become substantially richer but no happier. The positive benefits of higher incomes have been undermined by rising inequality and falling levels of trust and social cohesion. We've also reached the point where mental illness is one of our greatest social challenges – causing more of the suffering in our society than either unemployment or poverty.

Governments Recognize Importance Of Happiness

This is why increasing numbers of policymakers and leaders are now calling for measures of progress to be based on human well-being and happiness, not just economic factors such as growth in gross domestic product. In the United Kingdom, the government has introduced a program to measure national well-being, and influential figures – including former cabinet secretary Gus O'Donnell – are calling for well-being to become the overall measure of prosperity and the main guide to public policy.

This shift towards prioritizing happiness is important because this also reflects what the majority of people want. In a YouGov poll commissioned by Action for Happiness, a majority (87 percent) of U.K. adults said they would prefer a society with the "greatest overall happiness and well-being", rather than the "greatest overall wealth" (8 percent). The findings were consistent across all regions, age groups and social classes.

So happiness does matter – the scientific evidence is compelling. The pursuit of happiness is not some fluffy nice-to-have or middle-class luxury; it's about helping people to live better lives and creating a society that is more productive, healthy and cohesive. As Aristotle said: "Happiness is the meaning and the purpose of life, the whole aim and end of human existence."

There Are Limits To Happiness

Of course, being happy is not some magical cure-all. Happy people still get sick and lose loved ones – and not all happy people are efficient, creative or generous. But, other things being equal, happiness brings substantial advantages.

Perhaps the most powerful insight of all comes not from the research, but from the responses I've heard from many hundreds of parents when asking them what they want above all for their children. Nearly all say something like: "I really just want them to be happy."

Happiness is the thing we want most for the people we love the most. That's why it matters so much.

Quiz

1 Which matter is left uncertain in the article?

(A) whether other governments will follow the U.K.'s lead and develop ways to measure well-being

(B) whether people are able to use their happiness to mitigate difficult circumstances they encounter

(C) whether happiness plays a significant role in workplace productivity and earning potential

(D) whether happiness can improve the quality of life for an individual and for those around them

2 Read the following statement.

The pursuit of a happy life is a universal desire.

Which detail from the article BEST supports the statement above?

(A) Happiness is about being able to make the most of the good times – but also to cope effectively with the inevitable bad times, in order to experience the best possible life overall.

(B) But it doesn't just help us function better: happiness also brings substantial benefits for society as a whole. For example, a review of more than 160 studies found "clear and compelling evidence" that happier people have better overall health and live longer than their less happy peers.

(C) An extensive study in the British Medical Journal followed people over 20 years and found that their happiness affected others in their networks across "three degrees of separation." In other words, how happy we are has a measurable impact on the mood of our friend's friend's friend.

(D) In a YouGov poll commissioned by Action for Happiness, a majority (87 percent) of U.K. adults said they would prefer a society with the "greatest overall happiness and well-being", rather than the "greatest overall wealth" (8 percent). The findings were consistent across all regions, age groups and social classes.

3 What purpose is served by including data from scientific studies on happiness?

(A) It highlights the need for more research on the benefits of happiness.

(B) It reinforces the importance of promoting happiness in the workplace.

(C) It emphasizes the idea that the effects of happiness are noticeable and measurable.

(D) It encourages governments to highly value the well-being and happiness of their citizens.

4 Read the last two paragraphs of the article.

Perhaps the most powerful insight of all comes not from the research, but from the responses I've heard from many hundreds of parents when asking them what they want above all for their children. Nearly all say something like: "I really just want them to be happy."

Happiness is the thing we want most for the people we love the most. That's why it matters so much.

What is the MOST LIKELY reason the author concludes the article with these two paragraphs?

(A) to provide a compelling rationale for seeking happiness for oneself and loved ones

(B) to suggest that the research doesn't give sufficient information about happiness

(C) to emphasize the necessity of parents ensuring that their children are happy

(D) to highlight the importance of surveying people about their opinions on happiness



Algebra II

1

Up and Down or Down and Up

Exploring Quadratic Functions

Warm Up

Consider $f(x) = x^2 + 3x + 4$. Evaluate the function for each given value.

1. $f(1)$

2. $f(-1)$

3. $f(2)$

4. $f(-2)$

Learning Goals

- Write quadratic functions to model contexts.
- Graph quadratic functions using technology.
- Interpret the key features of quadratic functions in terms of a context.
- Identify the domain and range of quadratic functions and their contexts.

Key Terms

- parabola
- vertical motion model
- roots

You have used linear functions to model situations with constant change, and you have used exponential functions to model growth and decay situations. What type of real-world situations can be modeled by quadratic functions?

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Squaring It Up

Maddie is using pennies to create a pattern.



Figure 1 Figure 2 Figure 3 Figure 4

1. **Analyze the pattern and explain how to create Figure 5.**

2. **How many pennies would Maddie need to create Figure 5? Figure 6? Figure 7?**

3. **Which figure would Maddie create with exactly $4.00 in pennies?**

4. **Write an equation to determine the number of pennies for any figure number. Define your variables.**

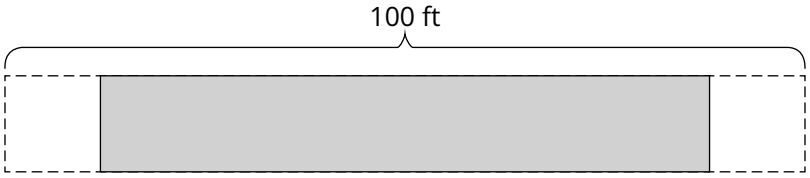
5. **Describe the function family to which this equation belongs.**

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ACTIVITY
1.1

Using Area to Introduce Quadratic Functions

A dog trainer is fencing in an enclosure, represented by the shaded region in the diagram. The trainer will also have two square-shaped storage units on either side of the enclosure to store equipment and other materials. She can make the enclosure and storage units as wide as she wants, but she can't exceed 100 feet in total length.



1. **Let *s* represent a side length, in feet, of one of the storage units.**

   a. **Label the length and width of the enclosure in terms of *s*.**

   b. **Write the function *L*(*s*) to represent the length of the enclosure as a function of side length, *s*.**

   c. **Sketch and label a graph of the function on the given coordinate plane. Identify any key points.**

2. **Describe the domain and range of the context and of the function.**

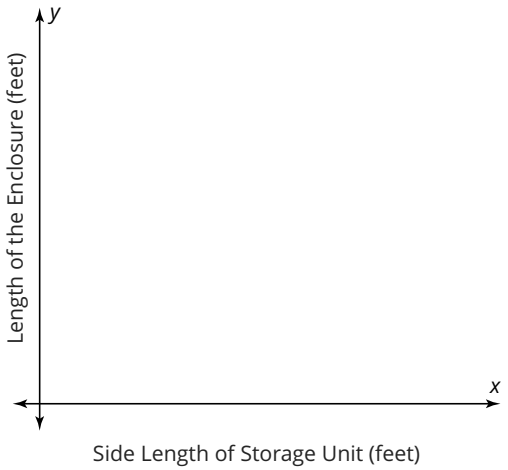
3. **Identify each key characteristic of the graph. Then, interpret the meaning of each in terms of the context.**

   a. **slope**

   b. ***y*-intercept**

   c. **increasing or decreasing**

   d. ***x*-intercept**

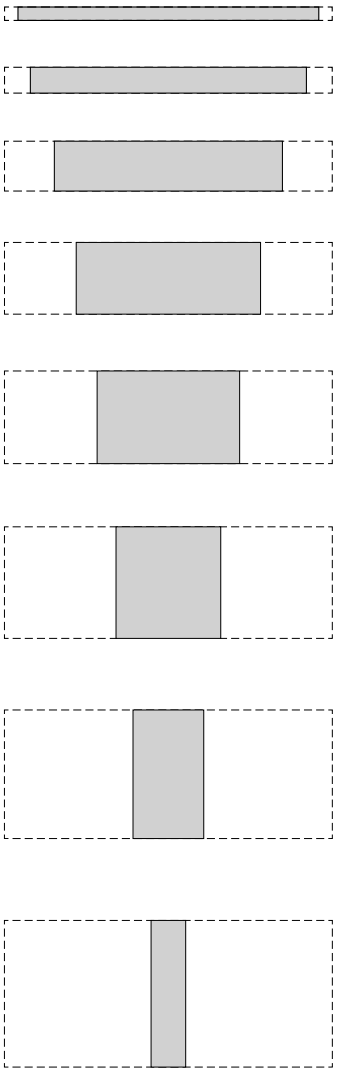


Ask yourself:

To identify key points on the graph, think about the function you are representing. Are there any intercepts? Are there any other points of interest?

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The progression of diagrams below shows how the area of the enclosure, $A(s)$, changes as the side length, s, of each square storage unit increases.



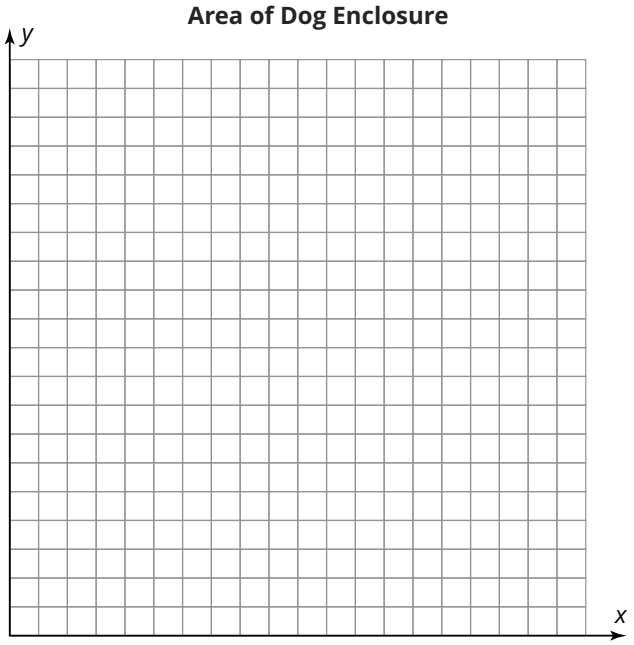
4. **Write the function $A(s)$ to represent the area of the enclosure as a function of side length, s.**

5. **Describe how the area of the enclosure changes as the side length increases.**

6. **Consider the graph of the function, $A(s)$.**

   a. **Predict what the graph of the function will look like.**

   b. **Use technology to graph the function $A(s)$. Then sketch the graph and label the axes.**



7. **Describe what all the points on the graph represent.**

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The function $A(s)$ that you wrote to model area is a quadratic function. The shape that a quadratic function forms when graphed is called a **parabola**.



Quadratic functions model area because area is measured in square units.

8. Think about the possible areas of the enclosure.

a. Is there a maximum area that the enclosure can contain? Explain your reasoning in terms of the graph and in terms of the context.

b. Use technology to determine the maximum of $A(s)$. Describe what the x- and y-coordinates of the maximum represent in this context.

c. Determine the dimensions of the enclosure that will provide the maximum area. Show your work and explain your reasoning.

9. Identify the domain and range of the context and of the function.

10. Identify each key characteristic of the graph. Then, interpret the meaning of each in terms of the context.

a. y-intercept

b. increasing and decreasing intervals

c. symmetry

d. x-intercepts

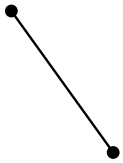
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ACTIVITY
1.2 Writing and Interpreting a Quadratic Function

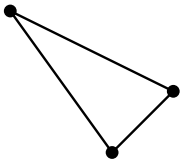
Suppose that there is a monthly meeting at CIA headquarters for all employees. How many handshakes will it take for every employee at the meeting to shake the hand of every other employee at the meeting once?

1. **Use the figures shown to determine the number of handshakes that will occur between 2 employees, 3 employees, and 4 employees.**

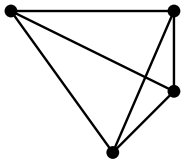
2 employees



3 employees



4 employees



2. **Draw figures to represent the number of handshakes that occur between 5 employees, 6 employees, and 7 employees and determine the number of handshakes that will occur in each situation.**

Ask yourself:

Can you tell what shape the graph will be?

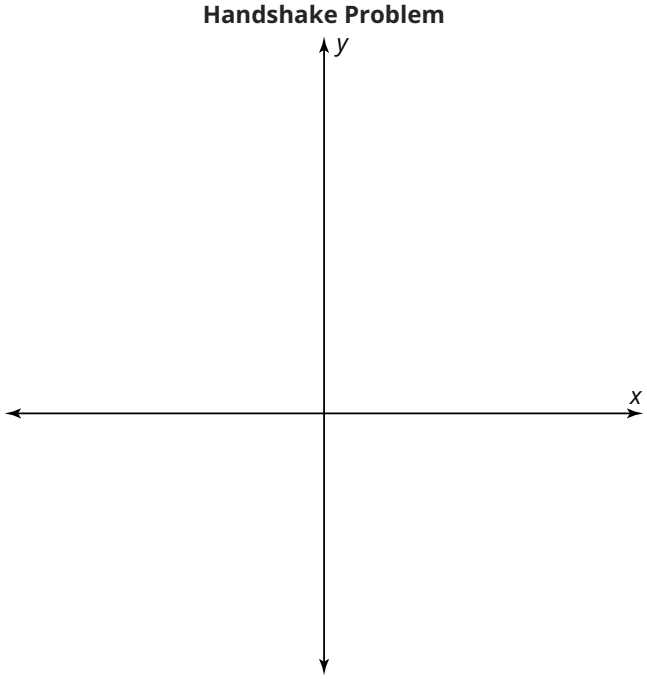
3. **Enter your results in the table.**

Number of Employees	2	3	4	5	6	7	*n*
Number of Handshakes							

4. **Write a function to represent the number of handshakes given any number of employees. Enter your function in the table.**

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5. **Use technology to graph the function you wrote in Question 4. Sketch the graph and label the axes.**



Ask yourself:

What do all the points on this graph represent?

6. **How is the orientation of this parabola different from the parabola for the area of the dog enclosure? How is this difference reflected in their corresponding equations?**

7. **Determine the minimum of your function. Then, describe what the *x*- and *y*-coordinates of this minimum represent in this problem situation.**

8. **Identify the domain and range of the problem situation and of the function.**

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ACTIVITY
1.3 Using a Quadratic Function to Model Vertical Motion



You can model the motion of a pumpkin released from a catapult using a vertical motion model. A **vertical motion model** is a quadratic equation that models the height of an object at a given time. The equation is of the form shown.

$$y = -16t^2 + v_0t + h_0$$

In this equation, y represents the height of the object in feet, t represents the time in seconds that the object has been moving, v_0 represents the initial vertical velocity (speed) of the object in feet per second, and h_0 represents the initial height of the object in feet.

1. **What characteristics of this situation indicate that it can be modeled by a quadratic function?**

Suppose that a catapult hurls a pumpkin from a height of 68 feet at an initial vertical velocity of 128 feet per second.

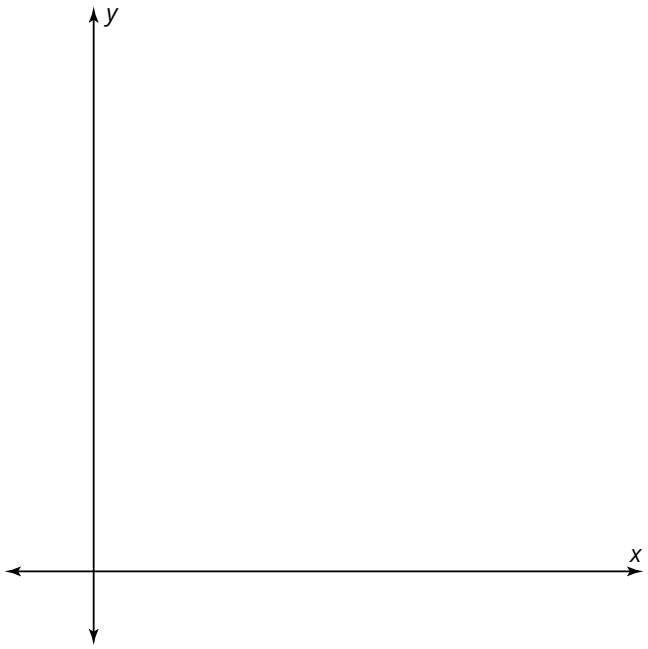
2. **Write a function for the height of the pumpkin, $h(t)$, in terms of time, t.**

3. **Does the function you wrote have a minimum or maximum? How can you tell from the form of the function?**

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4. **Use technology to graph the function. Sketch your graph and label the axes.**

Punkin' Chunkin'



Ask yourself:

What do all the points on this graph represent?

5. **Use technology to determine the maximum or minimum and label it on the graph. Explain what it means in terms of the problem situation.**

6. **Determine the *y*-intercept and label it on the graph. Explain what it means in terms of the problem situation.**

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7. **Use a horizontal line to determine when the pumpkin reaches each height after being catapulted. Label the points on the graph.**

   a. **128 feet**

   b. **260 feet**

   c. **55 feet**

8. **Explain why the *x*- and *y*-coordinates of the points where the graph and each horizontal line intersects are solutions.**

9. **When does the catapulted pumpkin hit the ground? Label this point on the graph. Explain how you determined your answer.**

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Remember:

The zeros of a function are the *x*-values when the function equals 0.

The time when the pumpkin hits the ground is one of the *x*-intercepts, (*x*, 0). When an equation is used to model a situation, the *x*-coordinate of the *x*-intercept is referred to as a root. The **root** of an equation indicates where the graph of the equation crosses the *x*-axis.

ACTIVITY
1.4

Expressing a Quadratic Function as the Product of Two Linear Functions



The Jacobson brothers own and operate their own ghost tour business. They take tour groups around town on a bus to visit the most notorious "haunted" spots throughout the city. They charge $50 per tour. Each summer, they book 100 tours at that price. The brothers are considering a decrease in the price per tour because they think it will help them book more tours. They estimate that they will gain 10 tours for every $1 decrease in the price per tour.

1. **According to the scenario, how much money do the Jacobson brothers currently generate each summer with their ghost tour business?**

Revenue is the amount of money regularly coming into a business. In the ghost tour business, the revenue is the number of tours multiplied by the price per tour. Your response to Question 1 can be referred to as revenue. Because the Jacobson brothers are considering different numbers of tours and prices per tour, the revenue can be modeled by a function.

2. **Write a function, $r(x)$, to represent the revenue for the ghost tour business.**

   a. **Let x represent the decrease in the price per tour. Write an expression to represent the number of tours booked if the decrease in price is x dollars per tour.**

   b. **Write an expression to represent the price per tour if the brothers decrease the price x dollars per tour.**

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Think about:

You can always check your function by testing it with values of x. What is the value of $r(x)$ when $x = 0$? Does it make sense?

c. Use your expressions from parts (a) and (b) to represent the revenue, $r(x)$, as the number of tours times the price per tour.

Revenue = Number of Tours • Price per Tour

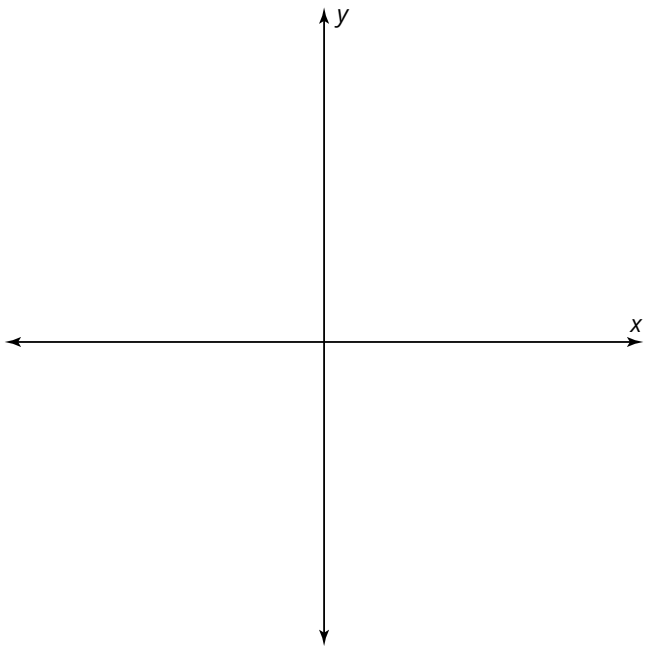
$r(x)$ = _____ • _____

3. Use technology to graph the function $r(x)$. Sketch your graph and label the axes.

Remember:

Don't forget to label key points!

Ghost Tour



4. Assume that the Jacobson brothers' estimate that for every $1 decrease in the price per tour, they will gain 10 tours is accurate.

a. What is the maximum revenue that the Jacobson brothers could earn for the summer?

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b. **Katie and Bryce are calculating the number of tours that would yield the maximum revenue.**



Katie said that according to the graph, a tour should cost $20. Since $9000 ÷ $20 = 450, the number of tours would be 450.

Bryce said that the cost of a tour should be $30, and $9000 divided by $30 per tour is 300 tours.

Who is correct? Explain your reasoning.

c. **Would you advise the Jacobson brothers to adjust their cost per tour to make the maximum revenue? Why or why not?**

5. **Identify each key characteristic of the graph. Then, interpret its meaning in terms of the context.**

   a. ***x*-intercepts**

   b. ***y*-intercept**

   c. **increasing and decreasing intervals**

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NOTES

TALK the TALK

Making Connections

Analyze the graphs of the four quadratic functions in this lesson.

1. **Summarize what you know about the graphs of quadratic functions. Include a sketch or sketches and list any characteristics.**

2. **Compare your sketch or sketches and list with your classmates. Did you all sketch the same parabola? Why or why not?**

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Assignment

Write

Fill in the blank.

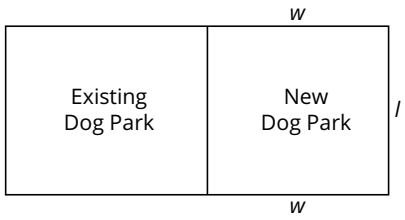
1. The *x*-intercepts of a graph of a quadratic function are also called the _____ of the quadratic function.
2. A quadratic equation that models the height of an object at a given time is a _____.
3. The shape that a quadratic function forms when graphed is called a _____.
4. The _____ of an equation indicate where the graph of the equation crosses the *x*-axis.

Remember

The graph of a quadratic function is called a parabola. Parabolas are smooth curves that have an absolute maximum or minimum, both increasing and decreasing intervals, up to two *x*-intercepts, and symmetry.

Practice

1. The citizens of Herrington County have an existing dog park for dogs to play, but have decided to build another one so that one park will be for small dogs and the other will be for large dogs. The plan is to build a rectangular fenced in area that will be adjacent to the existing dog park, as shown in the sketch. The county has enough money in the budget to buy 1000 feet of fencing.



   a. Determine the length of the new dog park, *l*, in terms of the width, *w*.
   b. Write the function *A*(*w*) to represent the area of the new dog park as a function of the width, *w*. Does this function have a minimum or a maximum? Explain your answer.
   c. Determine the *x*-intercepts of the function. Explain what each means in terms of the problem situation.
   d. What should the dimensions of the dog park be to maximize the area? What is the maximum area of the park?
   e. Sketch the graph of the function. Label the axes, the maximum or minimum, the *x*-intercepts, and the *y*-intercept.
   f. Use the graph to determine the dimensions of the park if the area was restricted to 105,000 square feet.

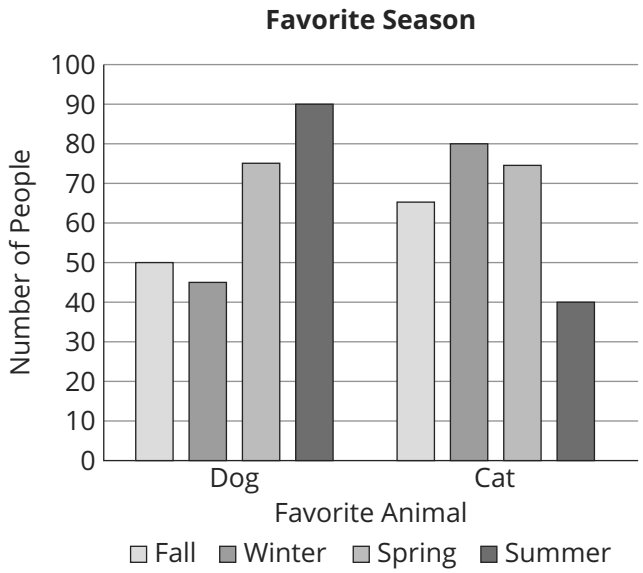
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Stretch

1. Sketch a graph of a quadratic function that has a maximum value of (0, 2) and x-intercepts when $x = \pm 2$.
2. What is the quadratic function of your graph? Explain your reasoning.

Review

People who prefer cats or dogs were surveyed to find out what their favorite season is.



1. Construct a marginal relative frequency table from the bar graph provided and answer each question.
   a. Which season would a cat lover most likely prefer? Justify your response.
   b. Is there a season a dog and cat lover both prefer equally? If so, what season? Justify your response.
   c. What is the total percentage of people that like the fall?
2. If the basic function $f(x) = x^2$ is translated 3 units to the right and 4 units up, what is the transformed equation?
3. If the basic function $f(x) = 4^x$ is vertically stretched by a factor of 2 and translated 5 units down, what is the transformed equation?

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2

Endless Forms Most Beautiful

Key Characteristics of Quadratic Functions

Warm Up

Determine the slope and y-intercept of each linear function.

1. $h(x) = 3x$

2. $g(x) = \frac{1}{2}(x - 5)$

3. $k(x) = x - 2$

4. $m(x) = \frac{8x}{4} + 1$

Learning Goals

- Identify the factored form and general form of an equation for a quadratic function.
- Determine the equation for the axis of symmetry of a quadratic function, given the equation in general form or factored form.
- Determine the absolute minimum or absolute maximum point on the graph of a quadratic function and identify this point as the vertex.
- Describe intervals of increase and decrease in relation to the axis of symmetry on the graph of a quadratic function.
- Use key characteristics of the graph of a quadratic function to write an equation in factored form.

Key Terms

- second differences
- concave up
- concave down
- general form of a quadratic function
- factored form
- vertex of a parabola
- axis of symmetry

You have identified key characteristics of linear and exponential functions. What are the key characteristics of quadratic functions?

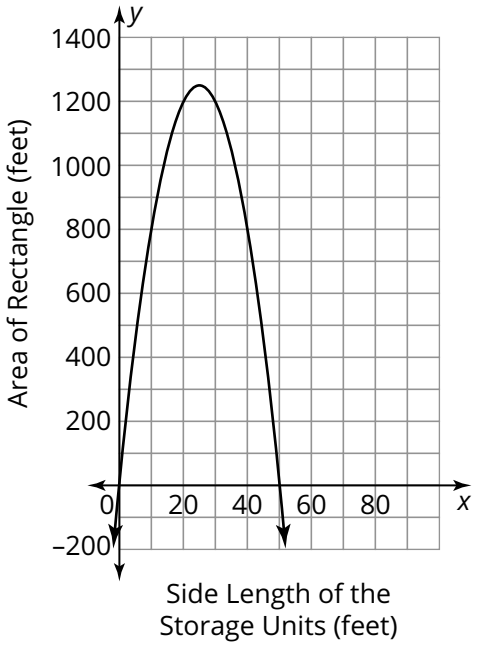
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Dogs, Handshakes, Pumpkins, Ghosts

Consider the four quadratic models you investigated in the previous lesson. There are multiple equivalent ways to write the equation to represent each situation and a unique parabola to represent the equivalent equations. You can also represent the function using a table of values.

Area of Dog Enclosure

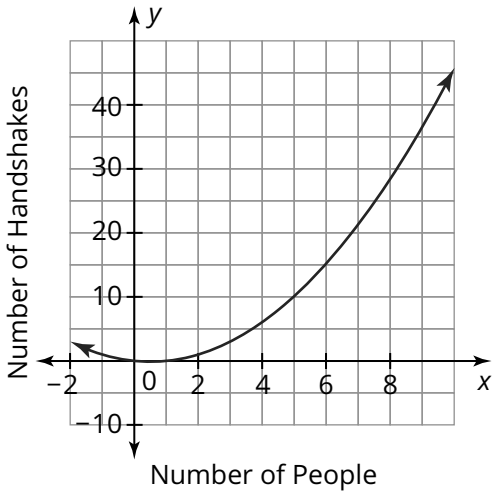
$A(s) = -2s^2 + 100s$
$= -2(s)(s - 50)$



s	*A*(*s*)
0	0
1	98
2	192
3	282
4	368

Handshake Problem

$f(n) = \frac{1}{2}n^2 - \frac{1}{2}n$
$= \frac{1}{2}(n)(n - 1)$



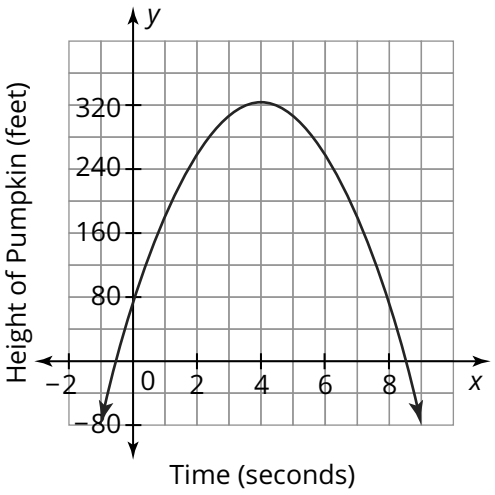
n	*f*(*n*)
0	0
1	0
2	1
3	3
4	6

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Punkin' Chunkin'

$h(t) = -16t^2 + 128t + 68$

$= -16(t - \frac{17}{2})(t + \frac{1}{2})$

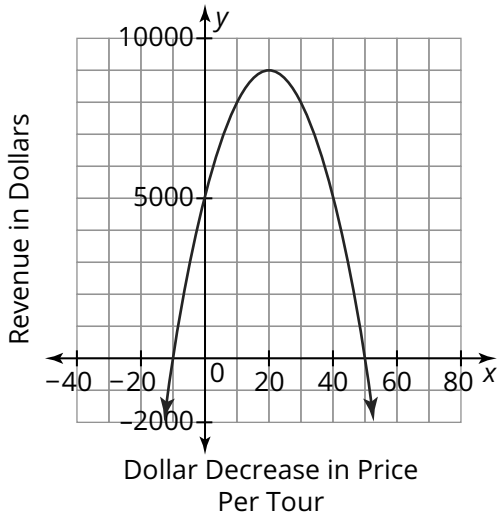


t	*h*(*t*)
0	68
1	180
2	260
3	308
4	324

Ghost Tour

$r(x) = -10(x + 10)(x - 50)$

$= -10x^2 + 400x + 5000$



x	*r*(*x*)
0	5000
1	5390
2	5760
3	6110
4	6440

1. Consider each representation.

a. How can you tell from the structure of the equation that it is quadratic?

b. What does the structure of the equation tell you about the shape and characteristics of the graph?

c. How can you tell from the shape of the graph that it is quadratic?

d. How can you tell from the table that the relationship is quadratic?

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ACTIVITY
2.1 Second Differences

Remember:

You can tell whether a table represents a linear function by analyzing first differences. First differences imply the calculation of $y_2 - y_1$.

Let's explore how a table of values can show that a function is quadratic. Consider the table of values represented by the basic quadratic function. This table represents the first differences between seven consecutive points.

x	$f(x)$	First Differences
−3	9	
−2	4	4 − 9 = −5
−1	1	1 − 4 = −3
0	0	0 − 1 = −1
1	1	1 − 0 = 1
2	4	4 − 1 = 3
3	9	9 − 4 = 5

1. What do the first differences tell you about the relationship of the table of values?

Let's consider the *second differences*. The **second differences** are the differences between consecutive values of the first differences.

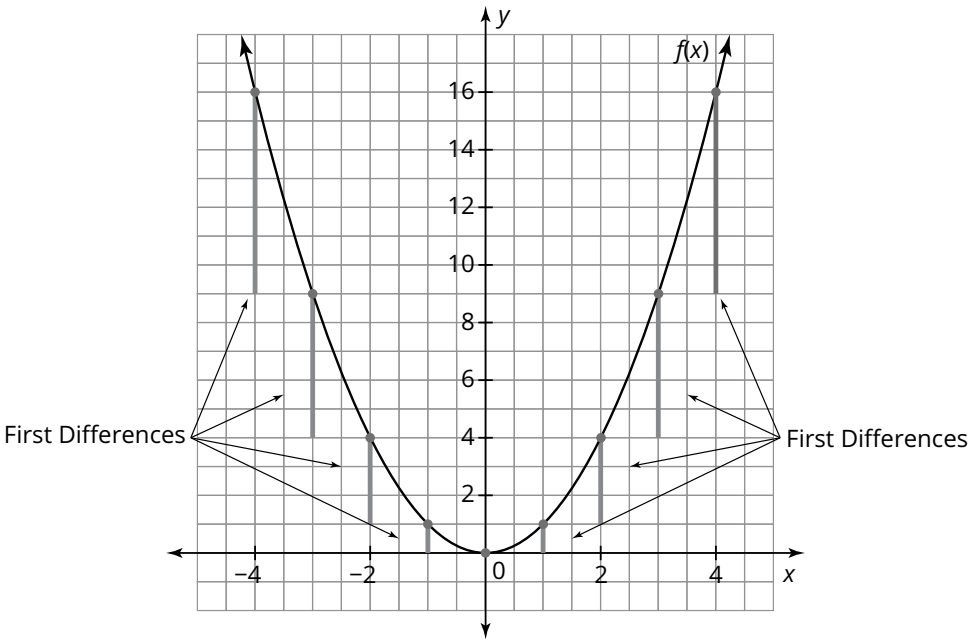
2. Calculate the second differences for $f(x)$. What do you notice?

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You know that with linear functions, the first differences are constant. For quadratic functions, the second differences are constant.

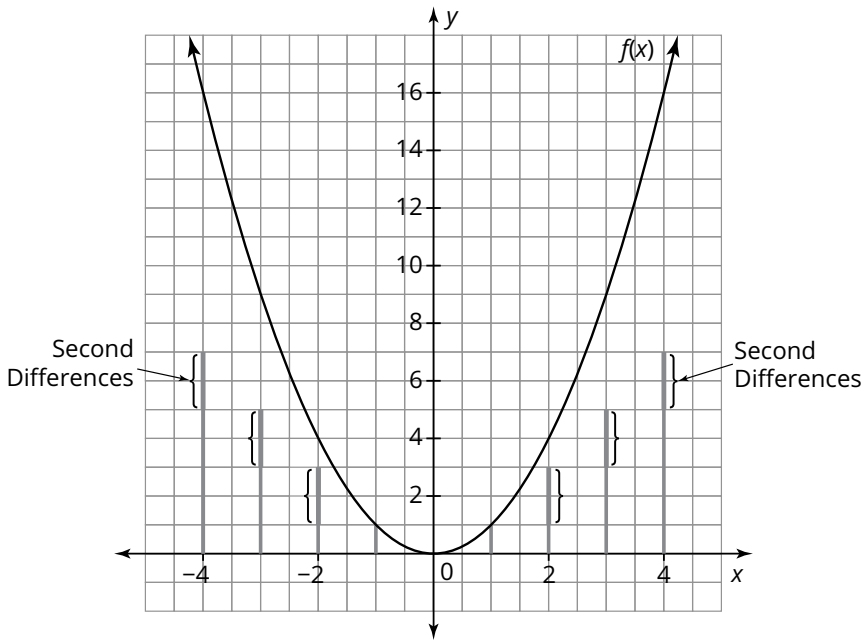
Let's consider the graph of the basic quadratic function, $f(x) = x^2$ and the distances represented by the first and second differences. Graph 1 shows the distances between consecutive values of $f(x)$. The colored line segments are different lengths because the first differences are not the same.

Graph 1



Graph 2 shows the lengths of the first differences positioned along the x-axis. By comparing these lengths, you can see the second differences.

Graph 2



Think about:

Quadratic equations are polynomials with a degree of 2. Their second differences are constant. Linear functions are polynomials with a degree of 1, and their first differences are constant.

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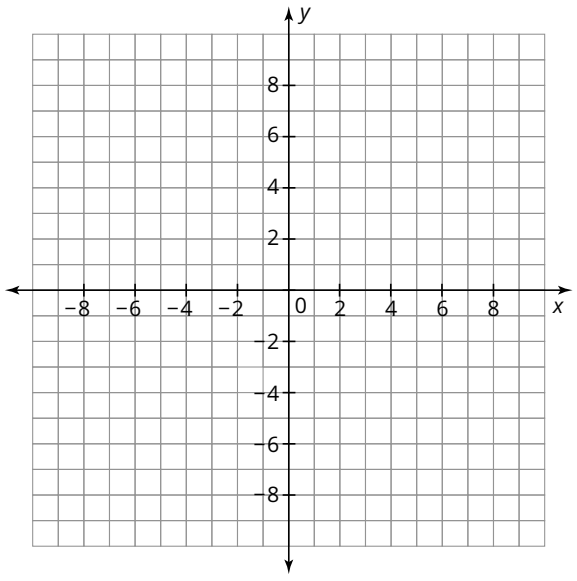
3. **How does the representation in Graph 1 support the first differences calculated from the table of values?**

4. **How does the representation in Graph 2 support the second differences you calculated in the table?**

5. **Identify each equation as linear or quadratic. Complete the table to calculate the first and second differences. Then sketch the graph.**

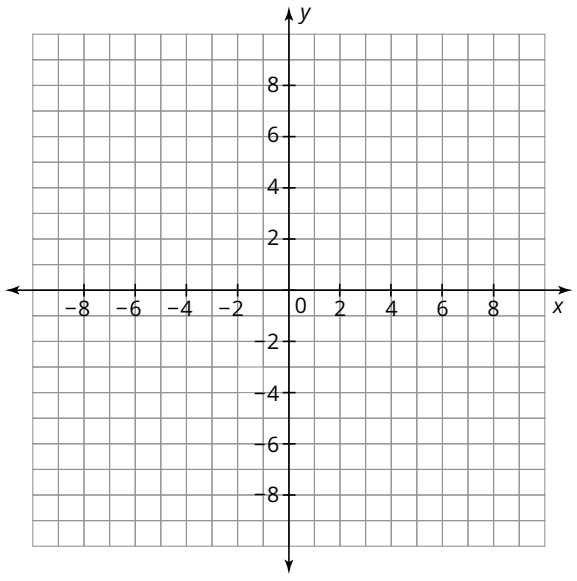
a. $y = 2x$ _____

x	y	First Differences	Second Differences
−3	−6		
−2	−4		
−1	−2		
0	0		
1	2		
2	4		
3	6		



b. $y = 2x^2$ _____

x	y	First Differences	Second Differences
−3	18		
−2	8		
−1	2		
0	0		
1	2		
2	8		
3	18		



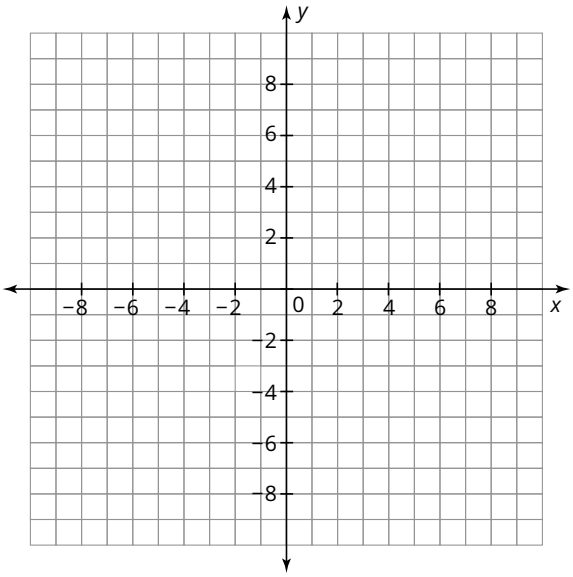
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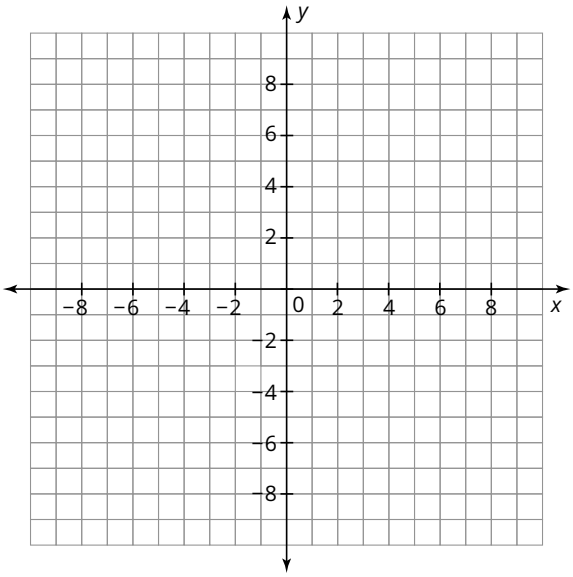
c. $y = -x + 4$ _____

x	y	First Differences	Second Differences
−3	7		
−2	6		
−1	5		
0	4		
1	3		
2	2		
3	1		

d. $y = -x^2 + 4$ _____

x	y	First Differences	Second Differences
−3	−5		
−2	0		
−1	3		
0	4		
1	3		
2	0		
3	−5		





6. Compare the signs of the first and second differences for each function and its graph.

a. How do the signs of the first differences for a linear function relate to the graph either increasing or decreasing?

b. How do the signs of the second differences for quadratic functions relate to whether the parabola is opening upward or downward?

A graph that opens upward is identified as being **concave up**.
A graph that opens downward is identified as begin **concave down**.

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ACTIVITY
2.2
Analyzing the Leading Coefficient



Remember:

The leading coefficient of an equation is the numeric coefficient of the term with the greatest power.

You know that different forms of an equation can reveal different characteristics about functions. Quadratic functions can be written in different forms.

A quadratic function written in the form $f(x) = ax^2 + bx + c$, where $a \neq 0$, is in **general form**, or standard form. In this form, a and b are numerical coefficients and c is a constant.

A quadratic function written in **factored form** is in the form $f(x) = a(x - r_1)(x - r_2)$, where $a \neq 0$.

1. **Identify the general form and factored form of each equation in the Getting Started.**

2. **Consider the leading coefficient of each function equation in both general form and factored form.**

   a. **What does the leading coefficient tell you about the graph of each function?**

   b. **How is the leading coefficient related to the absolute minimum or absolute maximum of each function?**

   c. **How can you determine the *y*-intercept of the graph using general form?**

The graph of a quadratic function has either an absolute maximum or absolute minimum.

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NOTES

3. **Determine from the equation whether each quadratic function has an absolute maximum or absolute minimum. Explain how you know.**

   a. $f(n) = 2n^2 + 3n - 1$

   b. $g(x) = -2x^2 - 3x + 1$

   c. $r(x) = -\frac{1}{2}x^2 - 3x + 1$

   d. $b(x) = -0.009(x + 50)(x - 250)$

   e. $f(t) = \frac{1}{3}(x - 1)(x - 1)$

   f. $j(x) = 2x(1 - x)$

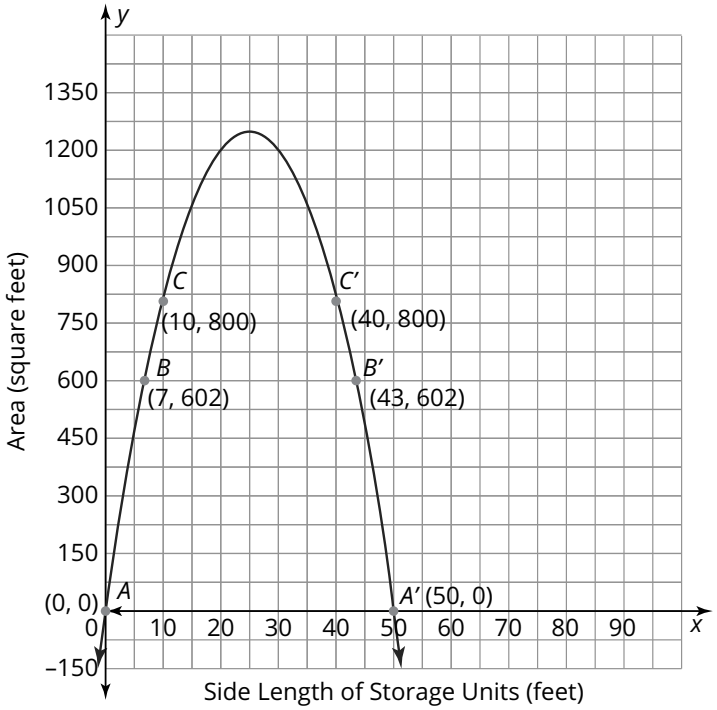
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ACTIVITY
2.3
Axis of Symmetry

The vertex is identified as either the absolute minimum or absolute maximum.

The **vertex of a parabola** is the lowest or highest point on the graph of the quadratic function. The **axis of symmetry** or the line of symmetry of a parabola is the vertical line that passes through the vertex and divides the parabola into two mirror images. Because the axis of symmetry always divides the parabola into two mirror images, you can say that a parabola has reflectional symmetry.

Area of Dog Enclosure



1. **Use patty paper to trace the graph representing the area of the dog enclosure. Then fold the graph to show the symmetry of the parabola and trace the axis of symmetry.**

   a. **Place the patty paper over the original graph. What is the equation of the axis of symmetry?**

   b. **Draw and label the axis of symmetry on the graph from your patty paper.**

2. **Analyze the symmetric points labeled on the graph.**

   a. **What do you notice about the *y*-coordinates of the points?**

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b. What do you notice about each point's horizontal distance from the axis of symmetry?

c. How does the *x*-coordinate of each symmetric point compare to the *x*-coordinate of the vertex?

For a function in factored form, $f(x) = a(x - r_1)(x - r_2)$, the equation for the axis of symmetry is given by $x = \frac{r_1 + r_2}{2}$. For a quadratic function in general form, $f(x) = ax^2 + bx + c$, the equation for the axis of symmetry is $x = \frac{-b}{2a}$.

3. Identify the axis of symmetry of the graph of each situation from the Getting Started using the factored form of each equation.

4. Describe the meaning of the axis of symmetry in each situation, if possible.

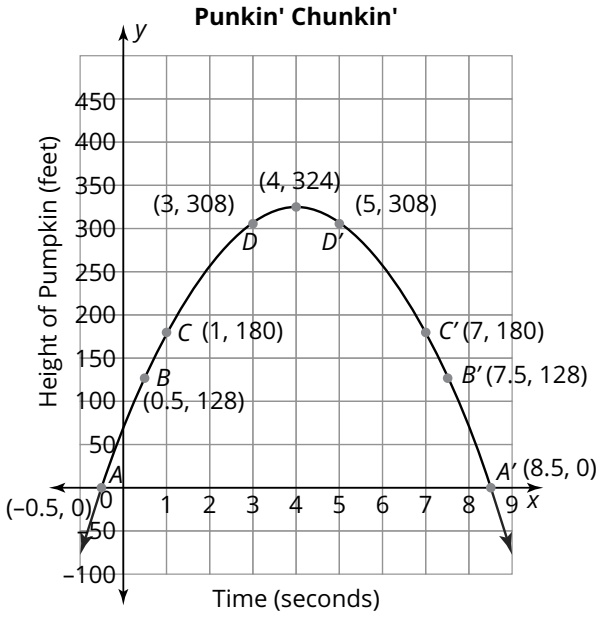
5. Describe how you can use the axis of symmetry to determine the ordered pair location of the absolute maximum or absolute minimum of a quadratic function, given the equation for the function in factored form.

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As you analyze a parabola from left to right, it will have either an interval of increase followed by an interval of decrease, or an interval of decrease followed by an interval of increase.

6. How does the absolute maximum or absolute minimum help you determine each interval?

Consider the graph of the quadratic function representing the Punkin' Chunkin' problem situation.



7. Determine the average rate of change between each pair. Then summarize what you notice.

a. points *A* and *B*

b. points *A*′ and *B*′

c. points *B* and *C*

d. points *B*′ and *C*′

The formula for the average rate of change is $\frac{f(b) - f(a)}{b - a}$.

e. What do you notice about the average rates of change between pairs of symmetric points?

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8. For each function shown, identify the domain, range, *x*-intercepts, *y*-intercept, axis of symmetry, vertex, and interval of increase and decrease.

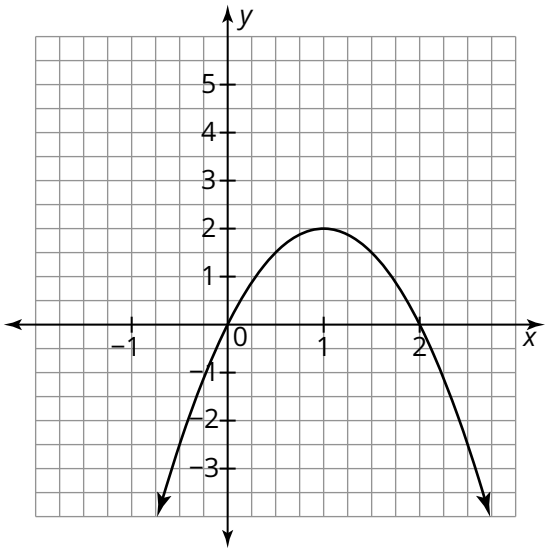
a. The graph shown represents the function $f(x) = -2x^2 + 4x$.

Domain: **Range:**

***x*-intercepts:** ***y*-intercept:**

Axis of symmetry: **Vertex:**

Interval of increase: **Interval of decrease:**



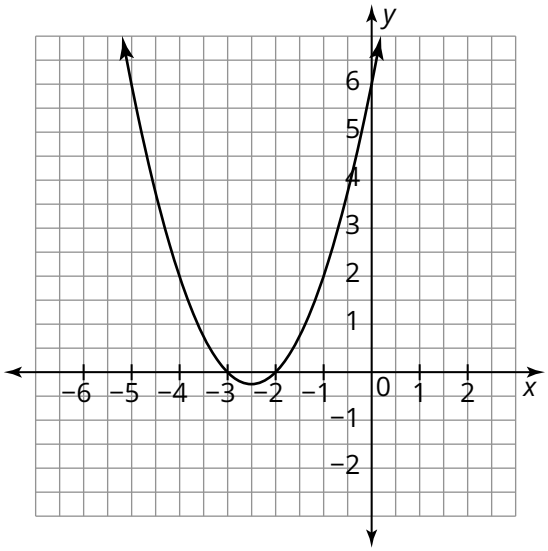
b. The graph shown represents the function $f(x) = x^2 + 5x + 6$.

Domain: **Range:**

***x*-intercepts:** ***y*-intercept:**

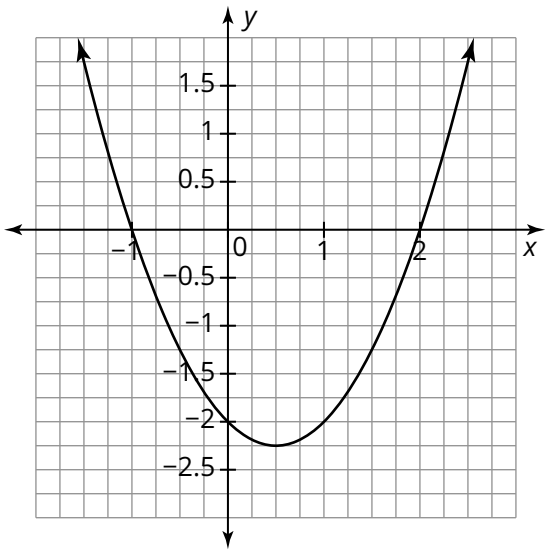
Axis of symmetry: **Vertex:**

Interval of increase: **Interval of decrease:**



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c. The graph shown represents the function $f(x) = x^2 - x - 2$.



Domain:

Range:

***x*-intercepts:**

***y*-intercept:**

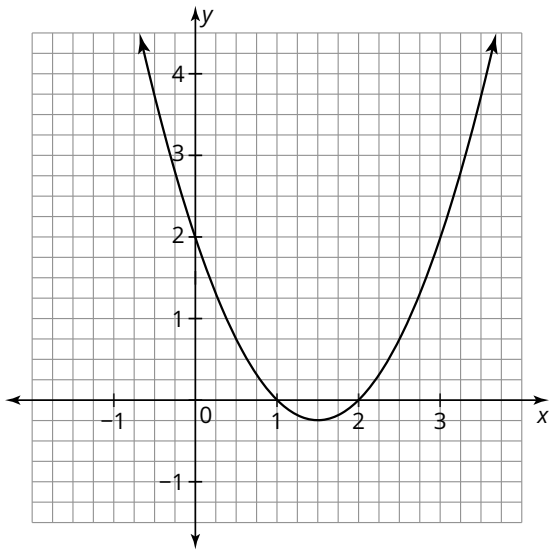
Axis of symmetry:

Vertex:

Interval of increase:

Interval of decrease:

d. The graph shown represents the function $f(x) = x^2 - 3x + 2$.



Domain:

Range:

***x*-intercepts:**

***y*-intercept:**

Axis of symmetry:

Vertex:

Interval of increase:

Interval of decrease:

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ACTIVITY
2.4 Exploring Factored Form

You have analyzed quadratic functions and their equations. Let's look at the factored form of a quadratic function in more detail.

If given a function $g(x)$ with a zero at $x = 4$, then $g(4) = 0$. This can also be interpreted as an x-intercept at (4, 0).

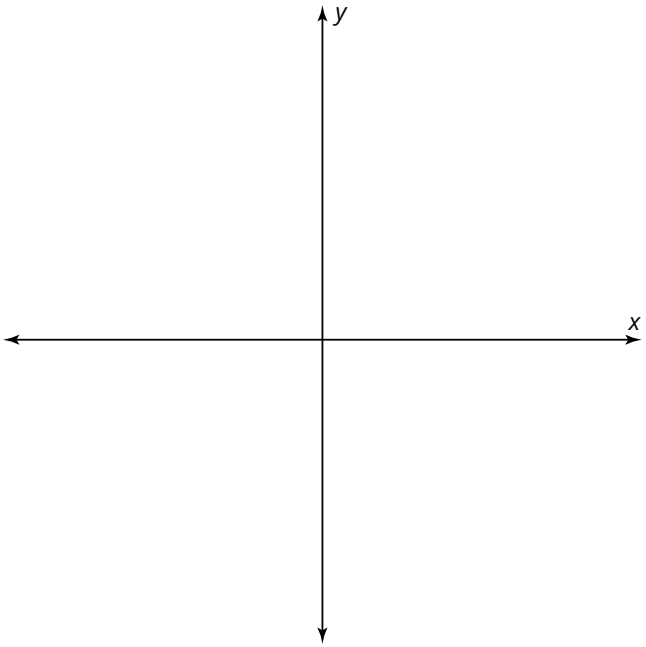
1. **A group of students each write a quadratic function in factored form to represent a parabola that opens downward and has zeros at $x = 4$ and $x = -1$.**

Maureen
My function is
$k(x) = -(x - 4)(x + 1)$.

Tom
My function is
$g(x) = -2(x - 4)(x + 1)$.

Tim
My function is
$m(x) = 2(x - 4)(x + 1)$.

MiCHeAL
MY FUNCTioN iS
$F(X) = -(X + 4)(X - 1)$.



a. **Sketch a graph of each student's function and label key points. What are the similarities among all the graphs? What are the differences among the graphs?**

b. **What would you tell Tim and Micheal to correct their functions?**

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c. **How is it possible to have more than one correct function?**

d. **How many possible functions can represent the given characteristics? Explain your reasoning.**

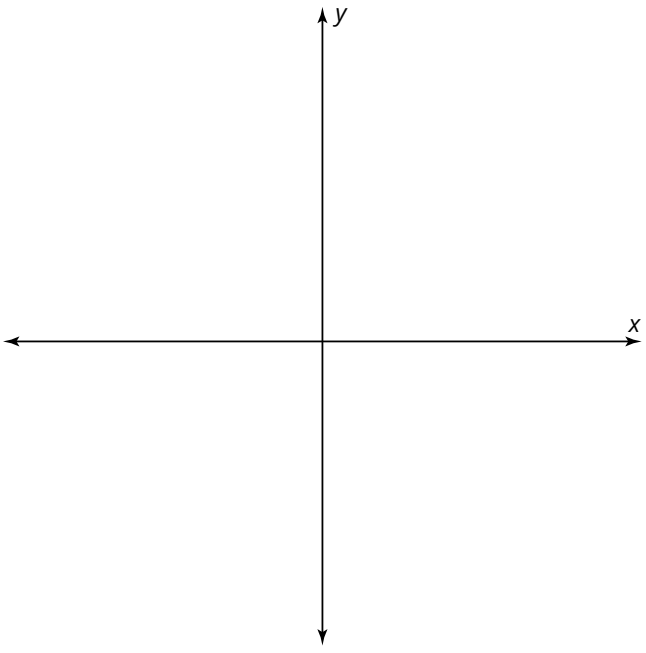
2. **Consider a quadratic function written in factored form, $f(x) = a(x - r_1)(x - r_2)$.**

   a. **What does the sign of the a-value tell you about the graph?**

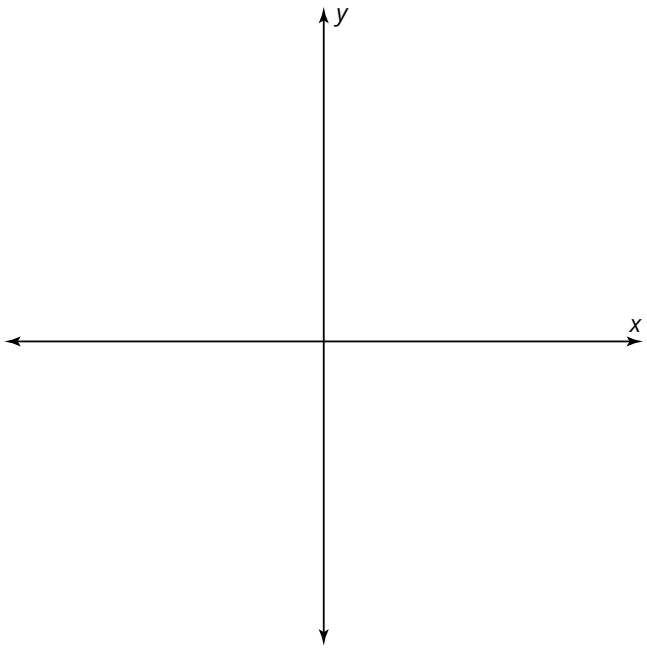
   b. **What do r_1 and r_2 tell you about the graph?**

3. **Use the given information to write a function in factored form. Sketch a graph of each function and label key points, which include the vertex, the x- and y-intercepts.**

a. **The parabola opens upward, and the zeros are at $x = 2$ and $x = 4$.**

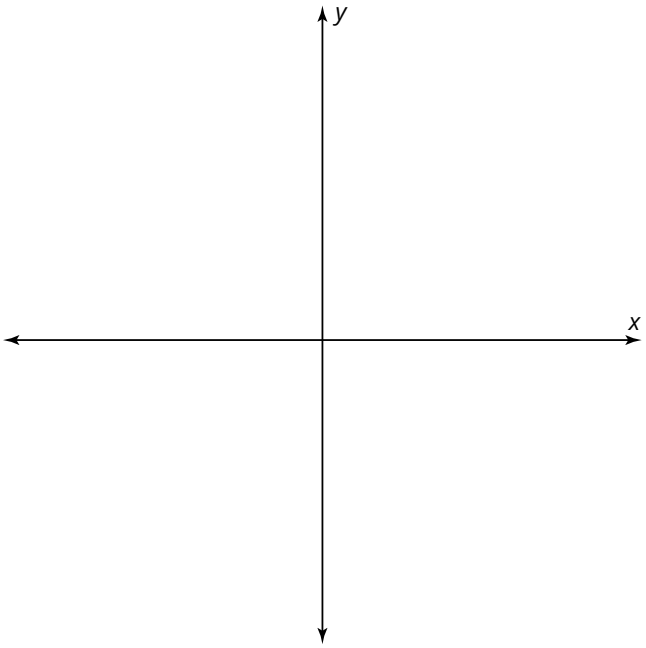


b. **The parabola opens downward, and the zeros at $x = -3$ and $x = 1$.**

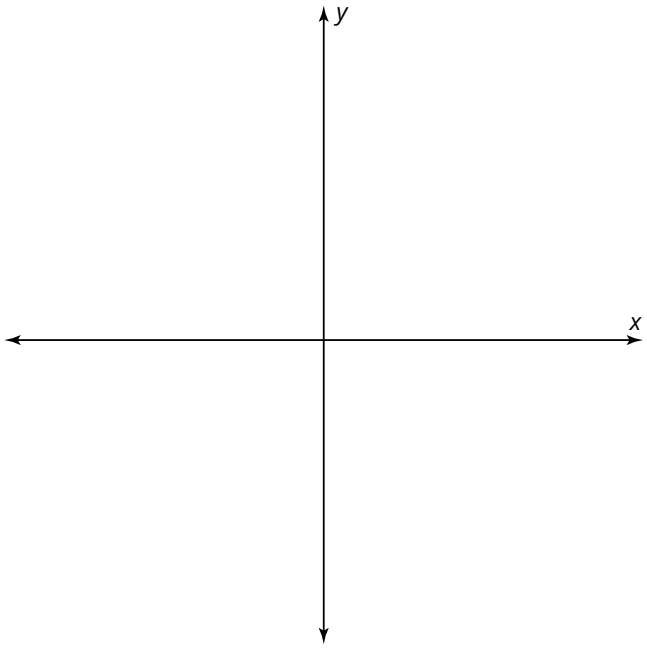


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c. The parabola opens downward, and the zeros are at $x = 0$ and $x = 5$.



d. The parabola opens upward, and the zeros are at $x = -2.5$ and $x = 4.3$.



4. Compare your quadratic functions with your classmates' functions. How does the *a*-value affect the shape of the graph?

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Remember:

A function written in general form $f(x) = ax^2 + bx + c$ has an axis of symmetry at $x = \frac{-b}{2a}$.

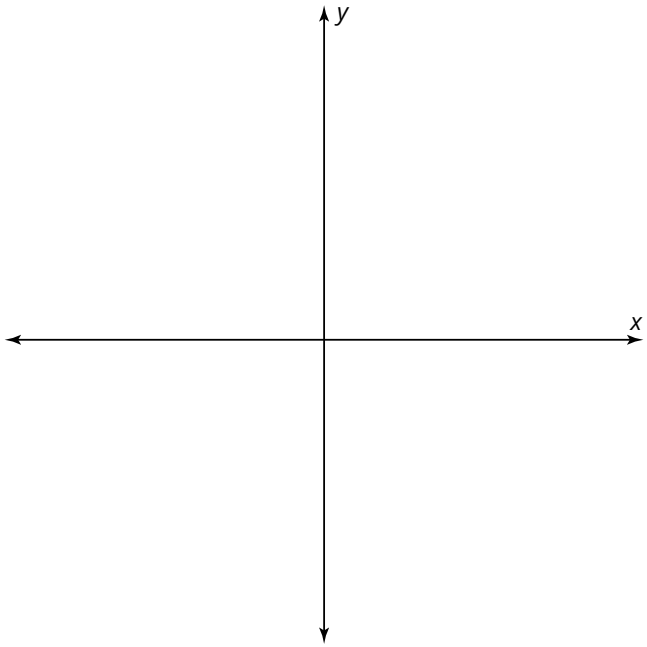
5. For each quadratic function,

- **Use the general form to determine the axis of symmetry, the absolute maximum or absolute minimum, and the *y*-intercept. Graph and label each characteristic.**
- **Use technology to identify the zeros. Label the zeros on the graph.**
- **Draw the parabola. Use the curve to write the function in factored form.**
- **Verify the function you wrote in factored form is equivalent to the given function in general form.**

a. $h(x) = x^2 - 8x + 12$

zeros: _____

factored form: _____

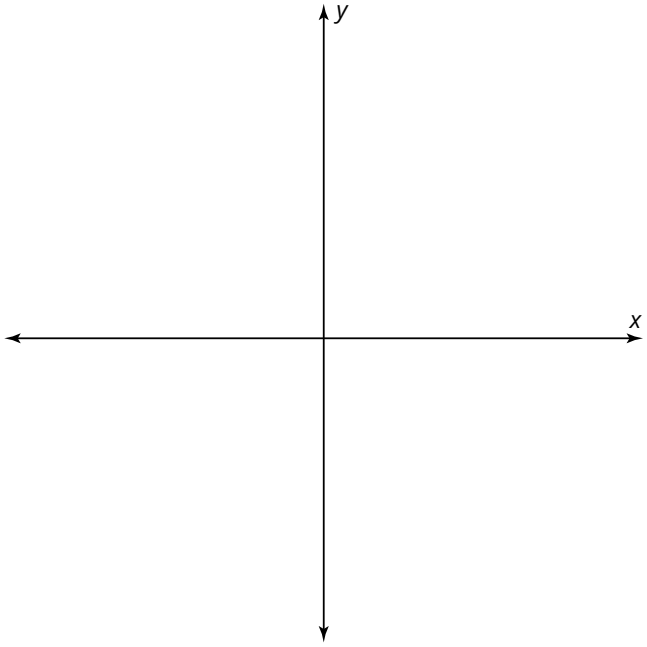


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b. $r(x) = -2x^2 + 6x + 20$

zeros: _____

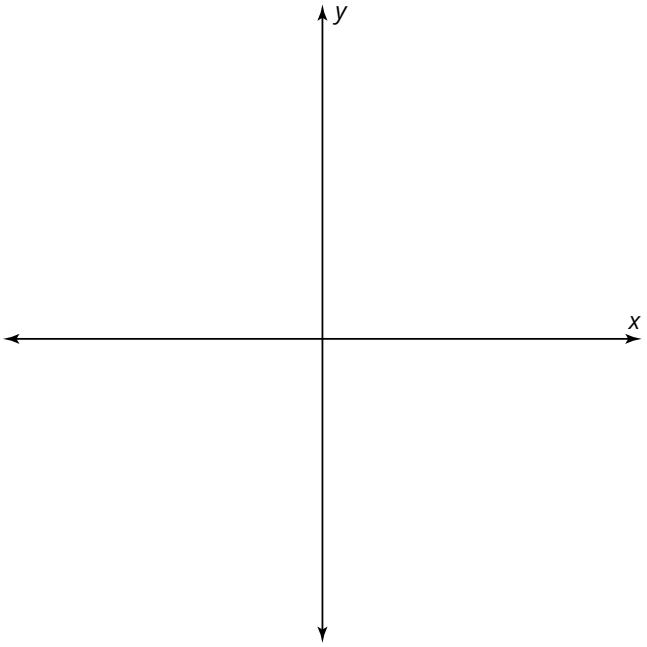
factored form: _____



c. $w(x) = -x^2 - 4x$

zeros: _____

factored form: _____



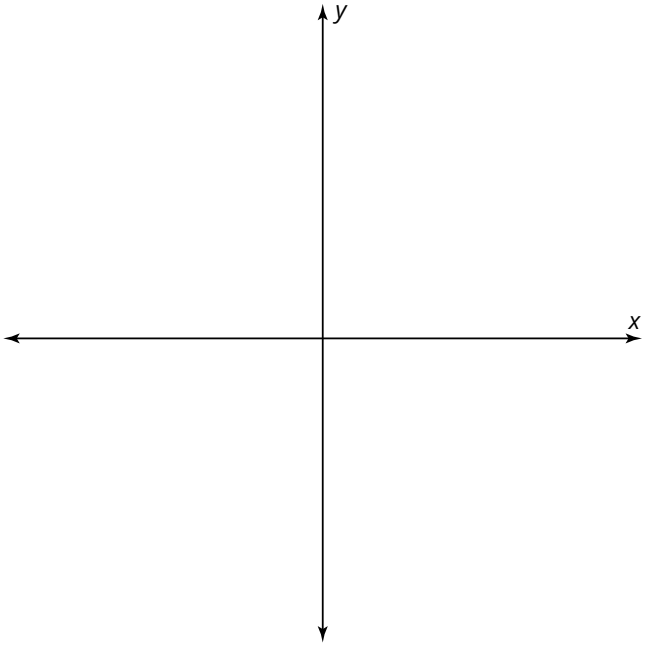
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NOTES

d. $c(x) = 3x^2 - 3$

zeros: _____

factored form: _____



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NOTES

TALK the TALK

Quadratic Sleuthing

Use the given information to answer each question. Do not use technology. Show your work.

1. **Determine the axis of symmetry of each parabola.**

   a. **The *x*-intercepts of the parabola are (1, 0) and (5, 0).**

   b. **The *x*-intercepts of the parabola are (−3.5, 0) and (4.1, 0).**

   c. **Two symmetric points on the parabola are (−7, 2) and (0, 2).**

2. **Describe how to determine the axis of symmetry given the *x*-intercepts of a parabola.**

3. **Determine the location of the vertex of each parabola.**

   a. **The function $f(x) = x^2 + 4x + 3$ has the axis of symmetry $x = -2$.**

   b. **The equation of the parabola is $y = x^2 - 4$, and the *x*-intercepts are (−2, 0) and (2, 0).**

Think about:

Sketch a graph by hand if you need a model.

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NOTES

c. The function $f(x) = x^2 + 6x - 5$ has two symmetric points $(-1, -10)$ and $(-5, -10)$.

4. Describe how to determine the vertex of a parabola given the equation and the axis of symmetry.

5. Determine another point on each parabola.

   a. The axis of symmetry is $x = 2$, and a point on the parabola is $(0, 5)$.

   b. The vertex is $(0.5, 9)$, and an x-intercept is $(-2.5, 0)$.

   c. The vertex is $(-2, -8)$, and a point on the parabola is $(-1, -7)$.

6. Describe how to determine another point on a parabola if you are given one point and the axis of symmetry.

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Assignment

Write

1. Describe the characteristics of a quadratic function that you can determine from its equation in general form.

2. Describe the characteristics of a quadratic function that you can determine from its equation in factored form.

Remember

The sign of the leading coefficient of a quadratic function in standard form or factored form describes whether the function has an absolute maximum or absolute minimum.

A parabola is a smooth curve with reflectional symmetry. The axis of symmetry contains the vertex of the graph of the function, which is located at the absolute minimum or absolute maximum of the function.

Practice

1. Analyze each quadratic function.

$$g(x) = 12x - 4x^2 + 16 \qquad h(x) = -\frac{1}{4}(x - 3)(x + 2)$$

   a. Identify the quadratic function as general form or factored form.
   b. Does the quadratic function have an absolute maximum or absolute minimum?
   c. Does the graph open upward or downward?
   d. Determine any intercepts from the given form of the function.

2. Analyze each quadratic function.

$$f(x) = -\frac{2}{3}x^2 - 3x + 15 \qquad g(x) = \frac{3}{4}x^2 + 12x - 27$$

   a. Identify the axis of symmetry.
   b. Use the axis of symmetry to determine the ordered pair of the absolute maximum or absolute minimum value.
   c. Describe the intervals of increase and decrease.
   d. Sketch the graph based on the information you just calculated.
   e. Use technology to identify the zeros.
   f. Place two pairs of symmetric points on your graph. What is the average rate of change between these pairs of symmetric points?
   g. Write the function in factored form.

3. Given a parabola that opens downward and has zeros at $x = -2$ and $x = 3$.
   a. Represent it as a quadratic equation in factored form.
   b. Sketch a graph of the quadratic function.
   c. What is the axis of symmetry and y-intercept of the quadratic function?

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Stretch

1. Sketch the graph $f(x) = -3x^2 - 4$. How could you change the quadratic function to make the graph open upward? Show the change on the graph.
2. How could you change the quadratic function $f(x) = -3x^2 - 4$ to shift the graph up or down? Show on the graph.
3. How could you change the quadratic function $f(x) = -3x^2 - 4$ to shift the graph right or left? Show the change on the graph.

Review

1. A camp wants to create a larger space for their albino rabbit, Clover. They want to reuse the materials from Clover's current enclosure in the construction of the new enclosure. The perimeter of Clover's current space is 6 feet. The perimeter of his new enclosure will be 3 times larger than his former enclosure.
   a. What is the area of the new enclosure $A(w)$ in terms of width, w?
   b. What is the maximum area of the new enclosure? What are the dimensions?
2. Is $7x^{2t} \cdot 5x^{2t}$ equivalent to $35x^{2t}$? Justify your answer.
3. Is $(16^{3z})^{6y}$ equivalent to 16^{18yz}? Justify your answer.
4. Use the marginal frequency distribution to answer each question.

Favorite Fruit				
	Apples	**Oranges**	**Grapes**	**Total**
Men	10	4	7	21
Women	11	9	8	28
Total	21	13	15	49

   a. Which fruit do men and women prefer overall? Justify your response.
   b. Is the fruit that the men and women like the least also the fruit that just women like the least? Justify your response.

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3

More Than Meets the Eye

Transformations of Quadratic Functions

Warm Up

Write the equation for the axis of symmetry given each quadratic function.

1. $f(x) = -3x^2 - 4x + 5$

2. $f(x) = \frac{1}{4}(x - 1)(x + 2)$

3. $f(x) = -x^2 + 3$

Learning Goals

- Translate, reflect, and dilate quadratic functions horizontally and vertically.
- Write equations of quadratic functions given multiple transformations.
- Graph quadratic functions given multiple transformations.
- Identify multiple transformations of quadratic functions given equations.
- Understand the form in which a quadratic function is written can reveal different key characteristics.
- Write quadratic equations in vertex and factored form.

Key Term

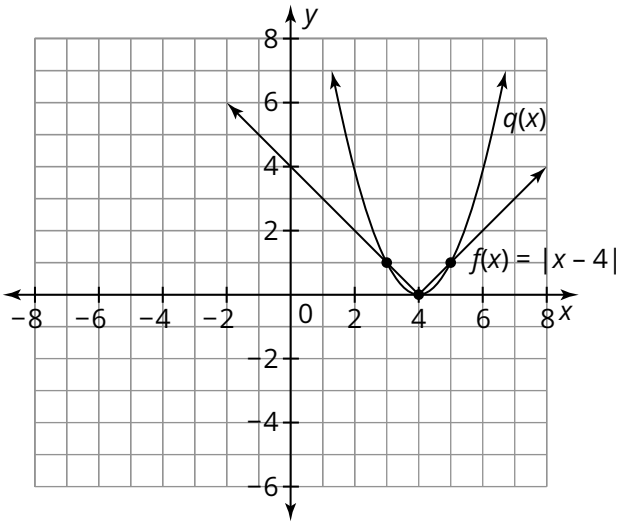
- vertex form

You know how to transform linear, absolute value, and exponential functions. How can you apply what you know about the transformation form of a function, $g(x) = A \cdot f(B(x - C)) + D$, to quadratic functions?

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Quadratics and Absolutes

The coordinate plane shows the graph of the absolute value function $f(x) = |x - 4|$ and a quadratic function, $q(x)$.



1. **How was the basic absolute value function $f(x) = |x|$ transformed to produce the graph shown?**

2. **Write an equation which can represent the quadratic function, $q(x)$. Test your equation with the graph to see if it is correct.**

3. **How does knowing that $1^2 = |1|$ and $(-1)^2 = |-1|$ explain the intersection points of the graph of the absolute value function and the graph of the quadratic function?**

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ACTIVITY
3.1

Translations and Reflections of Quadratic Functions

Given $g(x) = f(x - C) + D$, consider how to transform the basic function, $f(x) = x^2$, to graph the transformed function.

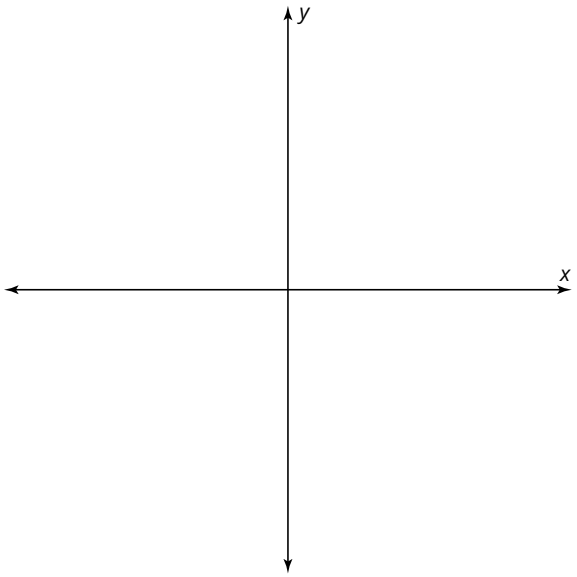
1. Consider the four quadratic functions shown, where $f(x) = x^2$ is the basic function.

- $c(x) = x^2 + 3$
- $d(x) = x^2 - 3$
- $j(x) = (x + 3)^2$
- $k(x) = (x - 3)^2$

a. Write the functions $c(x)$, $d(x)$, $j(x)$, and $k(x)$ in terms of the basic function. For each, determine whether an operation is performed on the function or on the argument of the function. Describe the operation.

b. Given the form $ax^2 + bx + c$, the functions $c(x)$ and $d(x)$ each have a b-value equal to 0. What does this tell you about the axis of symmetry of each graph? Explain your answer.

c. Sketch a graph of each function. Label each graph and include key points.



d. Use coordinate notation to represent the vertical or horizontal translation of each function, c, d, j, and k. Each point (x, y) on the graph of $f(x)$:

- **becomes the point _____ on the graph of $c(x)$.**
- **becomes the point _____ on the graph of $d(x)$.**
- **becomes the point _____ on the graph of $j(x)$.**
- **becomes the point _____ on the graph of $k(x)$.**

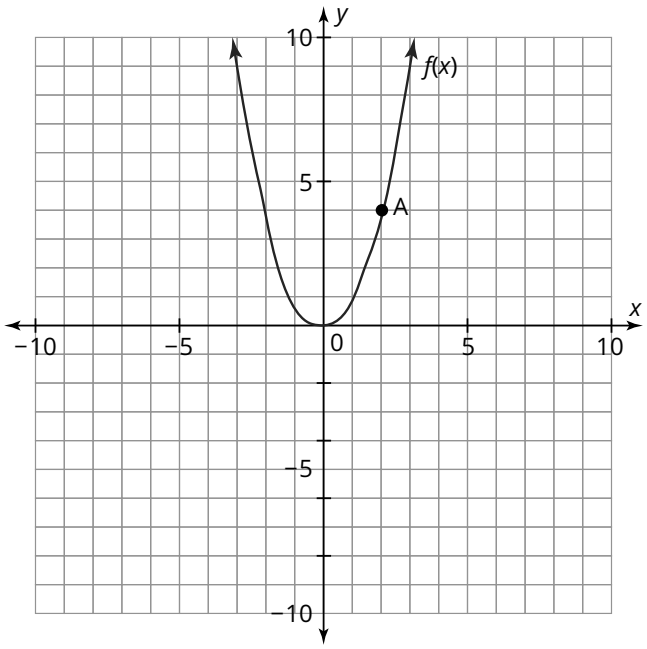
Ask yourself:

How do you think translating quadratics may be similar to translating other functions?

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You know that for any basic function, the *C*- and *D*-values describe translations of the function. The *C*-value defines an operation that is performed on the argument, and it describes a horizontal translation that affects the input values. The *D*-value defines an operation performed on the function, and it describes a vertical translation that affects the output values.

Now, let's consider reflections of graphs. You know that when a negative is on the outside of a function, the graph is reflected across a horizontal line of reflection. When a negative is on the inside of a function, the graph is reflected across a vertical line of reflection. Given $f(x) = x^2$, consider $g(x) = -f(x)$ and $h(x) = f(-x)$.



2. Consider the placement of the negative sign in each function, *g*(*x*) and *h*(*x*).

a. Sketch the graph and describe the line of reflection for *g*(*x*). Label *A'* on your graph.

b. Sketch the graph and describe the line of reflection for *h*(*x*). Label *A''* on your graph.

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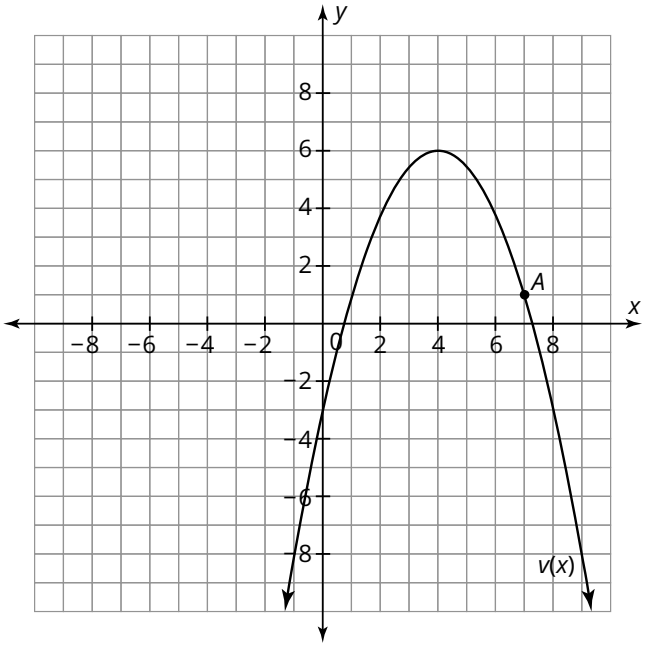
c. Use coordinate notation to represent the reflection of each function. Each point (x, y) on the graph of $f(x)$:

- **becomes the point _____ on the graph of $g(x)$.**
- **becomes the point _____ on the graph of $h(x)$.**

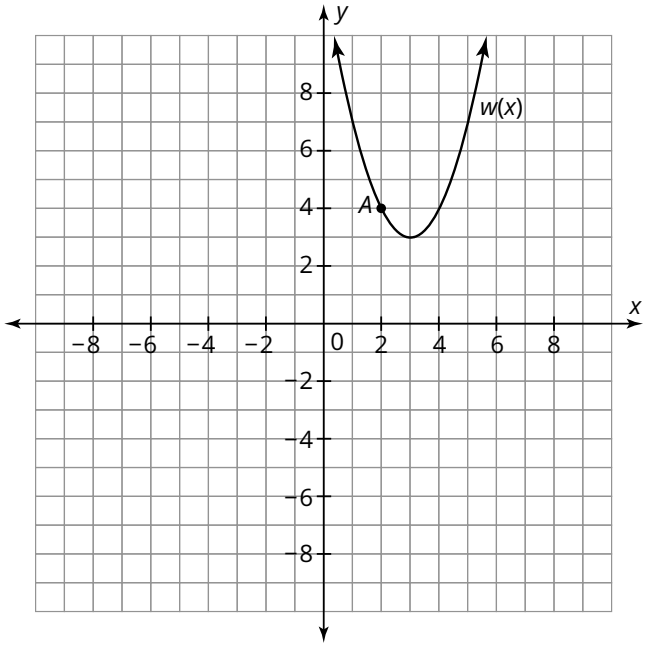
d. Given the basic quadratic function, $f(x) = x^2$, why does the graph of $f(-x)$ map onto itself?

3. Consider the graph of each given function. Sketch the result of the transformed function. Label A' on your graph. Then describe the transformation you performed.

a. Given the graph of $v(x)$, sketch $m(x) = v(-x)$.



b. Given the graph of $w(x)$, sketch $z(x) = -w(x)$.



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ACTIVITY
3.2
Vertical and Horizontal Dilations of Quadratic Functions

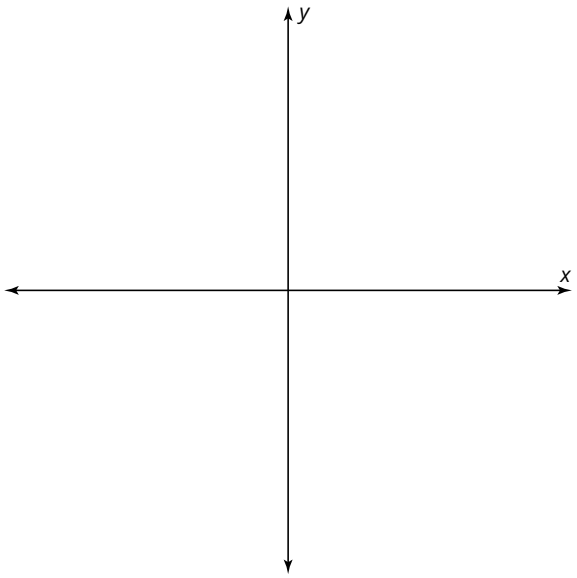
You can vertically and horizontally dilate quadratic functions just like other functions you have studied.

1. Consider the three quadratic functions shown, where $f(x) = x^2$ is the basic function.

- $f(x) = x^2$
- $n(x) = \frac{1}{2}x^2$
- $p(x) = 2x^2$

a. Write the functions $n(x)$ and $p(x)$ in terms of the basic function $f(x)$. For each, determine whether an operation is performed on the function $f(x)$ or on the argument of the function $f(x)$. Describe the operation.

b. Sketch the graph of each function. Label each graph and include key points.



c. Use coordinate notation to represent the dilation of each function. Each point (x, y) on the graph of $f(x)$:

- **becomes the point _____ on the graph of $n(x)$.**
- **becomes the point _____ on the graph of $p(x)$.**

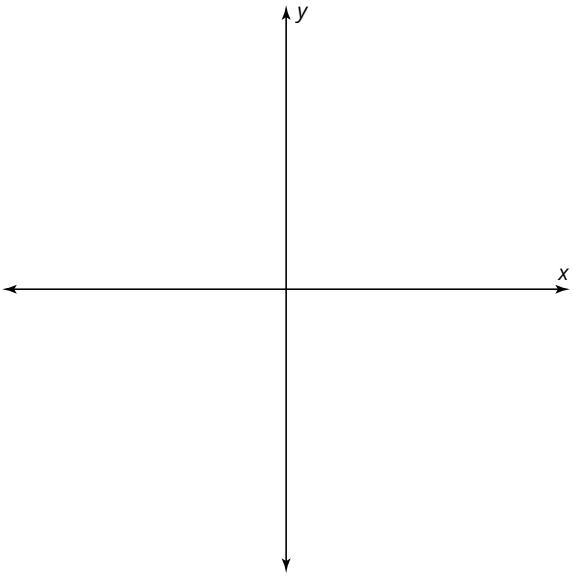
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2. Consider the three quadratic functions, where $f(x) = x^2$ is the basic function.

- $f(x) = x^2$
- $t(x) = (3x)^2$
- $q(x) = \left(\frac{1}{3}x\right)^2$

a. Write the functions $t(x)$ and $q(x)$ in terms of the basic function $f(x)$. For each, determine whether an operation is performed on the function $f(x)$ or on the argument of the function $f(x)$. Describe the operation.

b. Sketch the graph of each function. Label each graph and include key points.



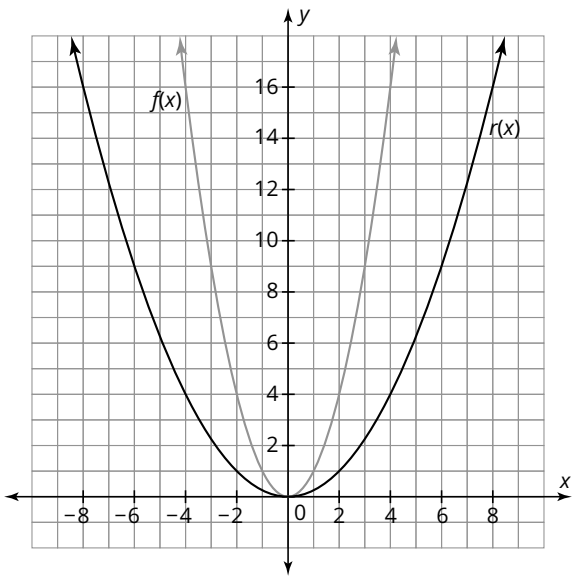
c. Use coordinate notation to represent the dilation of each function. Each point (x, y) on the graph of $f(x)$:

- **becomes the point _____ on the graph of $t(x)$.**
- **becomes the point _____ on the graph of $q(x)$.**

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Remember, a horizontal dilation is a type of transformation that stretches or compresses the entire graph. Horizontal stretching is the stretching of a graph away from the *y*-axis. Horizontal compression is the squeezing of a graph towards the *y*-axis.

3. Now, let's compare the graph of $f(x) = x^2$ with $r(x) = f\left(\frac{1}{2}x\right)$.



x	$f(x) = x^2$	$r(x) = p(\frac{1}{2}x)$
0	0	0
1	1	0.25
2	4	1
3	9	2.25
4	16	4
5	25	6.25
6	36	9

a. Analyze the table of values that correspond to the graph.

Circle instances where the *y*-values for each function are the same. Then, list all the points where $f(x)$ and $r(x)$ have the same *y*-value. The first instance has been circled for you.

b. How do the *x*-values compare when the *y*-values are the same?

c. Complete the statement.

The function $r(x)$ is a _____ of $f(x)$ by a factor of _____.

d. How does the factor of stretching or compression compare to the *B*-value in $r(x)$?

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Compared with the graph of $f(x)$, the graph of $f(Bx)$ is:

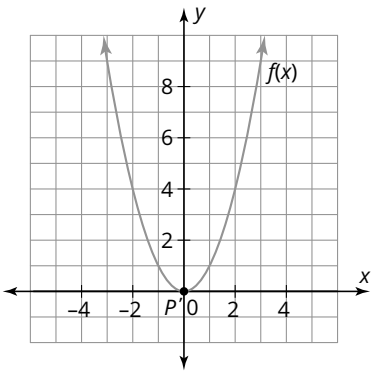
- horizontally compressed by a factor of $\frac{1}{|B|}$ if $|B| > 1$.
- horizontally stretched by a factor of $\frac{1}{|B|}$ if $0 < |B| < 1$.

Worked Example

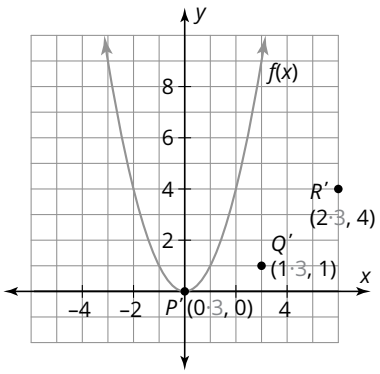
You can use reference points to graph the function $q(x) = f(\frac{1}{3}x)$ when $f(x) = x^2$.

From $q(x)$ you know that $C = 0$, $D = 0$, and $B = \frac{1}{3}$. The vertex for $q(x)$ is (0, 0).

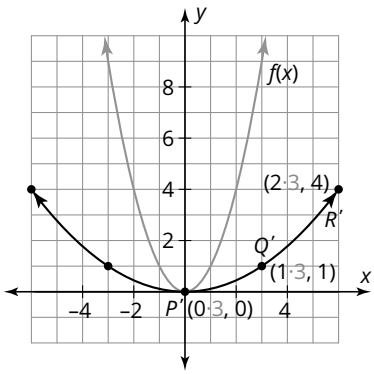
Notice $0 < |B| < 1$, so the graph will horizontally stretch by a factor of $\frac{1}{\frac{1}{3}}$ or 3.



The function $f(x)$ is shown. First plot the new vertex (C, D). This point establishes the new set of axes.



Next, think about B. To plot Q' move right $1 \cdot 3$ units and up 1 unit from the vertex because all x-coordinates are being stretched by a factor of 3. To plot R' start at the vertex and move to the right $2 \cdot 3$ units and go up 4 units.

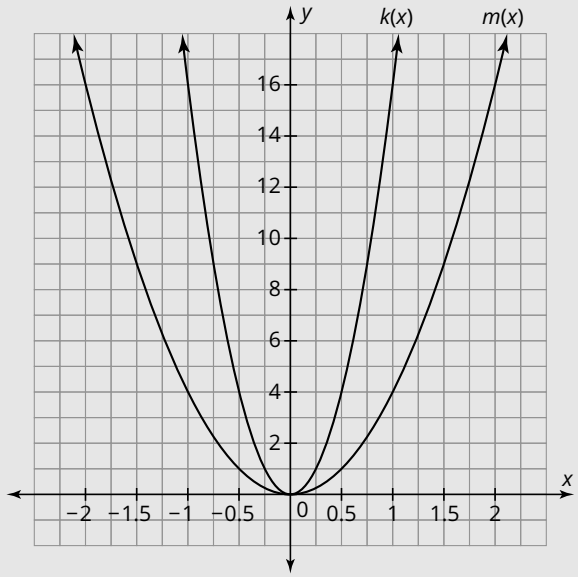


Finally, use symmetry to complete the graph.

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4. If you were asked to graph $p(x) = f(3x)$, describe how the graph would change. If (x, y) is any point on $f(x)$, describe any point on $p(x)$.

5. **Consider the graph showing the quadratic functions $k(x)$ and $m(x)$. Antoine and Xi Ling are writing the function $m(x)$ in terms of $k(x)$.**



Antoine says that $m(x)$ is a transformation of the A-value.

$$m(x) = \frac{1}{4}k(x)$$

Xi Ling says that $m(x)$ is a transformation of the B-value.

$$m(x) = k(\frac{1}{2}x)$$

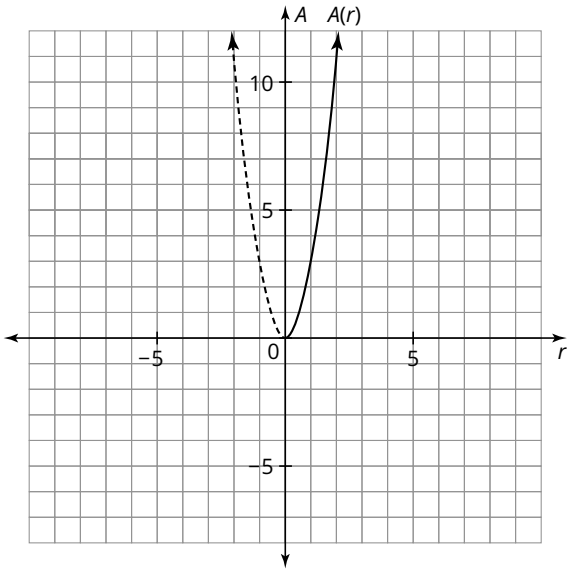
Who's correct? Justify your reasoning.

6. **Describe how you can rewrite a quadratic function with a B-value transformation as a quadratic function with an A-value transformation.**

7. **Rewrite the function from the worked example, $q(x) = f(\frac{1}{3}x)$, without a B-value.**

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Consider the formula to calculate the area of a circle, $A = \pi r^2$. You can represent the area formula as the function $A(r) = \pi r^2$ and represent it on a coordinate plane.



Ask yourself:

Why is part of the graph represented with a dashed smooth curve?

8. How is the area affected if you double the radius? Explain the change in area in terms of a transformation of the graph.

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ACTIVITY
3.3
Using Reference Points to Graph Quadratic Functions

Think about:

What is the pattern of the *A*-value when transforming the basic quadratic function?

Given $y = f(x)$ is the basic quadratic function, you can use reference points to graph $y = Af(B(x - C)) + D$. Any point (x, y) on $f(x)$ maps to the point $(\frac{1}{B}x + C, Ay + D)$.

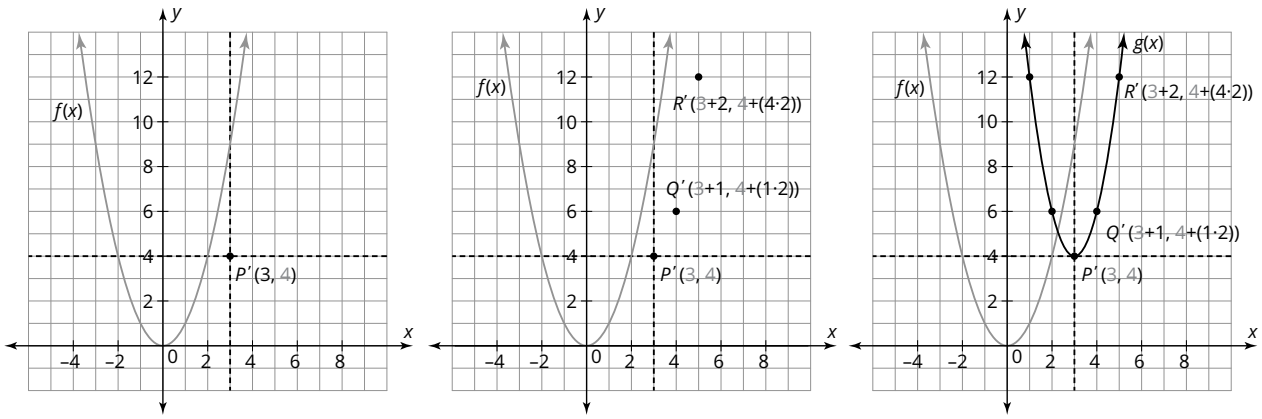
Worked Example

Given $f(x) = x^2$, graph the function $g(x) = 2f(x - 3) + 4$.

You can use reference points for $f(x)$ and your knowledge about transformations to graph the function $g(x)$.

From $g(x)$, you know that $A = 2$, $C = 3$, and $D = 4$.

The vertex for $g(x)$ will be at (3, 4). Notice $A > 0$, so the graph of the function will vertically stretch by a factor of 2.



First, plot the new vertex, (C, D). This point establishes the new set of axes.

Next, think about the reference points for the basic quadratic function and that $A = 2$. To plot point Q' move right 1 unit and up, not 1, but 1×2 units from the vertex P' because all y-coordinates are being multiplied by a factor of 2. To plot point R' move right 2 units from P' and up, not 4, but 4×2 units.

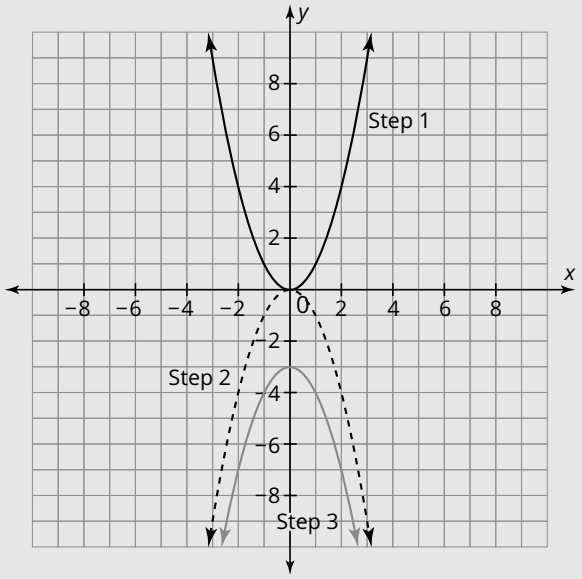
Finally, use symmetry to complete the graph.

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1. **Christian, Julia, and Emily each sketched a graph of the equation $y = -x^2 - 3$ using different strategies. Provide the step-by-step reasoning used by each student.**

Christian

A = −1 and D = −3



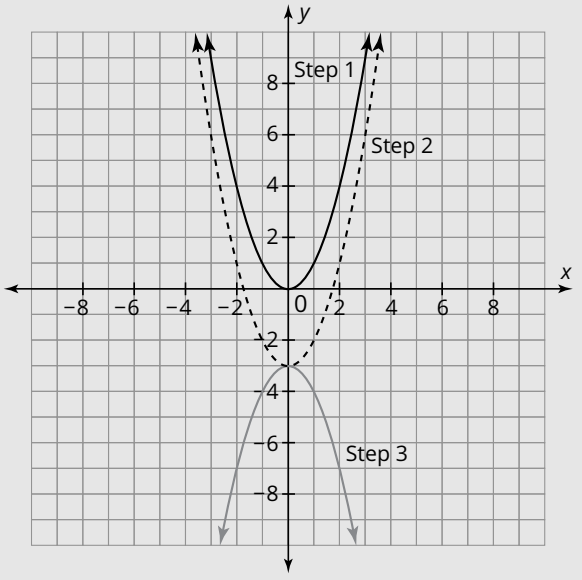
Step 1:

Step 2:

Step 3:

Julia

D = −3 and A = −1



Step 1:

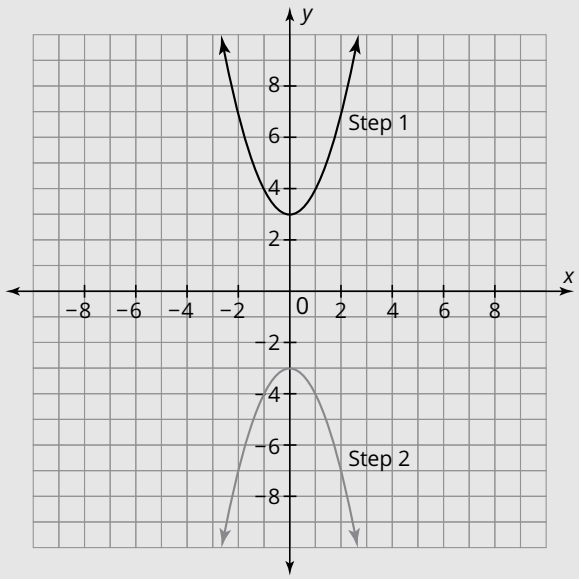
Step 2:

Step 3:

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Emily

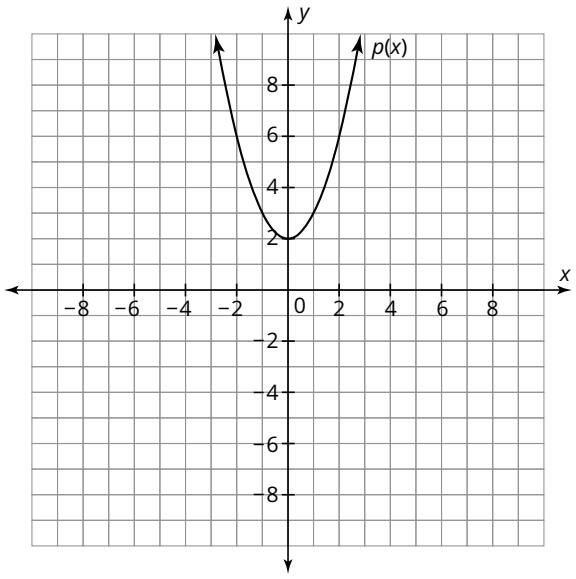
I rewrote the equation as $y = -(x^2 + 3)$.



Step 1:

Step 2:

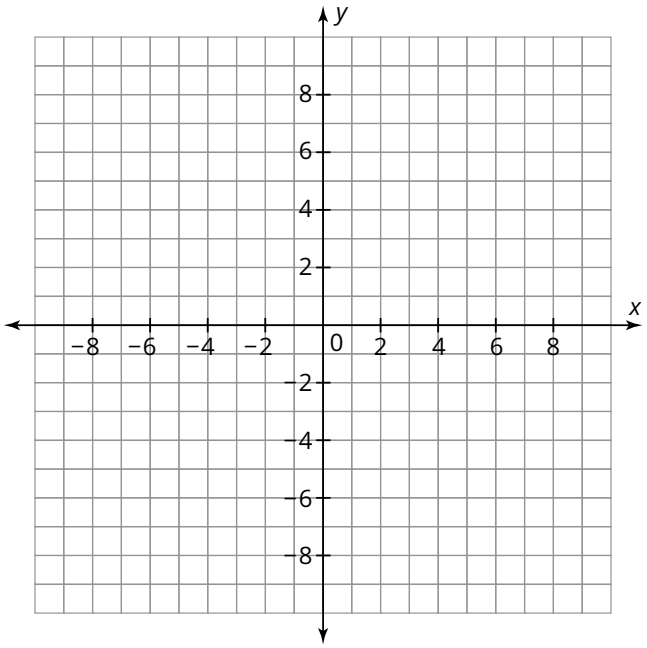
2. Given $y = p(x)$, sketch $m(x) = -p(x + 3)$. Describe the transformations you performed.



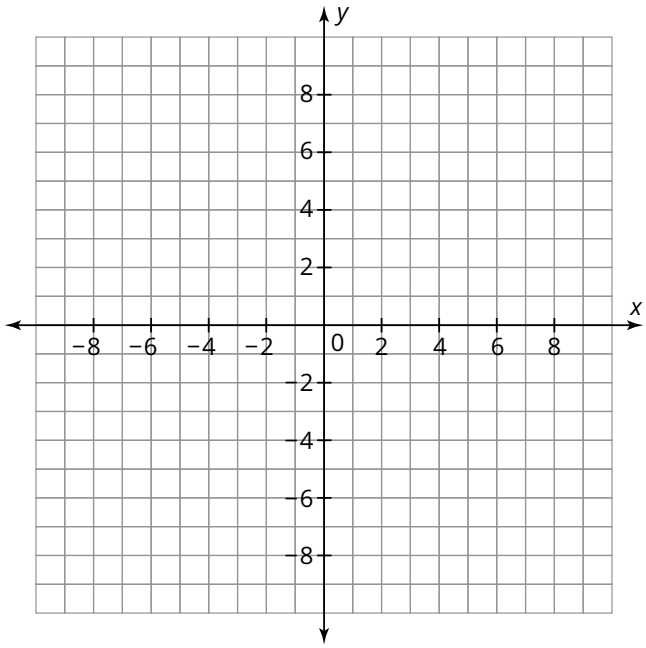
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3. Given $f(x) = x^2$, graph each function. Then write each corresponding quadratic equation.

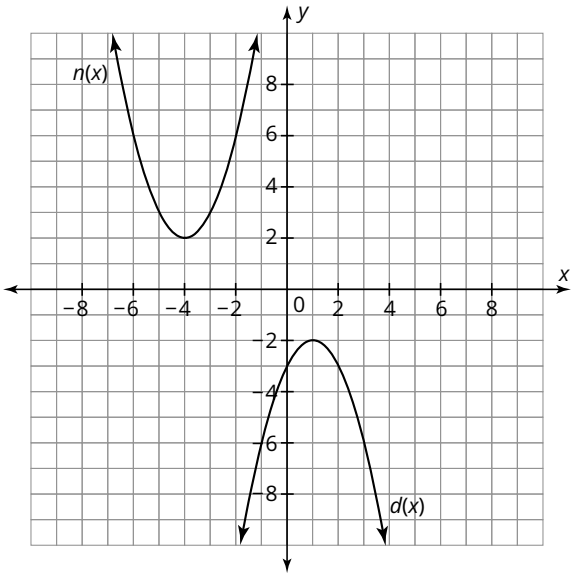
a. $f'(x) = \frac{1}{2}f(x - 2) + 3$



b. $f'(x) = -3f(x + 1) + 1$



4. Write $n(x)$ in terms of $d(x)$. Then write the quadratic equation for $n(x)$.



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ACTIVITY
3.4
Vertex Form of a Quadratic Function

In vertex form, the coefficient of x is always 1. Therefore, the B-value in the transformation form in this case is also 1 and is left out of the expression.

Given a basic function $y = f(x)$, you have learned how to identify the effects and graph a function written in the transformation form $g(x) = Af(x - C) + D$. For quadratic functions written in transformation form, $A \neq 0$.

For quadratic functions specifically, you will also see them written in the form $f(x) = a(x - h)^2 + k$, where $a \neq 0$. This is referred to as **vertex form**.

1. What does the variable *h* represent in the vertex form of a quadratic function?

Think about:

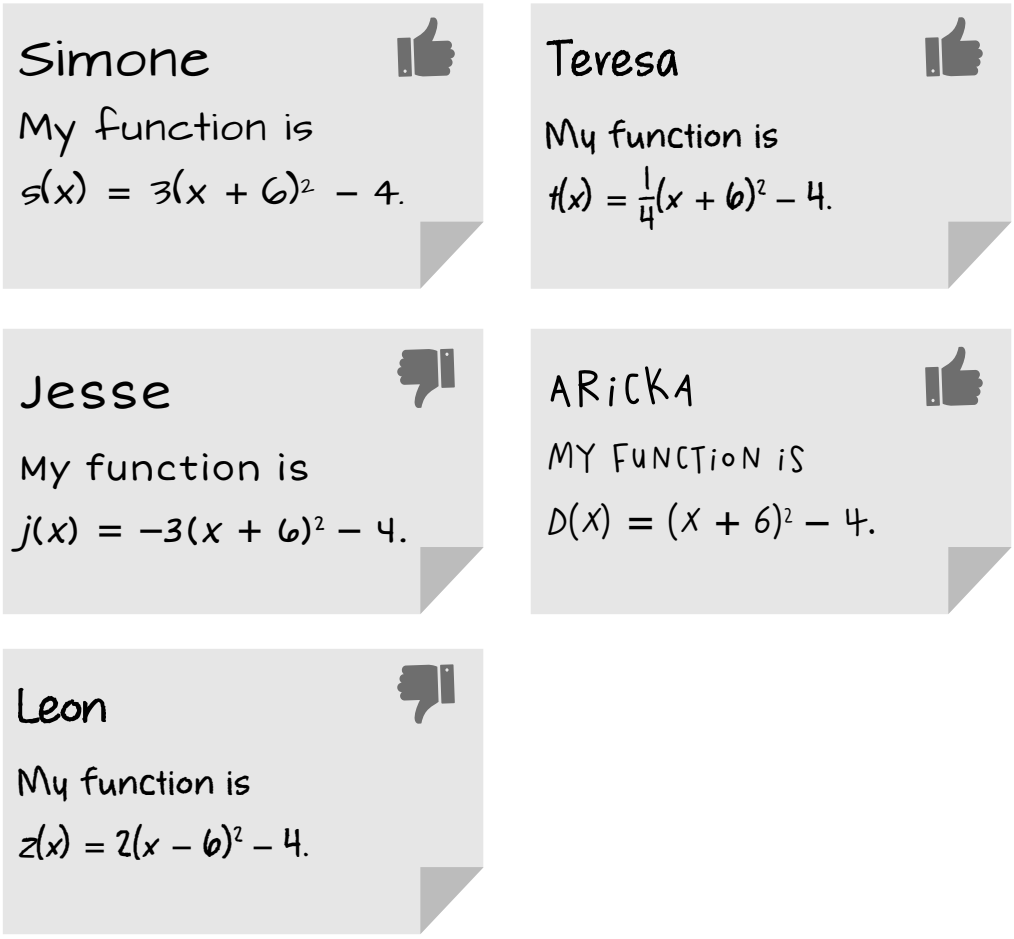
Do you see how this form of the function tells you about the vertex?

2. What does the variable *k* represent in the vertex form of a quadratic function?

3. What key characteristics can you determine directly from the quadratic function when it is written in vertex form?

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4. **Simone, Teresa, Jesse, Aricka, and Leon are working together to write a quadratic function to represent a parabola that opens upward and has a vertex at (−6, −4).**



a. **What are the similarities among all the graphs of the functions? What are the differences among the graphs?**

b. **How is it possible to have more than one correct function?**

c. **What would you tell Jesse and Leon to correct their functions?**

d. **How many possible functions can you write for the parabola described in this problem? Explain your reasoning.**

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5. **Use technology to graph each function. Use the graph to rewrite the function in vertex form and in factored form.**

   a. $h(x) = x^2 - 8x + 12$

      vertex: _____

      vertex form: _____

      zero(s): _____

      factored form: _____

   b. $r(x) = -2x^2 + 6x + 20$

      vertex: _____

      vertex form: _____

      zero(s): _____

      factored form: _____

   c. $w(x) = -x^2 - 4x$

      vertex: _____

      vertex form: _____

      zero(s): _____

      factored form: _____

   d. $c(x) = 3x^2 - 3$

      vertex: _____

      vertex form: _____

      zero(s): _____

      factored form: _____

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NOTES

6. **Identify the form(s) of each quadratic function as either general form, factored form, or vertex form. Then state all you know about each quadratic function's key characteristics, based only on the given equation of the function.**

   a. $g(x) = -(x - 1)^2 + 9$

   b. $g(x) = x^2 + 4x$

   c. $g(x) = -\frac{1}{2}(x - 3)(x + 2)$

   d. $g(x) = x^2 - 5$

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ACTIVITY
3.5
Writing Equations in Vertex and Factored Forms

You can write a quadratic function in vertex form if you know the coordinates of the vertex and another point on the graph.

Worked Example

Write an equation for a quadratic function with vertex (1, −2) that passes through the point (0, 1).

Step 1: Substitute the coordinates of the vertex into vertex form of a quadratic function.

$y = a(x - h)^2 + k$
$y = a(x - 1)^2 - 2$

Step 2: Substitute the coordinates of the other point on the graph for x and y.

$1 = a(0 - 1)^2 - 2$

Step 3: Solve for the value of a.

$1 = a(-1)^2 - 2$
$1 = a(1) - 2$
$1 = a - 2$
$3 = a$

Step 4: Rewrite the equation in vertex form, substituting the vertex and the value of a.

$f(x) = 3(x - 1)^2 - 2$

1. **How would you determine an equation of a quadratic function in factored form given the zeros and another point on the graph?**

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2. **Dawson and Dave each wrote an equation for the function represented by the graph shown.**

Dawson

$y = a(x + 1)^2 - 3$

$0 = a(1 + 1)^2 - 3$

$0 = 4a - 3$

$3 = 4a$

$a = \frac{3}{4}$

$y = \frac{3}{4}(x + 1)^2 - 3$

Dave

$y = a(x + 3)(x - 1)$

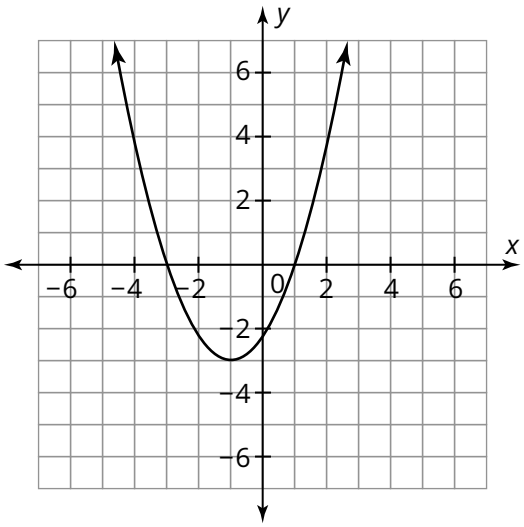
$-3 = a(-1 + 3)(-1 - 1)$

$-3 = a(2)(-2)$

$-3 = -4a$

$a = \frac{3}{4}$

$y = \frac{3}{4}(x + 3)(x - 1)$



a. **Explain Dawson's reasoning.**

b. **Explain Dave's reasoning.**

c. **Use technology to show that Dawson's equation and Dave's equation are equivalent.**

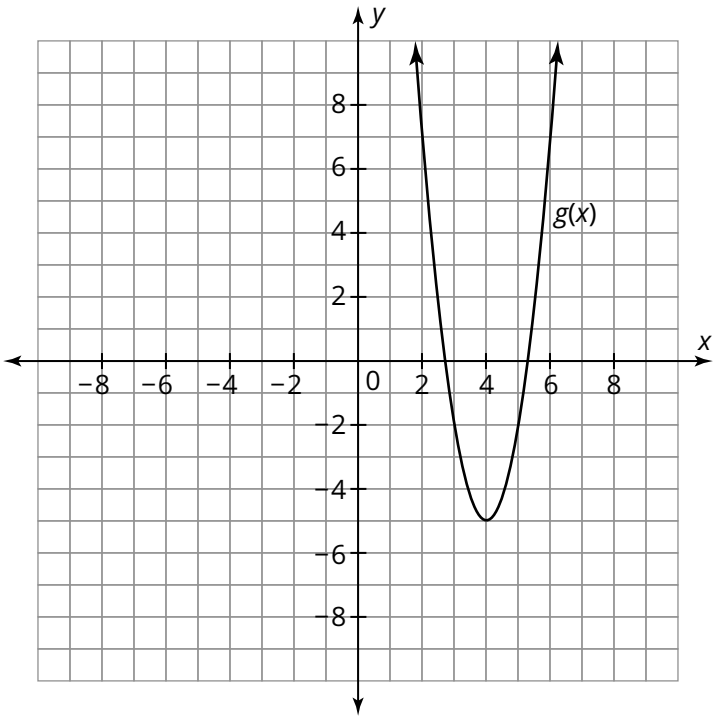
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3. **Write an equation for a quadratic function in vertex form with vertex (3, 1) that passes through the point (1, 9).**

4. **Write an equation for a quadratic function in factored form with zeros at $x = -4$ and $x = 0$ that passes through the point (−3, 6).**

5. **Write an equation for a quadratic function in vertex form with vertex (−1, 6) that passes through the point (−3, 4).**

6. **Write an equation for a quadratic function $g(x)$ in vertex form given the graph of $g(x)$.**



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NOTES

TALK the TALK

Show What You Know

1. **Based on the equation of each function, describe how the graph of each function compares to the graph of $f(x) = x^2$.**

   a. $z(x) = -(x - 1)^2 - 10$

   b. $r(x) = \frac{1}{2}(x + 6)^2 + 7$

   c. $m(x) = (4x)^2 + 5$

2. **Describe each transformation in relation to the basic function $f(x) = x^2$.**

   a. $h(x) = f(x) + D$ when $D > 0$

   b. $h(x) = f(x) + D$ when $D < 0$

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c. $h(x) = f(x - C)$ **when** $C > 0$

d. $h(x) = f(x - C)$ **when** $C < 0$

e. $h(x) = Af(x)$ **when** $|A| > 1$

f. $h(x) = Af(x)$ **when** $0 < |A| < 1$

g. $h(x) = Af(x)$ **when** $A = -1$

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Assignment

Write

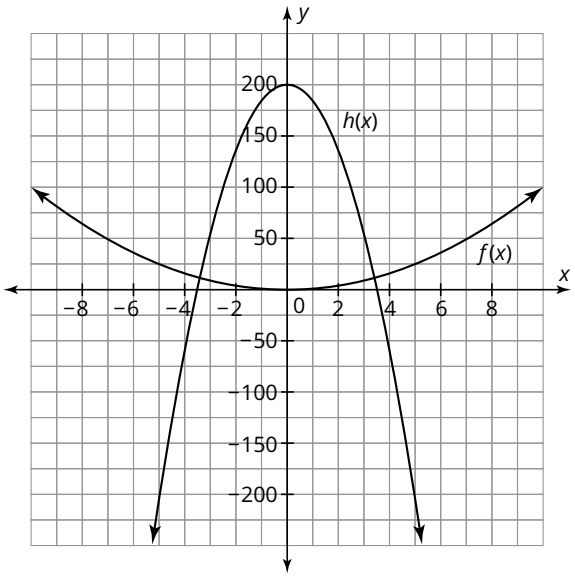
Describe the connections between the vertex form of a quadratic function, $f(x) = a(x - h)^2 + k$, and the transformation form, $g(x) = A \cdot f(x - C) + D$, of the basic quadratic function, $y = f(x)$.

Remember

Transformations performed on any function $f(x)$ can be described by the transformation function $g(x) = Af(B(x + C)) + D$ where the C-value translates the function $f(x)$ horizontally, the D-value translates $f(x)$ vertically, the A-value vertically stretches or compresses $f(x)$, and the B-value horizontally stretches or compresses $f(x)$. When the A-value is negative the function $f(x)$ is reflected across a horizontal line of reflection and when the B-value is negative the function $f(x)$ is reflected across a vertical line of reflection.

Practice

1. Given $f(x) = x^2$, graph each function and write the corresponding quadratic equation.
   a. $g(x) = 3f(x - 1)$
   b. $g(x) = f(3x) - 1$
   c. $g(x) = \frac{1}{2}f(x) + 5$
   d. $g(x) = 2f(x - 3) + 1$
2. The graph shows the basic function $f(x) = x^2$, and also shows the function $h(x)$.
   a. Describe the types of transformations performed on $f(x)$ to result in $h(x)$.
   b. If the dilation factor is 16, write the function $h(x)$.



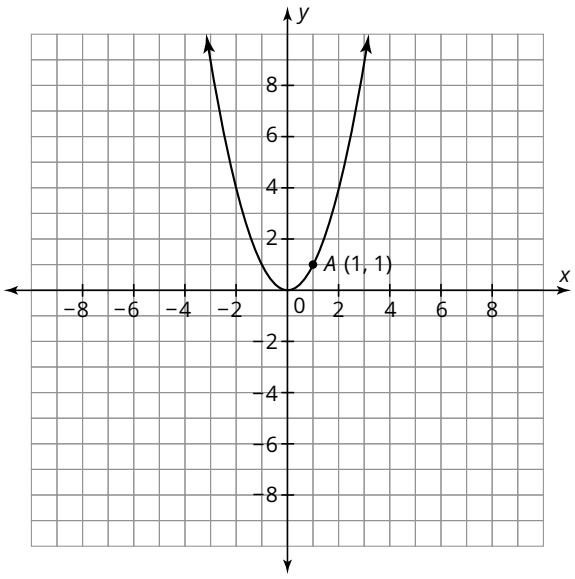
3. Use the given characteristics to write a function $R(x)$ in vertex form. Then, sketch the graph of $R(x)$ and the basic function $f(x) = x^2$.
   - The function has an absolute maximum.
   - The function is translated 70 units up and 100 units to the right.
   - The function is vertically dilated by a factor of $\frac{1}{5}$.

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Stretch

Given $f(x) = x^2$. Sketch each function. Label point A' for each transformation.

1. $m(-x + 3)$
2. $n(-(x + 3))$
3. $r(-(x - 3))$
4. $t(-x - 3)$



Review

1. Rupert owns a small store and he polled his customers to decide what type of bread he should be carrying. The table shows the results.

	White	Wheat	Rye
0–20 Years Old	15	5	3
21–30 Years Old	13	12	7
31–40 Years Old	6	16	9
41+ Years Old	8	21	5

   a. Construct a marginal relative frequency distribution of the data.

   b. Rupert wants to choose one type of bread to sell in his store. Construct a stacked bar graph of the relative frequency distribution. Which type of bread should he sell? Justify your response.

2. Use the equation $f(x) = \frac{1}{3}(x - 5)(x - 3)$ to determine each characteristic.

   a. axis of symmetry

   b. x-intercepts

   c. Will the graph open upward or downward?

3. Use the equation $f(x) = 4x^2 + 3x - 10$ to determine each characteristic.

   a. axis of symmetry

   b. y-intercept

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4

You Lose Some, You Lose Some

Comparing Functions Using Key Characteristics and Average Rate of Change

Warm Up

Write the ordered pair for the *y*-intercept of each quadratic function.

1. $f(x) = 4(x - 2)(x - 3)$

2. $f(x) = -6x^2 + 9x - 5$

3. $f(x) = 5(x - 1)^2 + 14$

Learning Goals

- Understand the form in which a quadratic function is written can reveal different key characteristics.
- Show different rearrangements of quadratic functions in general form, factored form, and vertex form and analyze their properties.
- Compare properties of quadratic functions represented in different ways.
- Compare functions increasing linearly, quadratically, and exponentially by analyzing the average rate of change of the function.
- Use multiple representations of quadratic functions to identify key characteristics, such as the maximum, minimum, intercepts, and the axis of symmetry.

You have seen quadratic functions modeled using tables, equations, and graphs. How can you use the different representations of quadratic functions to analyze their key characteristics?

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Function Form File Cabinet

1. **Complete each graphic organizer located at the end of the lesson using the general form of the function given. For each form of the equation, check the box of any characteristic that can be identified in that form of the equation. Then, sketch a graph of the equation and identify key points.**

ACTIVITY
4.1

Comparing Functions Increasing Linearly, Quadratically, and Exponentially



Think about the two functions you studied in the previous activity.

$$f(x) = x^2 + 2x - 3$$

$$g(x) = 2x^2 - 4x - 30$$

1. **Compare the two functions. Show your work and explain your reasoning.**

   a. **Which function has the lowest minimum point?**

   b. **Which function has a greater value at $x = 8$?**

   c. **Which function has a greater value at $x = 9$?**

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2. Complete the table to compare the average rate of change of the two functions on the given intervals. Show your work.

Interval	Average Rate of Change $f(x) = x^2 + 2x - 3$	Average Rate of Change $g(x) = 2x^2 - 4x - 30$
[0, 1]		
[0, 2]		
[0, 3]		
[4, 5]		

Remember:

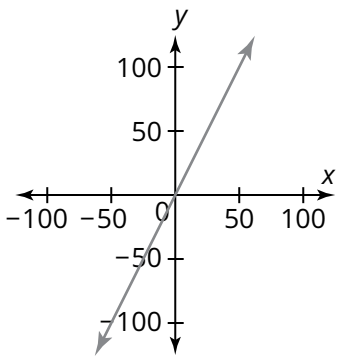
The average rate of change of any function over an interval is the slope of a linear function passing through the beginning and end points of the interval.

3. The two functions you compared increase or decrease quadratically, but they do not have the same average rates of change on the given intervals. Explain why.

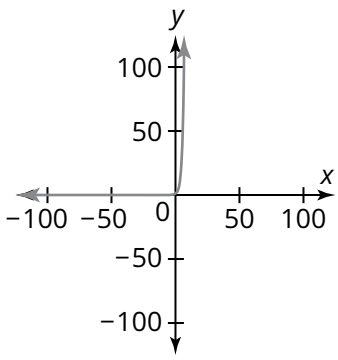
Let's compare a quadratic function with other function types you have studied. You can say that a quadratic function increases or decreases quadratically, so a linear function increases or decreases linearly, and an exponential function increases or decreases exponentially.

4. Consider the linear, exponential, and quadratic functions shown.

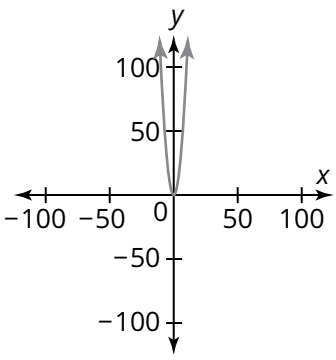
$h(x) = 2x$



$j(x) = 2^x$



$k(x) = x^2$



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a. At what point do the three graphs intersect? Explain how you know.

b. Which function do you think has the greatest average rate of change from negative infinity to positive infinity? Explain your reasoning.

The table shown organizes the average rates of change of the three functions across different intervals of their domains. Some of the rates have been provided.

	[−10, 10]	[10, 100]	[100, 1000]
$h(x) = 2x$			
$j(x) = 2^x$		6.34×10^{27}	1.07×10^{298}
$k(x) = x^2$	0		

5. Consider the quadratic function.

a. Why is the average rate of change for the quadratic function 0 across the interval [−10, 10]? Use a calculation to explain your reasoning.

b. Enter the average rate of change for the quadratic function across the intervals [10, 100] and [100, 1000] in the table. Explain why your answers are correct.

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6. **Enter the average rate of change for the linear function across each of the three intervals in the table. Justify your answers.**

7. **Enter the average rate of change for the exponential function across the interval [−10, 10] in the table. Show your work.**

8. **Do the average rates of change for the exponential function in the table seem reasonable? Explain why or why not.**

9. **Compare the change in the average rates of change for the functions shown in the table across the different intervals. What do you notice?**

10. **Parker says that any function increasing exponentially will eventually have a greater value than any function increasing linearly or quadratically.**

    Is Parker correct? Explain why or why not.



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ACTIVITY
4.2
Comparing Equations, Tables, and Graphs

Maya saved up some money and decided to take a risk and invest in some stocks. She invested her money in Doogle, a popular computer company. Unfortunately she lost it all in just 25 months. The change in her money during this time can be represented by the function $v(x) = 75 + 72x - 3x^2$, where v is the value of her investment and x is the time in months.

1. **Three quadratic functions are shown. Which of these models represents Maya's investment money over time? Explain your choice and why you eliminated the other model(s).**

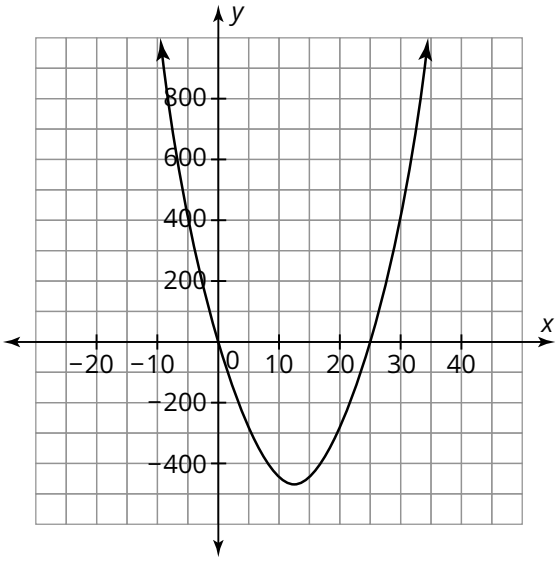
Model 1

$v(x) = -3(x + 1)(x - 25)$

Model 2

x	*y*
0	0
3	197
15	450
25	0

Model 3



2. **How much money did Maya initially invest? Explain how you determined your answer.**

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3. **The function that models Maya's investment over time has a maximum value.**

   a. **What was the greatest value of Maya's investment account over the time of her investment? Show your work.**

   b. **How much time did it take for Maya's account to reach its maximum value?**

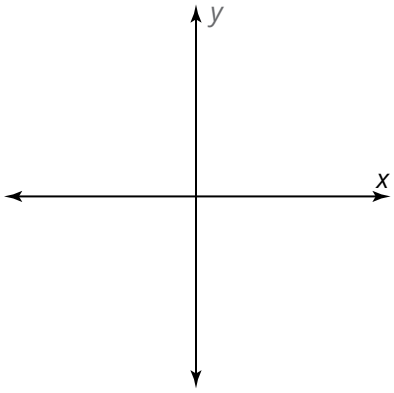
   c. **On average, how much did Maya's account gain in value each month from the time she opened the account to the time it reached its maximum value?**

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ACTIVITY
4.3
Representations of Transformations of Quadratic Functions

Consider the quadratic function $h(t) = -5(t - 3)^2 + 60$.

1. **Sketch a graph of the function and label the vertex and the *y*-intercept. Explain your work.**



2. **Identify the table that represents the function. Explain why you eliminated the other tables.**

A

t	*h*(*t*)
−1	55
0	60
1	55
2	40

B

t	*h*(*t*)
0	45
1	20
4	5
5	20

C

t	*h*(*t*)
$-\sqrt{12} + 3$	0
0	15
3	60
$\sqrt{12} + 3$	0

D

t	*h*(*t*)
$-\sqrt{12} + 3$	−60
0	−45
3	0
$\sqrt{12} + 3$	−60

3. **Describe how the function $h(x)$ has been transformed from the basic function $f(x) = x^2$.**

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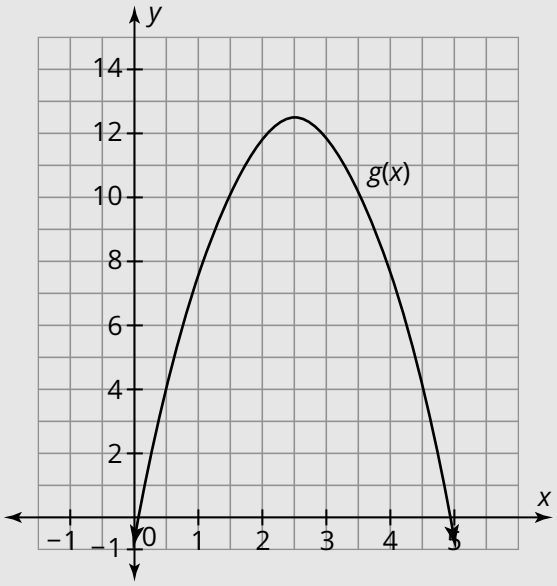
ACTIVITY
4.4

Comparing Quadratics in Different Forms

In this activity, you will compare quadratic functions represented in different forms.

1. Josiah compared the table of values for $f(x)$ and the graph of $g(x)$ to determine which quadratic function has the greater maximum.

x	$f(x)$
−1	0
0	4.5
1	8
2	10.5
3	12



Josiah says that the function $g(x)$ has a greater maximum, because it has an output value greater than 12 at its maximum while the table for $f(x)$ shows a greatest output of 12.
Is Josiah's reasoning correct? Explain your answer.

2. Approximate the absolute maximum for each function. Show your work.

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Ben and Corinne are trying out their new drones, but they're not very good at flying them yet. The drones keep very precise records of their elevations.

3. Compare these two drone flights, launched at the same time.

The height in feet of Corinne's drone flight over time in seconds can be approximated by the function $c(x) = -3x^2 + 7x + 1$.

The table of values shows the height in feet of Ben's drone at different times.

x	$b(x)$
0	4
0.25	4.25
0.5	4
1	2
1.281	0

a. Which flight began at a higher elevation? How do you know?

b. Which drone began descending first? Show your work.

c. Which of the drones had a greater average increase in height over time up to its maximum height? Explain your reasoning.

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TALK the TALK

More Ups and Downs

1. **Analyze each pair of representations. Then, answer each question and justify your reasoning.**

   a. **Which function has a greater average rate of change for the interval (2, 4)?**

A

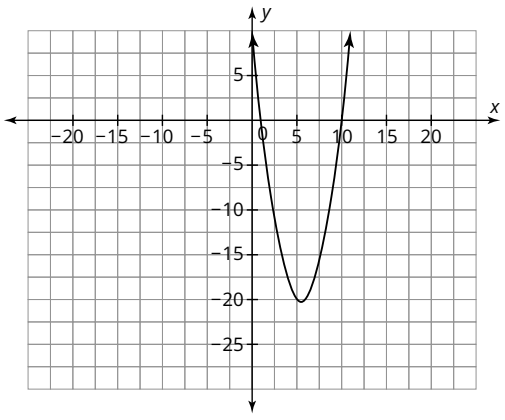
$f(x) = (x + 1)^2 + 20$

B

x	*y*
0	4
2	0
4	4

   b. **Which function has a greater absolute minimum?**

A



B

x	*y*
0	4
1	0
4	0

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NOTES

c. Which function's axis of symmetry has a greater *x*-value?

A	B
$f(x) = 2x^2 + 4$	***x*** | ***y*** −3 | 30 0 | 0 5 | 30

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Graphic Organizer

General Form

Equation: $f(x) = x^2 + 2x - 3$

Select which key features of the graph can be identified from the general form of the equation.

- □ parabola opens up/down
- □ location of vertex
- □ zeros
- □ *y*-intercept

Factored Form

Equation: _____

Select which key features of the graph can be identified from the factored form of the equation.

- □ parabola opens up/down
- □ location of vertex
- □ zeros
- □ *y*-intercept

KEY CHARACTERISTICS OF A QUADRATIC FUNCTION

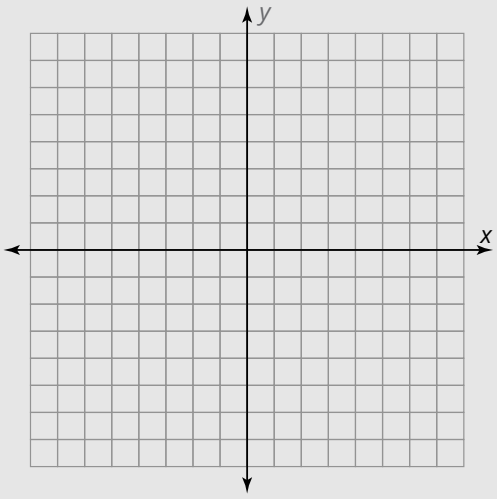
Vertex Form

Equation: _____

Select which key features of the graph can be identified from the vertex form of the equation.

- □ parabola opens up/down
- □ location of vertex
- □ zeros
- □ *y*-intercept

Graph of the Quadratic Function



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Graphic Organizer

KEY CHARACTERISTICS OF A QUADRATIC FUNCTION

General Form

Equation: $g(x) = 2x^2 - 4x - 30$

Select which key features of the graph can be identified from the general form of the equation.

- □ parabola opens up/down
- □ location of vertex
- □ zeros
- □ *y*-intercept

Factored Form

Equation: _____

Select which key features of the graph can be identified from the factored form of the equation.

- □ parabola opens up/down
- □ location of vertex
- □ zeros
- □ *y*-intercept

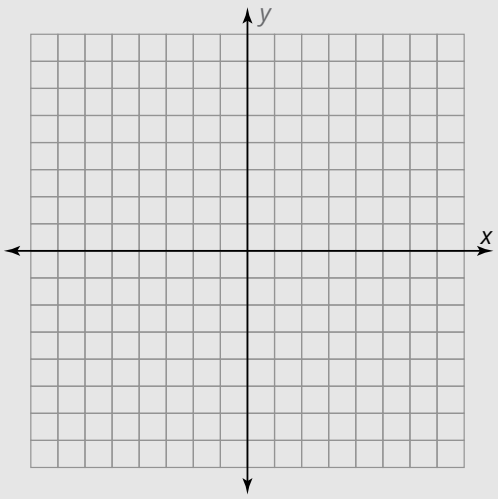
Vertex Form

Equation: _____

Select which key features of the graph can be identified from the vertex form of the equation.

- □ parabola opens up/down
- □ location of vertex
- □ zeros
- □ *y*-intercept

Graph of the Quadratic Function



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Assignment

Write

Describe the difference between quadratic equations in general form, factored form, and vertex form.

Remember

You can use what you know about the structure of quadratic functions represented as tables, equations, graphs and scenarios to compare the characteristics of two quadratic functions represented in different forms.

Practice

1. Analyze each pair of representations. Then, answer each question and justify your reasoning.

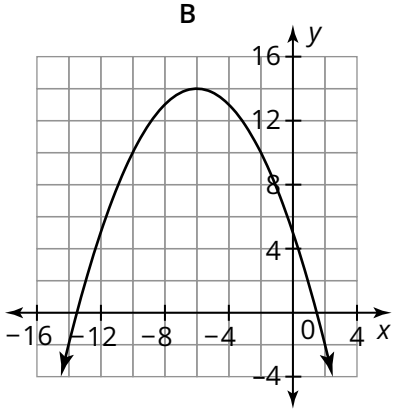
   a. Which function has a greater *y*-intercept?

   b. Which function has a greater average rate of change for the interval (1, 2)?

A

$f(x) = \frac{1}{3}x^2 - 4x + 12$

B



A

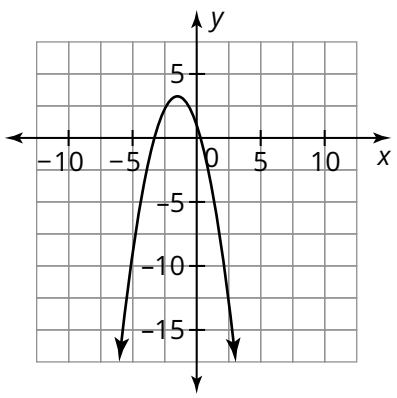
$f(x) = \frac{1}{2}x^2 + 9$

B

x	*y*
0	9
1	7
2	1

   c. Which function has an absolute maximum with a greater *y*-value?

A



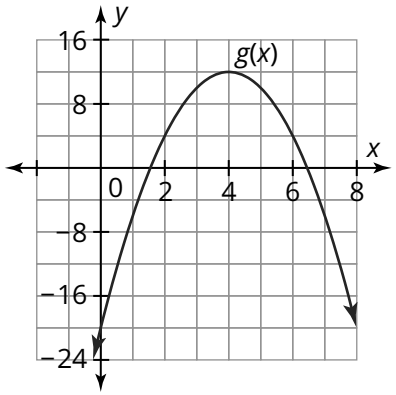
B

x	*y*
−1	0
0	0
0.5	−0.75

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Stretch

Analyze each pair of representations.

A	B
$f(x) = x^2 + 2x - 3$	

Write a function $m(x)$ that has an average rate of change for the interval (1, 2) that falls between the average rate of change for the same interval for $f(x)$ and $g(x)$.

Review

1. Write an equation for a quadratic function in vertex form with vertex (4, 9) that has a y-intercept of (0, 12.2).
2. Write an equation for a quadratic function in factored form with zeros (−7, 0) and (10, 0) that passes through the point (−4, −10).
3. The table shows the careers that students in grades 2, 6, and 12 would like to have when they are adults.

	Fire/Police	Doctor/Nurse	Teacher	Engineer	Veterinarian
2nd Graders	12	6	4	3	5
6th Graders	6	7	5	5	9
12th Graders	4	7	10	8	6

   a. Construct a conditional relative frequency distribution of future careers by grade level.
   b. What percent of 2nd graders want to be a doctor, nurse, or veterinarian?
   c. What percent of 12th graders want to be something other than a teacher?

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Skills Practice

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I. Modeling with Quadratic Functions

A. Write a quadratic function in standard form that represents each area as a function of the width. Remember to define your variables.

1. A builder is designing a rectangular parking lot. She has 300 feet of fencing to enclose the parking lot around three sides.

2. Aiko is enclosing a new rectangular flower garden with a rabbit garden fence. She has 40 feet of fencing.

3. Pedro is building a rectangular sandbox for the community park. The materials available limit the perimeter of the sandbox to at most 100 feet.

4. Lea is designing a rectangular quilt. She has 16 feet of piping to finish the quilt around three sides.

5. Kiana is making a rectangular vegetable garden alongside her home. She has 24 feet of fencing to enclose the garden around the three open sides.

6. Nelson is building a rectangular ice rink for the community park. The materials available limit the perimeter of the ice rink to at most 250 feet.

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B. Use technology to determine the absolute maximum of each function. Describe what the *x*- and *y*-coordinates of this point represent in terms of the problem situation.

1. A builder is designing a rectangular parking lot. He has 400 feet of fencing to enclose the parking lot around three sides. Let x = the width of the parking lot. Let A = the area of the parking lot. The function $A(x) = -2x^2 + 400x$ represents the area of the parking lot as a function of the width.

2. Joelle is enclosing a portion of her yard to make a pen for her ferrets. She has 20 feet of fencing. Let x = the width of the pen. Let A = the area of the pen. The function $A(x) = -x^2 + 10x$ represents the area of the pen as a function of the width.

3. A baseball is thrown upward from a height of 5 feet with an initial velocity of 42 feet per second. Let t = the time in seconds after the baseball is thrown. Let h = the height of the baseball. The quadratic function $h(t) = -16t^2 + 42t + 5$ represents the height of the baseball as a function of time.

4. Hector is standing on top of a playground set at a park. He throws a water balloon upward from a height of 12 feet with an initial velocity of 25 feet per second. Let t = the time in seconds after the balloon is thrown. Let h = the height of the balloon. The quadratic function $h(t) = -16t^2 + 25t + 12$ represents the height of the balloon as a function of time.

5. Franco is building a rectangular roller-skating rink at the community park. The materials available limit the perimeter of the skating rink to at most 180 feet. Let x = the width of the skating rink. Let A = the area of the skating rink. The function $A(x) = -x^2 + 90x$ represents the area of the skating rink as a function of the width.

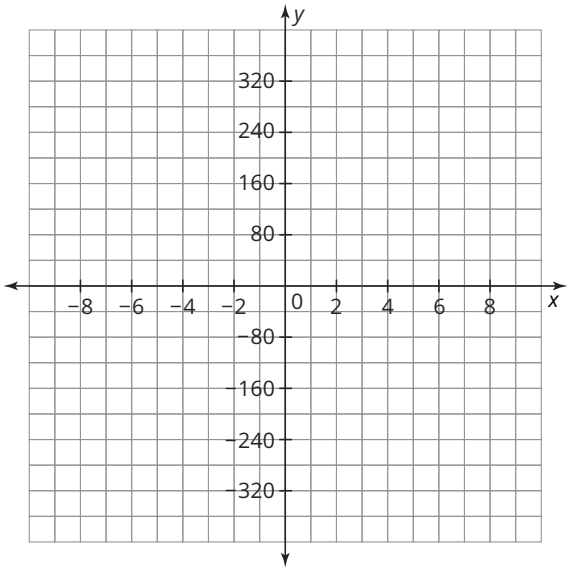
6. A football is thrown upward from a height of 6 feet with an initial velocity of 65 feet per second. Let t = the time in seconds after the football is thrown. Let h = the height of the football. The quadratic function $h(t) = -16t^2 + 65t + 6$ represents the height of the football as a function of time.

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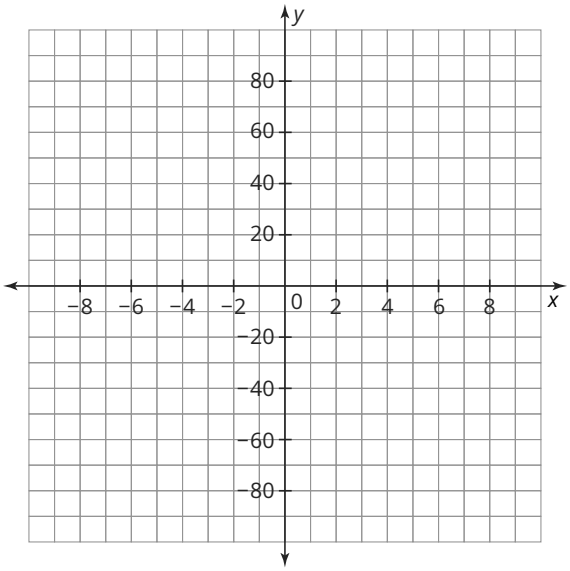
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C. Graph the function that represents each problem situation. Identify the absolute maximum, zeros, and the domain and range of the function in terms of both the graph and problem situation. Round your answers to the nearest hundredth, if necessary.

1. A model rocket is launched from the ground with an initial velocity of 120 feet per second. The function $g(t) = -16t^2 + 120t$ represents the height of the rocket, $g(t)$, t seconds after it was launched.

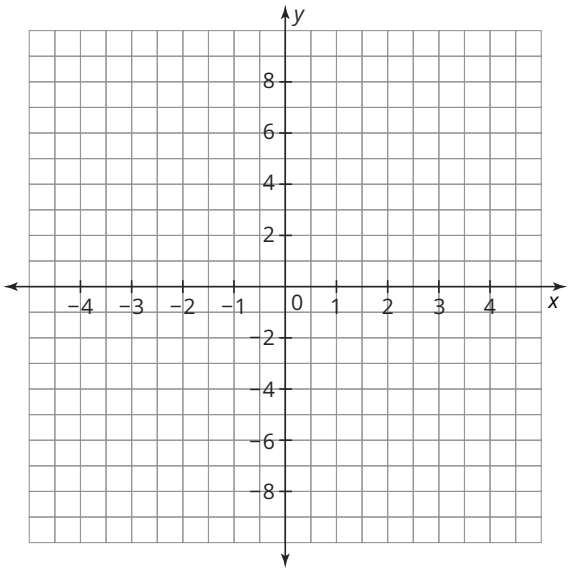


2. A model rocket is launched from the ground with an initial velocity of 60 feet per second. The function $g(t) = -16t^2 + 60t$ represents the height of the rocket, $g(t)$, t seconds after it was launched.

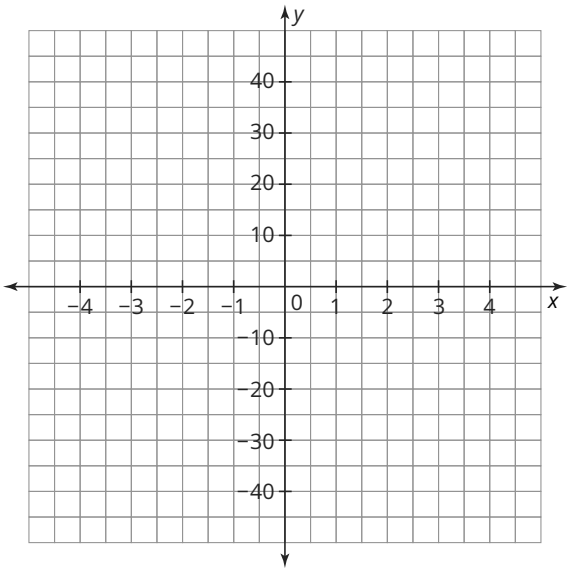


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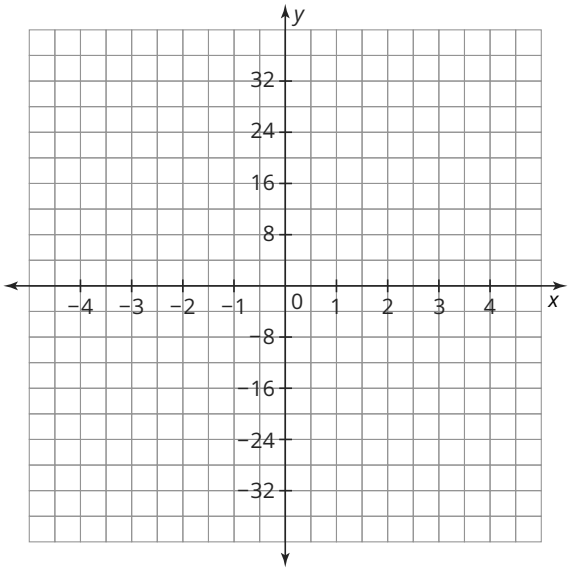
3. A baseball is thrown in the air from a height of 5 feet with an initial vertical velocity of 15 feet per second. The function $g(t) = -16t^2 + 15t + 5$ represents the height of the baseball, $g(t)$, t seconds after it was launched.



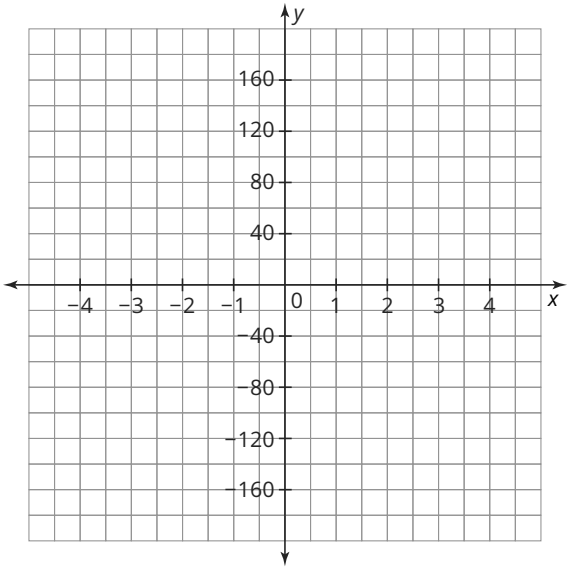
4. A football is thrown in the air from a height of 6 feet with an initial vertical velocity of 50 feet per second. The function $g(t) = -16t^2 + 50t + 6$ represents the height of the football, $g(t)$, t seconds after it was launched.



5. A tennis ball is dropped from a height of 25 feet. The initial velocity of an object that is dropped is 0 feet per second. The function $g(t) = -16t^2 + 25$ represents the height of the tennis ball, $g(t)$, t seconds after it was dropped.



6. A tennis ball is dropped from a height of 150 feet. The initial velocity of an object that is dropped is 0 feet per second. The function $g(t) = -16t^2 + 150$ represents the height of the tennis ball, $g(t)$, t seconds after it was dropped.



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D. Write a function that represents the vertical motion described in each problem situation.

1. A catapult hurls a watermelon from a height of 36 feet at an initial velocity of 82 feet per second.

2. A catapult hurls a cantaloupe from a height of 12 feet at an initial velocity of 47 feet per second.

3. A catapult hurls a pineapple from a height of 49 feet at an initial velocity of 110 feet per second.

4. A basketball is thrown from a height of 7 feet at an initial velocity of 58 feet per second.

5. A soccer ball is thrown from a height of 25 feet at an initial velocity of 46 feet per second.

6. A football is thrown from a height of 6 feet at an initial velocity of 74 feet per second.

E. Identify the vertex and the equation of the axis of symmetry for each vertical motion model.

1. A catapult hurls a grapefruit from a height of 24 feet at an initial velocity of 80 feet per second. The function $h(t) = -16t^2 + 80t + 24$ represents the height of the grapefruit $h(t)$ in terms of time t.

2. A catapult hurls a pumpkin from a height of 32 feet at an initial velocity of 96 feet per second. The function $h(t) = -16t^2 + 96t + 32$ represents the height of the pumpkin $h(t)$ in terms of time t.

3. A catapult hurls a watermelon from a height of 40 feet at an initial velocity of 64 feet per second. The function $h(t) = -16t^2 + 64t + 40$ represents the height of the watermelon $h(t)$ in terms of time t.

4. A baseball is thrown from a height of 6 feet at an initial velocity of 32 feet per second. The function $h(t) = -16t^2 + 32t + 6$ represents the height of the baseball $h(t)$ in terms of time t.

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5. A softball is thrown from a height of 20 feet at an initial velocity of 48 feet per second. The function $h(t) = -16t^2 + 48t + 20$ represents the height of the softball $h(t)$ in terms of time t.

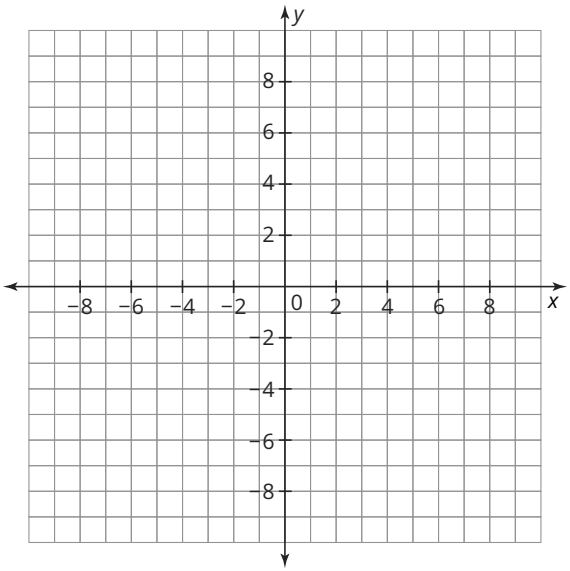
6. A rocket is launched from the ground at an initial velocity of 112 feet per second. The function $h(t) = -16t^2 + 112t$ represents the height of the rocket $h(t)$ in terms of time t.

II. Comparing Linear, Quadratic, and Exponential Functions

A. Graph each table of values. Describe the type of function represented by the graph.

1.

x	*y*
−4	7
−2	6
0	5
2	4
4	3

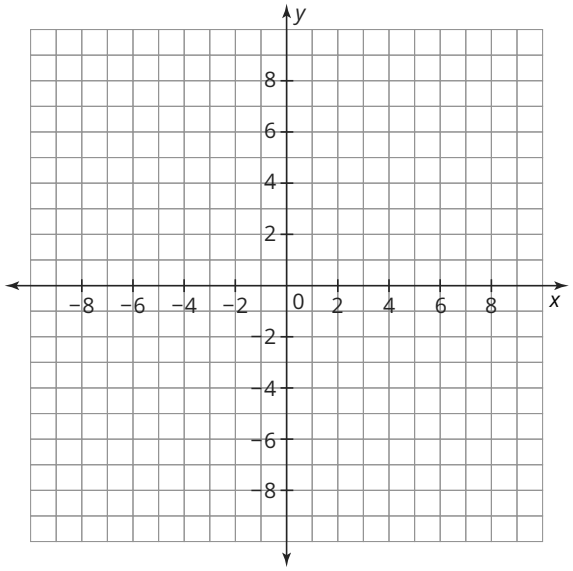


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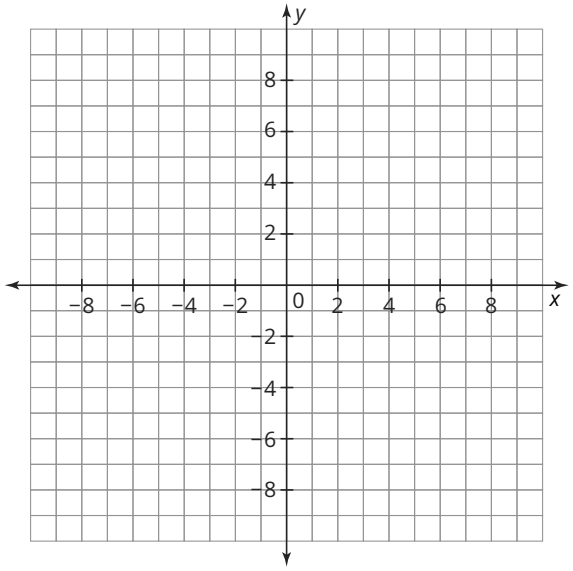
2.

x	*y*
−3	$\frac{1}{8}$
−2	$\frac{1}{4}$
−1	$\frac{1}{2}$
0	1
1	2



3.

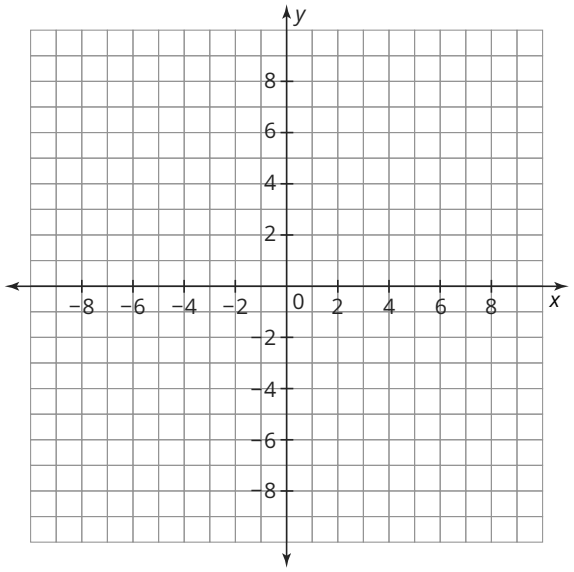
x	*y*
−2	−8
0	0
2	4
4	4
6	0



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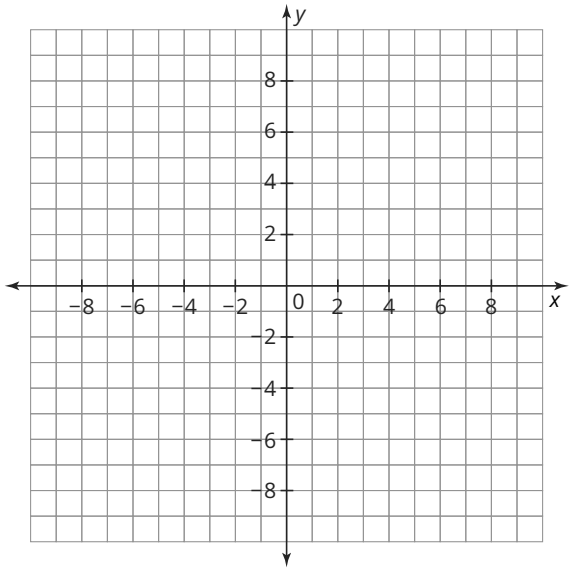
4.

x	*y*
−2	$\frac{1}{9}$
−1	$\frac{1}{3}$
0	1
1	3
2	9



5.

x	*y*
1	6
2	3
3	0
4	−3
5	−6

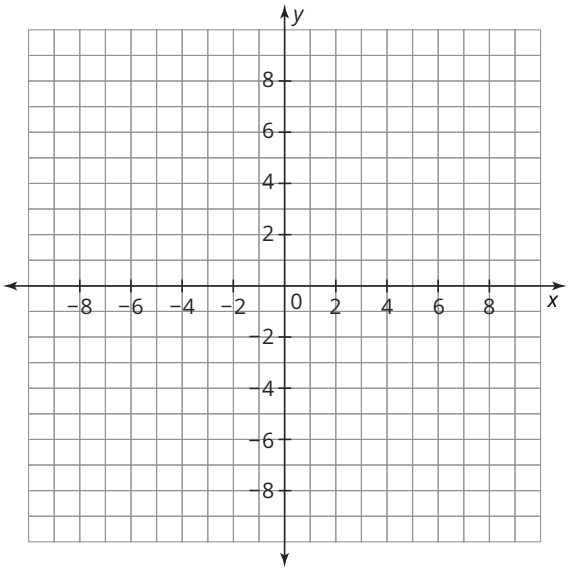


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6.

x	*y*
−3	−9
0	0
3	3
6	0
9	−9



B. Calculate the first and second differences for each table of values. Describe the type of function represented by the table.

1.

x	*y*	First Differences	Second Differences
−2	−6		
−1	−3		
0	0		
1	3		
2	6		

2.

x	*y*	First Differences	Second Differences
−2	12		
−1	3		
0	0		
1	3		
2	12		

3.

x	*y*	First Differences	Second Differences
−3	3		
−2	4		
−1	5		
0	6		
1	7		

4.

x	*y*	First Differences	Second Differences
−1	1		
0	0		
1	3		
2	10		
3	21		

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5.

x	*y*	First Differences	Second Differences
−4	−48		
−3	−27		
−2	−12		
−1	−3		
0	0		

6.

x	*y*	First Differences	Second Differences
−1	10		
0	8		
1	6		
2	4		
3	2		

C. Calculate the average rate of change of the functions $f(x) = x$, $g(x) = x^2$, and $h(x) = 2^x$ for each interval.

1. [−1, 0]

2. [−2, 2]

3. [0, 3]

4. [2, 4]

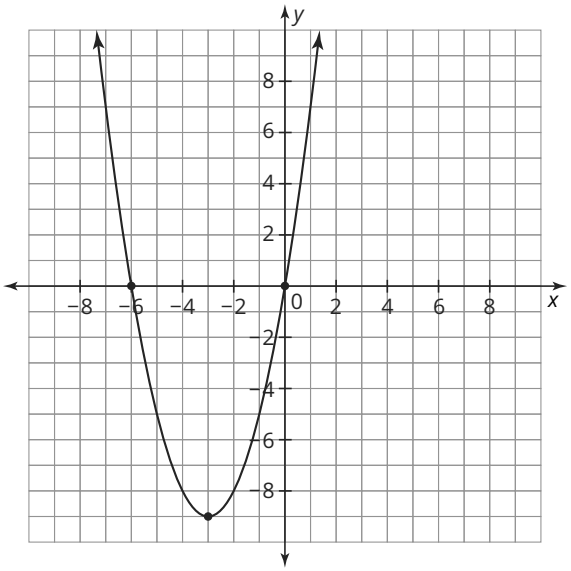
5. [0, 5]

6. [4, 5]

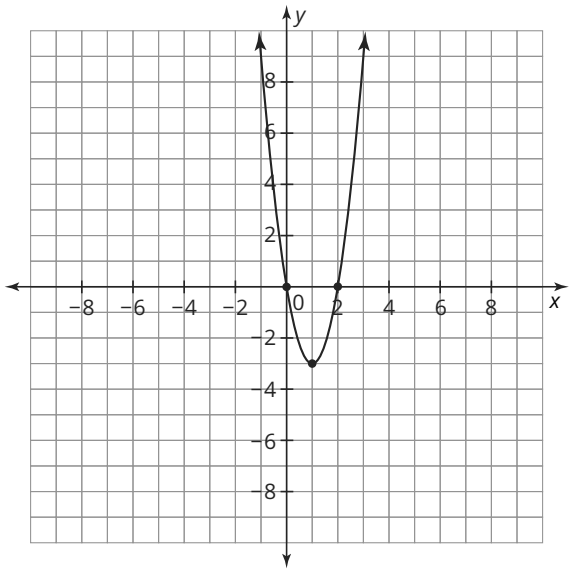
III. Identifying Characteristics of Quadratic Functions

A. Identify the intervals of increase and decrease for each function.

1. $f(x) = x^2 + 6x$



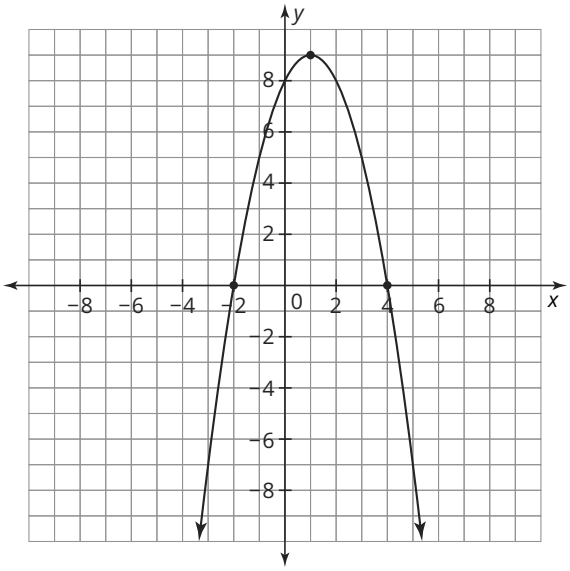
2. $f(x) = 3x^2 - 6x$



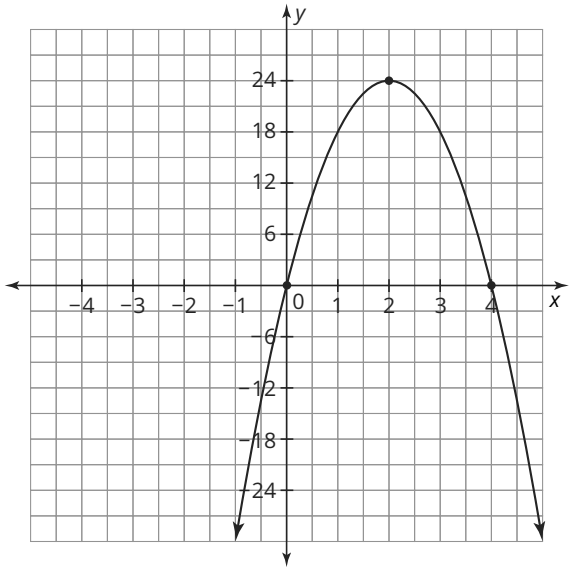
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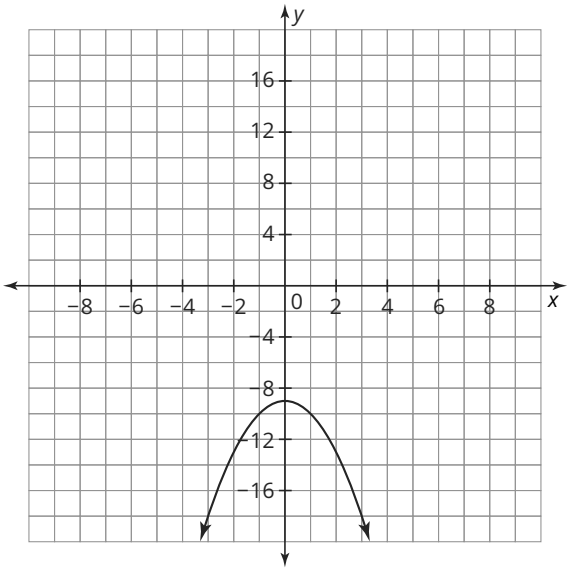
3. $f(x) = -x^2 + 2x + 8$



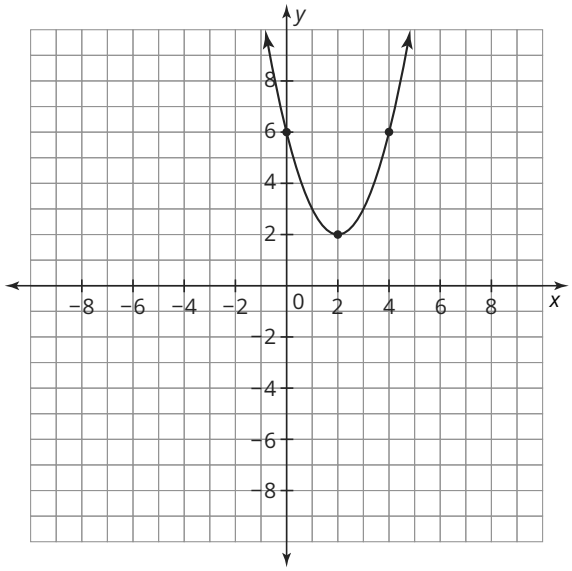
4. $f(x) = -6x^2 + 24x$



5. $f(x) = -x^2 - 9$



6. $f(x) = x^2 - 4x + 6$



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B. Determine the *x*-intercepts of each quadratic function in factored form.

1. $f(x) = (x - 2)(x - 8)$

2. $f(x) = (x + 1)(x - 6)$

3. $f(x) = 3(x + 4)(x - 2)$

4. $f(x) = 0.25(x - 1)(x - 12)$

5. $f(x) = 0.5(x + 15)(x + 5)$

6. $f(x) = 4(x - 1)(x - 9)$

C. Determine the axis of symmetry of each parabola.

1. The *x*-intercepts of a parabola are (3, 0) and (9, 0).

2. The *x*-intercepts of a parabola are (−3, 0) and (1, 0).

3. The *x*-intercepts of a parabola are (−12, 0) and (−2, 0).

4. Two symmetric points on a parabola are (−1, 4) and (5, 4).

5. Two symmetric points on a parabola are (−4, 8) and (2, 8).

6. Two symmetric points on a parabola are (3, 1) and (15, 1).

D. Determine the vertex of each parabola.

1. $f(x) = x^2 + 2x - 15$
axis of symmetry: $x = -1$

2. $f(x) = x^2 - 8x + 7$
axis of symmetry: $x = 4$

3. $f(x) = x^2 + 4x - 12$
x-intercepts: (2, 0) and (−6, 0)

4. $f(x) = -x^2 - 14x - 45$
x-intercepts: (−9, 0) and (−5, 0)

5. $f(x) = -x^2 + 8x + 20$
two symmetric points on the parabola: (−1, 11) and (9, 11)

6. $f(x) = -x^2 + 16$
two symmetric points on the parabola: (−3, 7) and (3, 7)

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E. Determine another point on each parabola.

1. The axis of symmetry is $x = 3$. A point on the parabola is (1, 4).

2. The axis of symmetry is $x = -4$. A point on the parabola is (0, 6).

3. The axis of symmetry is $x = 1$. A point on the parabola is (−3, 2).

4. The vertex is (5, 2). A point on the parabola is (3, −1).

5. The vertex is (−1, 6). A point on the parabola is (2, 3).

6. The vertex is (3, −1). A point on the parabola is (4, 1).

F. Determine the vertex of each quadratic function given in vertex form.

1. $f(x) = (x - 3)^2 + 8$

2. $f(x) = (x + 4)^2 + 2$

3. $f(x) = -2(x - 1)^2 - 8$

4. $f(x) = \frac{1}{2}(x - 2)^2 + 6$

5. $f(x) = -(x + 9)^2 - 1$

6. $f(x) = (x - 5)^2$

G. Identify the form of each quadratic function as either standard form, factored form, or vertex form. Then state all you know about the quadratic function's key characteristics, based only on the given equation of the function.

1. $f(x) = 5(x - 3)^2 + 12$

2. $f(x) = -(x - 8)(x - 4)$

3. $f(x) = -3x^2 + 5x$

4. $f(x) = \frac{2}{3}(x + 6)(x - 1)$

5. $f(x) = -(x + 2)^2 - 7$

6. $f(x) = 2x^2 - 1$

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IV. Writing Quadratic Functions

A. Write a quadratic function in factored form with each set of given characteristics.

1. Write a quadratic function that represents a parabola that opens downward and has *x*-intercepts (−2, 0) and (5, 0).

2. Write a quadratic function that represents a parabola that opens downward and has *x*-intercepts (2, 0) and (14, 0).

3. Write a quadratic function that represents a parabola that opens upward and has *x*-intercepts (−8, 0) and (−1, 0).

4. Write a quadratic function that represents a parabola that opens upward and has *x*-intercepts (3, 0) and (7, 0).

5. Write a quadratic function that represents a parabola that opens downward and has *x*-intercepts (−5, 0) and (2, 0).

6. Write a quadratic function that represents a parabola that opens upward and has *x*-intercepts (−12, 0) and (−4, 0).

B. Determine the *x*-intercepts for each function using technology. Write the function in factored form.

1. $f(x) = x^2 - 8x + 7$

2. $f(x) = 2x^2 - 10x - 48$

3. $f(x) = -x^2 - 20x - 75$

4. $f(x) = x^2 + 8x + 12$

5. $f(x) = -3x^2 - 9x + 12$

6. $f(x) = x^2 - 6x$

C. Use technology to determine the vertex of each quadratic function given in standard form. Rewrite the function in vertex form.

1. $f(x) = x^2 - 6x - 27$

2. $f(x) = -x^2 - 2x + 15$

3. $f(x) = 2x^2 - 4x - 6$

4. $f(x) = x^2 - 10x + 24$

5. $f(x) = -x^2 + 15x - 54$

6. $f(x) = -2x^2 - 14x - 12$

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D. Write an equation for a quadratic function that satisfies each set of given characteristics.

1. The vertex is (−1, 4) and the parabola opens down.

2. The x-intercepts are −3 and 4 and the parabola opens down.

2. The vertex is (3, −2) and the parabola opens up.

4. The vertex is (0, 8) and the parabola opens up.

5. The x-intercepts are 5 and 12 and the parabola opens up.

6. The x-intercepts are 0 and 7 and the parabola opens down.

7. The vertex is (−2, −3) and the parabola passes through the point (1, 6).

8. The vertex is (0, 0) and the parabola passes through the point (−2, −8).

9. The function has zeros (6, 0) and (−4, 0), and the parabola passes through the point (0, 8).

10. The vertex is (−4, 0) and the parabola passes through the point (−6, 12).

11. The vertex is (0, −8) and the parabola passes through the point (4, 0).

12. The function has zeros (5, 0) and (−1, 0), and the parabola passes through the point (1, −8).

V. Transforming Quadratic Functions

A. Describe the transformation performed on each function $g(x)$ to result in $d(x)$.

1. $g(x) = x^2$
$d(x) = x^2 - 5$

2. $g(x) = x^2$
$d(x) = -x^2$

3. $g(x) = x^2$
$d(x) = x^2 + 2$

4. $g(x) = x^2$
$d(x) = (x + 4)^2$

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5. $g(x) = 3x^2$
$d(x) = 3x^2 + 6$

6. $g(x) = x^2$
$d(x) = (-x)^2$

7. $g(x) = \frac{1}{2}x^2$
$d(x) = \frac{1}{2}x^2 - 1$

8. $g(x) = x^2$
$d(x) = (x - 8)^2$

9. $g(x) = (x + 2)^2$
$d(x) = (x + 2)^2 - 3$

10. $g(x) = x^2 + 2$
$d(x) = -(x^2 + 2)$

11. $g(x) = x^2$
$d(x) = (x + 1)^2$

12. $g(x) = x^2 - 5$
$d(x) = (-x)^2 - 5$

13. $g(x) = x^2 - 7$
$d(x) = (x + 2)^2 - 7$

14. $g(x) = -(x - 2)^2$
$d(x) = -(x - 2)^2 + 5$

15. $g(x) = x^2 + 8$
$d(x) = (x + 3)^2 + 8$

16. $g(x) = \frac{2}{3}x^2 + 4$
$d(x) = \frac{2}{3}(-x)^2 + 4$

17. $g(x) = x^2 - 6$
$d(x) = (x - 5)^2 - 6$

18. $g(x) = 5x^2 - 7$
$d(x) = -(5x^2 - 7)$

B. Represent each function $n(x)$ as a vertical dilation of $g(x)$ using coordinate notation.

1. $g(x) = x^2$
$n(x) = 4x^2$

2. $g(x) = x^2$
$n(x) = \frac{1}{2}x^2$

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3. $g(x) = -x^2$
$n(x) = -5x^2$

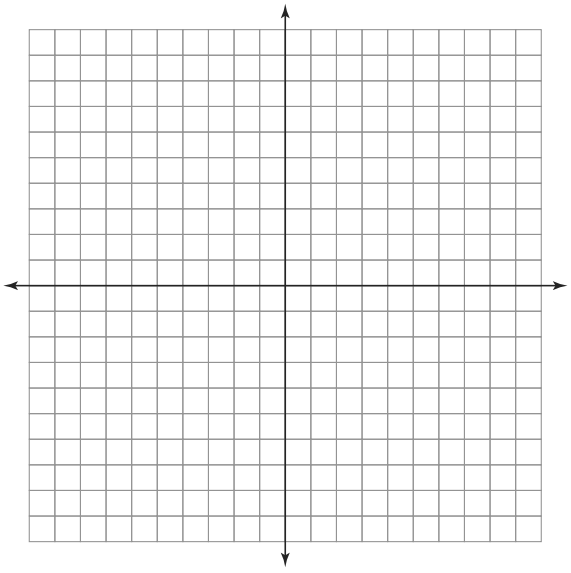
4. $g(x) = -x^2$
$n(x) = -\frac{3}{4}x^2$

5. $g(x) = (x + 1)^2$
$n(x) = 2(x + 1)^2$

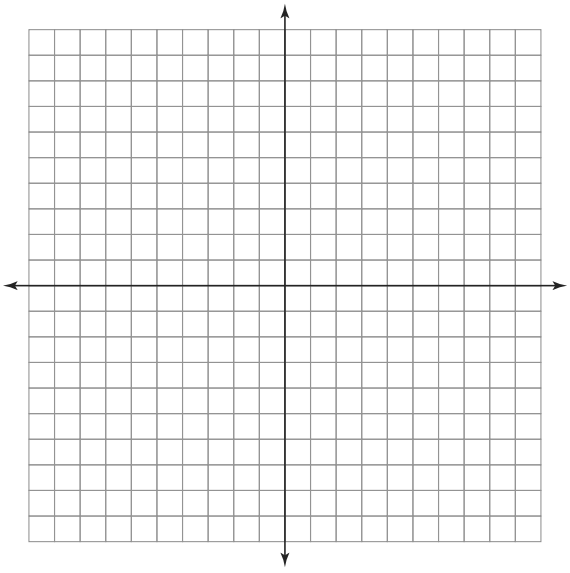
6. $g(x) = (x - 3)^2$
$n(x) = \frac{1}{2}(x - 3)^2$

C. Write an equation in vertex form for a function $g(x)$ with the given characteristics. Sketch a graph of each function $g(x)$.

1. The function $g(x)$ is quadratic.
The function $g(x)$ is continuous.
The graph of $g(x)$ is a horizontal reflection of the graph of $f(x) = x^2$.
The function $g(x)$ is translated 3 units up from $f(x) = -x^2$.

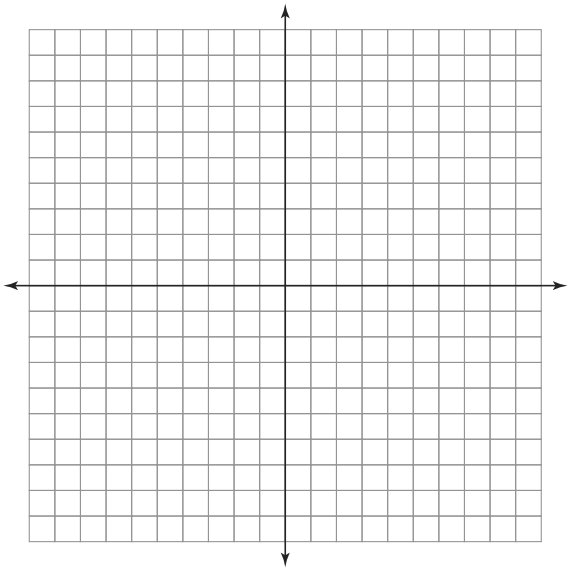


2. The function $g(x)$ is quadratic.
The function $g(x)$ is continuous.
The graph of $g(x)$ is a horizontal reflection of the graph of $f(x) = x^2$.
The function $g(x)$ is translated 2 units down and 5 units left from $f(x) = -x^2$.

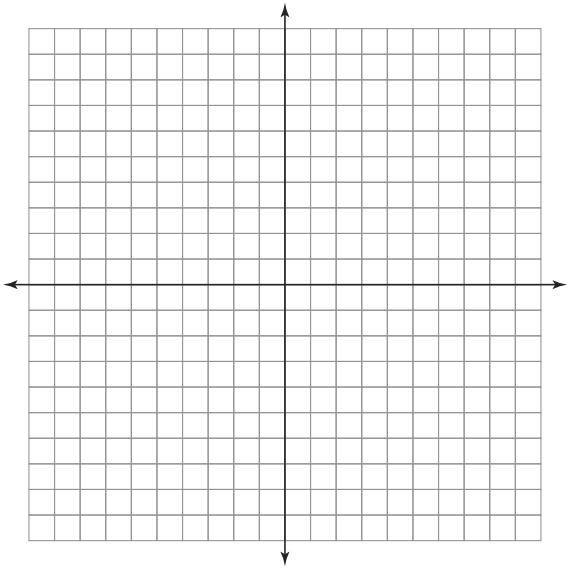


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3. The function $g(x)$ is quadratic.
The function $g(x)$ is continuous.
The function $g(x)$ is vertically dilated with a dilation factor of 6.
The function $g(x)$ is translated 1 unit up and 4 units right from $f(x) = 6x^2$.



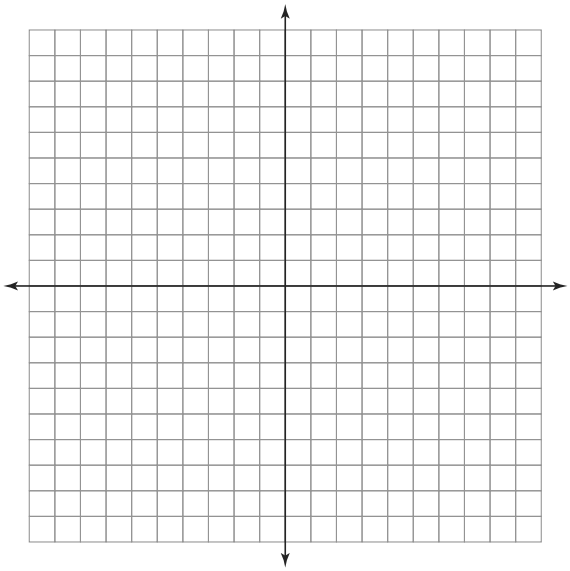
4. The function $g(x)$ is quadratic.
The function $g(x)$ is continuous.
The function $g(x)$ is vertically dilated with a dilation factor of $\frac{1}{2}$.
The function $g(x)$ is translated 2 units down and 6 units left from $f(x) = \frac{1}{2}x^2$.



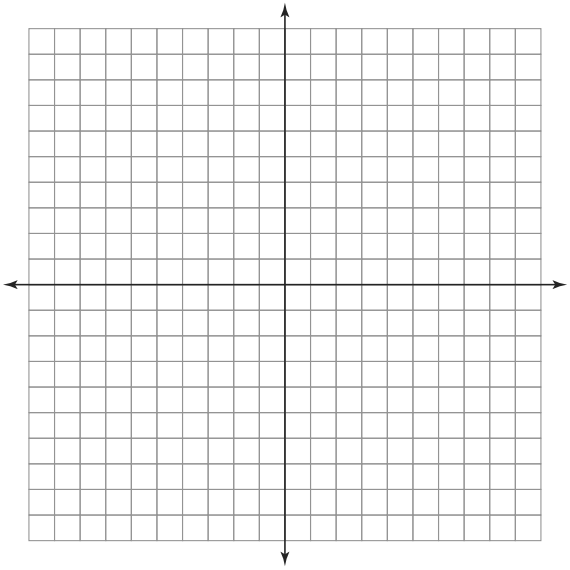
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5. The function $g(x)$ is quadratic.
The function $g(x)$ is continuous.
The graph of $g(x)$ is a horizontal reflection of the graph of $f(x) = x^2$.
The function $g(x)$ is vertically dilated with a dilation factor of 3.
The function $g(x)$ is translated 2 units down and 4 units right from $f(x) = -3x^2$.



6. The function $g(x)$ is quadratic.
The function $g(x)$ is continuous.
The function $g(x)$ is vertically dilated with a dilation factor of $\frac{1}{4}$.
The function $g(x)$ is translated 3 units up and 2 units left from $f(x) = \frac{1}{4}x^2$.



D. Describe the transformation(s) necessary to translate the graph of the function $f(x) = x^2$ into the graph of each function $g(x)$.

1. $g(x) = x^2 + 7$

2. $g(x) = -x^2 - 4$

3. $g(x) = (x - 2)^2 + 8$

4. $g(x) = 4x^2 + 1$

5. $g(x) = \frac{2}{3}(x + 4)^2 - 9$

6. $g(x) = -(x - 6)^2 + 3$

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1

This Time, With Polynomials

Adding, Subtracting, and Multiplying Polynomials

Warm Up

Rewrite each expression by combining like terms.

1. $-3x + 4y - 9x - 5y$

2. $2xy^2 + 5x^2y - 7xy + xy^2$

3. $6 - m^2 + 5m^2$

4. $-8 - (-4k) + 7 + 1 - 4k$

Learning Goals

- Name polynomials by number of terms or degree.
- Understand that operations can be performed on functions as well as numbers.
- Add, subtract, and multiply polynomials.
- Explain why polynomials are closed under addition, subtraction and multiplication.
- Recognize and use special products when multiplying binomials.

Key Terms

- polynomial
- monomial
- binomial
- trinomial
- degree of a polynomial
- closed, closure
- difference of two squares
- perfect square trinomial

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You know that a linear expression is one type of polynomial expression. What are other polynomial expressions, and how do you add, subtract, and multiply them?

Sorting It Out

You are familiar with many types of mathematical expressions. Cut out the 12 expressions located at the end of this lesson. Analyze and sort them into groups based upon common characteristics.

1. **Summarize the groups you formed by listing the expressions that you grouped together and your description for each group. Use mathematical terms in your descriptions.**

2. **Compare your groups of expressions to your classmates' groups. Describe any similarities and differences.**



3. **Jimmy and Andrew agree that $4x - 6x^2$ and $25 - 18m^2$ belong in the same group. They each are adding the expressions shown to the group. Who is correct? Explain your reasoning.**

Jimmy	Andrew
$5 - 7h$	$y^2 - 4y + 10$
$78j^3 - 3j$	$-3 + 7n + n^2$
$-13s + 6$	

4. **What characteristics do all twelve expressions share?**

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ACTIVITY
1.1 Categorizing Polynomials



Previously, you worked with linear expressions in the form $ax + b$ and quadratic expressions in the form $ax^2 + bx + c$. Each is also part of a larger group of expressions known as *polynomials*.

A **polynomial** is a mathematical expression involving the sum of powers in one or more variables multiplied by coefficients. A polynomial in one variable is the sum of terms of the form ax^k, where a is any real number and k is a non-negative integer. In general, a polynomial is of the form $a_1x^k + a_2x^{k-1} + \ldots + a_nx^0$. Within a polynomial, each product is a term, and the number being multiplied by a power is a coefficient.

Worked Example

The polynomial $m^3 + 8m^2 - 10m + 5$ has four terms. Each term is written in the form ax^k.

- The first term is m^3.
- The power is m^3, and its coefficient is 1.
- In this term, the variable is m and the exponent is 3.

1. Write each term from the worked example and identify the coefficient, power, and exponent. The first term has already been completed for you.

	1st	2nd	3rd	4th
Term	m^3			
Coefficient	1			
Variable	m			
Power	m^3			
Exponent	3			

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2. Identify the terms and coefficients in each polynomial.

a. $-2x^2 + 100x$

b. $4m^3 - 2m^2 - 5$

c. $y^5 - y + 3$

Polynomials are named according to the number of terms they have. Polynomials with only one term are **monomials**. Polynomials with exactly two terms are **binomials**. Polynomials with exactly three terms are **trinomials**.

The degree of a term in a polynomial is the exponent of the term. The greatest exponent in a polynomial determines the **degree of the polynomial**. In the polynomial $4x + 3$, the greatest exponent is 1, so the degree of the polynomial is 1.



3. Khalil says that $3x^{-2} + 4x - 1$ is a trinomial with a degree of 1 because 1 is the greatest exponent. Jazmin disagrees and says that this is not a polynomial at all because the power on the first term is not a whole number. Who is correct? Explain your reasoning.

4. Determine whether each expression is a polynomial. Explain your reasoning.

$5^x + 4^{x-1} + 3^{x-2}$ **$x^2 + \sqrt{x}$** **$x^4y + x^3y^2 + x^2y$**

A polynomial is written in general form when the terms are in descending order, starting with the term with the largest degree and ending with the term with the smallest degree.

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5. **Revisit the cards you sorted in the Getting Started.**

   a. **Identify any polynomial not written in general form and rewrite it in general form on the card.**

   b. **Identify the degree of each polynomial and write the degree on the card.**

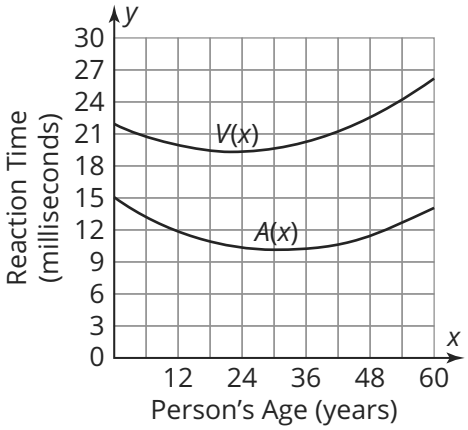
   c. **Glue each card in the appropriate column based on the number of terms in each polynomial. Write your own polynomial to complete any empty boxes.**

Monomial	Binomial	Trinomial

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ACTIVITY
1.2 Interpreting the Graphs of Polynomial Functions

The graphs of functions $V(x)$ and $A(x)$ are shown. The function $V(x)$ models people's reaction times to visual stimuli in milliseconds, based upon the age of a person in years. The function $A(x)$ models people's reaction times to audio stimuli in milliseconds based on the age of a person in years.



1. Interpret the graphs of the functions.

a. Describe the functions $V(x)$ and $A(x)$.

b. Write a summary to describe people's reaction times to visual stimuli and audio stimuli.

c. Do you think a person would react faster to a car horn or a flashing light? Explain your reasoning.

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2. **Estimate the age that a person has the quickest reaction time to each stimuli. Explain how you determined each answer.**

   a. **visual stimuli**

   b. **audio stimuli**

Many times, auto insurance companies use test results similar to the ones shown to create insurance policies for different drivers.

3. **How do you think the information provided in the graphic representation may be used by an auto insurance company?**

4. **Consider a new function $h(x)$, where $h(x) = V(x) - A(x)$. What does $h(x)$ mean in terms of the problem situation?**

5. **Write a report about drivers' reaction times to visual and audio stimuli. Discuss actions that may improve drivers' reaction times and distractions that may worsen drivers' reaction times. Discuss the importance of flashing lights and sirens on emergency vehicles.**



How can you incorporate information about auto insurance rates and a driver's age in your report?

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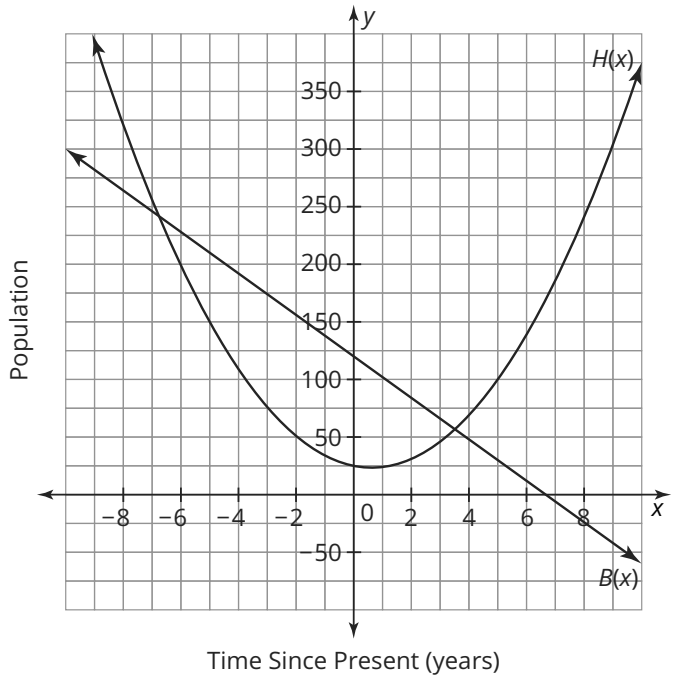
ACTIVITY
1.3 Adding and Subtracting Polynomial Functions

You are playing a new virtual reality game called "Species." You are an environmental scientist who is responsible for tracking two species of endangered parrots, the orange-bellied parrot and the yellow-headed parrot. Suppose the orange-bellied parrots' population can be modeled by the function $B(x)$, where x represents the number of years since the current year. Suppose that the population of the yellow-headed parrot can be modeled by the function $H(x)$.

$$B(x) = -18x + 120$$

$$H(x) = 4x^2 - 5x + 25$$

The two polynomial functions are shown on the coordinate plane.



Your new task in this game is to determine the total number of these endangered parrots each year over a six-year span. You can calculate the total population of parrots using the two graphed functions.

1. Use the graphs of $B(x)$ and $H(x)$ to determine the function, $T(x)$, to represent the total population of parrots.

a. Write $T(x)$ in terms of $B(x)$ and $H(x)$.

Ask yourself:

One place to start the sketch of $T(x)$ would be to consider the y-intercept for each function. What would the new y-intercept be for $T(x)$?

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b. Predict the shape of the graph of $T(x)$.

x	$B(x)$	$H(x)$	$T(x)$

c. Sketch a graph of $T(x)$ on the coordinate plane shown. First choose any 5 x-values and add their corresponding y-values to create a new point on the graph of $T(x)$. Then connect the points with a smooth curve. Record the values in the table.

d. Did the graph of $T(x)$ match your prediction in part (b)? Identify the function family to which $T(x)$ belongs.

You can write a function, $T(x)$, in terms of x to calculate the total number of parrots at any time.

Worked Example

$T(x) = B(x) + H(x)$	Write $T(x)$ in terms of two known functions.
$T(x) = (-18x + 120) + (4x^2 - 5x + 25)$	Substitute the functions in terms of x.
$T(x) = 4x^2 + (-18x + (-5x)) + (120 + 25)$	Use the Commutative Property to reorder and the Associative Property to group like terms.
$T(x) = 4x^2 - 23x + 145$	Combine like terms.

2. Choose any two x-values in your table. Use the new polynomial function, $T(x)$, to confirm that your solution in the table for those times is correct. Show your work.

3. Use technology to confirm that your graph and the remaining solutions in the table are correct. Explain any discrepancies and how you corrected them.

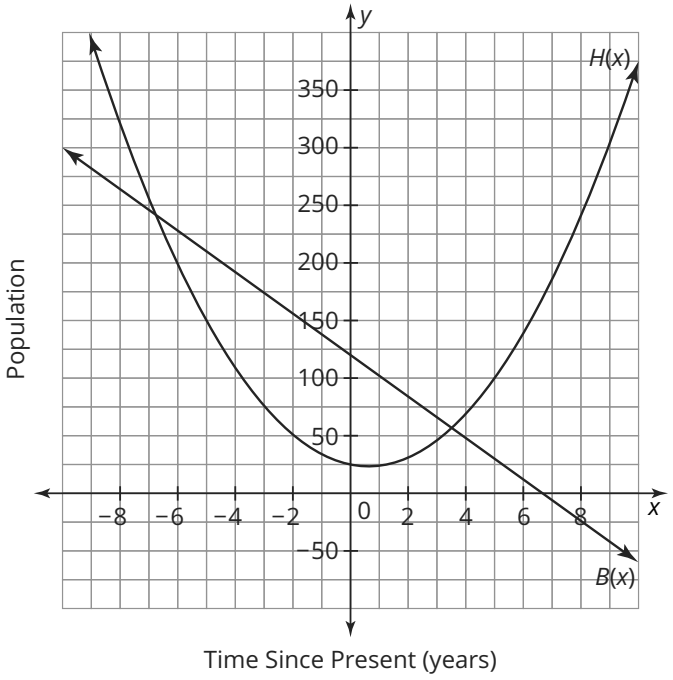
Remember:

The table feature on a graphing calculator is an efficient tool to determine y-values.

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4. **Zoe says that using $T(x)$ will not work for any time after 6 years from now because by that point the orange-bellied parrot will be extinct. Is Zoe's statement correct? Why or why not?**

Throughout the game "Species," you must always keep track of the difference between the population of each type of species. If the difference gets to be too great, you lose the game. The graphs of $B(x) = -18x + 120$ and $H(x) = 4x^2 - 5x + 25$ are shown.



5. **Use the graphs of $B(x)$ and $H(x)$ to determine the function, $D(x)$, to represent the difference between the populations of each type of species.**

   a. **Write $D(x)$ in terms of $B(x)$ and $H(x)$.**

   b. **Predict the shape of the graph of $D(x)$.**

   c. **Sketch a graph of $D(x)$ on the coordinate plane shown. First choose any 5 x-values and subtract their corresponding y-values to create a new point on the graph of $D(x)$. Then connect the points with a smooth curve. Record the values in the table.**

   d. **Did the graph of $D(x)$ match your prediction in part (b)? Identify the function family to which $D(x)$ belongs.**

x	$B(x)$	$H(x)$	$D(x)$

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6. **Write a function, $D(x)$, in terms of x to calculate the difference between the population of the orange-bellied parrots and the yellow-headed parrots. Write $D(x)$ as a polynomial in general form.**



Refer to the Worked Example for adding polynomials as a guide.

7. **Choose any two x-values in your table. Use your new polynomial function to confirm that your solution in the table for those times is correct. Show your work.**

8. **Use technology to confirm that your graph and the remaining solutions in the table are correct. Explain any discrepancies and how you corrected them.**

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9. **Eric uses his function $D(x) = -4x^2 - 13x + 95$ to determine that the difference between the number of orange-bellied parrots and the number of yellow-headed parrots 7 years from now will be −192. Is Eric correct or incorrect? If he is correct, explain to him what his answer means in terms of the problem situation. If he is incorrect, explain where he made his error and how to correct it.**

10. **The next round of the Species game included the red-winged parrot, whose population can be modeled by the function $W(x) = -9x + 80$ and the rainbow lorikeet parrot, whose population can be modeled by the function $L(x) = 2x^2 - 4x + 10$. In both cases, x represents the number of years since the current year.**

    a. **Write a function, $S(x)$, in terms of x to calculate the total number of red-winged parrots and rainbow lorikeet parrots at any time.**

    b. **Write a function, $M(x)$, in terms of x to calculate the difference in the number of red-winged parrots and rainbow lorikeet parrots at any time.**

    c. **Calculate $S(4)$ and $M(4)$. Interpret the meaning of your results.**

    d. **In four years, how many red-winged parrots will there be? How many rainbow lorikeet parrots will there be?**

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ACTIVITY
1.4 Combining Functions and Addressing Closure

In this activity, you will practice adding and subtracting polynomials.

1. Analyze each student's work. Determine the error and make the necessary corrections.

Marco

$3x^2 + 5x^2 = 8x^4$

Kamiah

$2x - (4x + 5)$

$2x - 4x + 5$

$-2x + 5$

Alexis

$(4x^2 - 2x - 5) + (3x^2 + 7)$

$(4x^2 + 3x^2) - (2x) - (5 + 7)$

$7x^2 - 2x - 12$

Consider each polynomial function.

$A(x) = x^3 + 5x^2 - 9$ $B(x) = -3x^2 - x + 1$ $C(x) = 2x^2 + 7x$ $D(x) = -2x^2 - 8x$

2. Determine each function. Write your answers in general form.

a. $J(x) = A(x) + C(x)$

b. $K(x) = D(x) - B(x)$

c. $L(x) = C(x) + D(x)$

d. $M(x) = B(x) - A(x)$

e. $N(x) = A(x) - C(x) - D(x)$

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3. Are the functions $J(x)$, $K(x)$, $L(x)$, $M(x)$ and $N(x)$ polynomial functions? Explain why or why not.

When an operation is performed on any of the numbers in a set and the result is a number that is also in the same set, the set is said to be **closed**, or have **closure**, under that operation.

For example, the set of integers is closed under addition and subtraction. That means whenever two integers are added or subtracted, the result is also an integer.

The definition of closure can also be applied to polynomials.

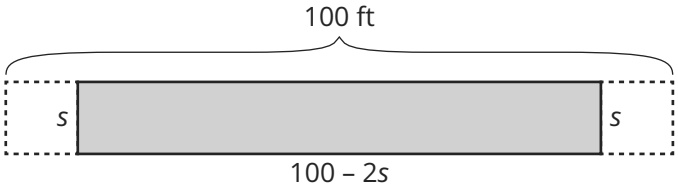
4. Based on the definition of closure, determine whether polynomials are closed under addition and subtraction. Justify your answer.

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ACTIVITY
1.5

Multiplying Polynomial Functions

Consider the dog enclosure scenario from the previous topic.



The area of the enclosure is expressed as $A(s) = s(100 - 2s)$, or the product of a monomial and a binomial.

1. **Consider how Jason and Julie wrote an equivalent polynomial function in general form by calculating the product.**

Jason

·	100	$-2s$
s	$100s$	$-2s^2$

$A(s) = -2s^2 + 100s$

Julie

$A(s) = s(100 - 2s)$

$A(s) = 100s - 2s^2$

$A(s) = -2s^2 + 100s$

Remember:

Develop a habit of writing answers in general form. It makes them easier to compare with others' answers.

   a. **Describe the strategy Jason used to calculate the product.**

   b. **How is Jason's strategy similar to Julie's strategy?**

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Consider the ghost tour scenario from the previous topic. The revenue for the business is expressed as the product of a binomial times a binomial.

Revenue	=	**Number of Tours**	·	**Price per Tour**
↓		↓		↓
$r(x)$	=	$(10x + 100)$	·	$(50 - x)$

2. Finish Jason's process to write an equivalent polynomial function for revenue in general form.

The process of using a multiplication table to multiply polynomials is referred to as an area model.

·	**50**	$-x$
10*x*	$500x$	$-10x^2$
100		

3. Use an area model to calculate the product of each polynomial. Write each product in general form.

a. $(3x + 2)(x - 4)$

b. $(x - 5)(x + 5)$

c. $(2x + 3)^2$

d. $(4x^2 + x - 1)(3x - 7)$

Ask yourself:

Does it matter where you place the polynomials in the multiplication table?

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In Question 1, Julie uses the Distributive Property to multiply a monomial and a binomial. She wants to use the Distributive Property to multiply any polynomials.

Worked Example

Consider the polynomials $x + 5$ and $x - 2$. You can use the Distributive Property to multiply these polynomials.

Distribute x to each term of $(x - 2)$, and then distribute 5 to each term of $(x - 2)$.

$$(x + 5)(x - 2) = (x)(x - 2) + (5)(x - 2)$$

$$= x^2 - 2x + 5x - 10$$

$$= x^2 + 3x - 10$$

Think about:

How can you use technology to check your answers?

4. Use the Distributive Property to determine each product. Write the polynomial in general form.

a. $(5x - 1)(2x + 1)$

b. $(x - 7)(x + 7)$

c. $(x + 2)(x - 9)$

d. $(2x^2 + 1)(3x^2 + x - 1)$

5. Explain the mistake in Cheyanne's thinking. Then determine the correct product.

Cheyanne

$$(x + 4)^2 = x^2 + 16.$$

I can just square each term to determine the product.

6. Based on the definition of closure, are polynomials closed under the operation of multiplication? Justify your answer.

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ACTIVITY
1.6 Special Products When Multiplying Binomials



In this activity you will investigate the product of two linear factors when one is the sum of two terms and the other is the difference of the same two terms, and when the two linear factors are the same.

1. Determine each product.

a. $(x - 4)(x + 4) =$ _____

$(x + 4)(x + 4) =$ _____

$(x - 4)(x - 4) =$ _____

b. $(x - 3)(x + 3) =$ _____

$(x + 3)(x + 3) =$ _____

$(x - 3)(x - 3) =$ _____

c. $(3x - 1)(3x + 1) =$ _____

$(3x + 1)(3x + 1) =$ _____

$(3x - 1)(3x - 1) =$ _____

d. $(2x - 1)(2x + 1) =$ _____

$(2x + 1)(2x + 1) =$ _____

$(2x - 1)(2x - 1) =$ _____

2. What patterns do you notice between the factors and the products?

3. Multiply each pair of binomials.

$(ax - b)(ax + b) =$ _____

$(ax + b)(ax + b) =$ _____

$(ax - b)(ax - b) =$ _____

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In Questions 1 and 3, you should have observed a few special products. The first type of special product is called the *difference of two squares*. The **difference of two squares** is an expression in the form $a^2 - b^2$ that has factors $(a - b)(a + b)$.

4. Label the expressions in Questions 1 and 3 that are examples of the difference of two squares.

The second type of special product is called a *perfect square trinomial*. A **perfect square trinomial** is an expression in the form $a^2 + 2ab + b^2$ or the form $a^2 - 2ab + b^2$. A perfect square trinomial can be written as the square of a binomial.

$$a^2 + 2ab + b^2 = (a + b)^2$$
$$a^2 - 2ab + b^2 = (a - b)^2$$

5. Label the expressions in Questions 1 and 3 that are examples of perfect square trinomials.

6. Use special products to determine each product.

a. $(x - 8)(x - 8)$

b. $(x + 8)(x - 8)$

c. $(x + 8)^2$

d. $(3x + 2)^2$

e. $(3x - 2)(3x - 2)$

f. $(3x - 2)(3x + 2)$

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NOTES

TALK the TALK

Putting It Into Practice

Match each expression with the equivalent polynomial.

Expressions	Polynomials
1. $(x^2 - 3) + (x^2 + 2)$	A. -1
2. $(x^2 - 3) - (x^2 + 2)$	B. $-2x^2 - 1$
3. $(x^2 - 3) - (x^2 - 2)$	C. $-2x^2 - 5$
4. $(x^2 - 3) + (x^2 - 2)$	D. $2x^2 - 1$
5. $-(x^2 + 3) - (x^2 - 2)$	E. $2x^2 - 5$
6. $-(x^2 + 3) - (x^2 + 2)$	F. -5
7. $(x - 3)(x + 2)$	G. $x^2 + 5x + 6$
8. $(x + 3)(x - 2)$	H. $x^2 - 5x + 6$
9. $(x + 3)(x + 2)$	I. $x^2 - x - 6$
10. $(x - 3)(x - 2)$	J. $x^2 + x - 6$

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Expression Cards

$4x - 6x^2$	$125p$	$\frac{4}{5}r^3 + \frac{2}{5}r - 1$
$-\frac{2}{3}$	$y^2 - 4y + 10$	$5 - 7h$
$-3 + 7n + n^2$	-6	$-13s + 6$
$12.5t^3$	$78j^3 - 3j$	$25 - 18m^2$

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Assignment

Write

Match each definition with its corresponding term.

1. polynomial
2. term
3. coefficient
4. monomial
5. binomial
6. trinomial
7. degree of a term
8. degree of a polynomial

a. a polynomial with only 1 term
b. the degree of the term with the greatest exponent
c. a mathematical expression involving the sum of powers in one or more variables multiplied by coefficients
d. a polynomial with exactly 3 terms
e. any number being multiplied by a power within a polynomial expression
f. each product in a polynomial expression
g. a polynomial with exactly 2 terms
h. the exponent of a term in a polynomial

Remember

- The difference of two squares is an expression in the form $a^2 - b^2$ that has factors $(a + b)(a - b)$.
- A perfect square trinomial is an expression in the form $a^2 + 2ab + b^2$ or in the form $a^2 - 2ab + b^2$ that has the factors $(a + b)^2$ and $(a - b)^2$, respectively.

Practice

1. Ramona and James each build a rocket launcher. They launch a model rocket using Ramona's launcher and on its way back down it lands on the roof of a building that is 320 feet tall. The height of the rocket can be represented by the equation $H_1(x) = -16x^2 + 200x$, where x represents the time in seconds and $H_1(x)$ represents the height. Ramona and James take the stairs to the roof of the building and re-launch the rocket using James's rocket launcher. The rocket lands back on the ground. The height of the rocket after this launch can be represented by the equation $H_2(x) = -16x^2 + 192x + 320$.
   a. Compare and contrast the polynomial functions.
   b. Use technology to sketch a graph of the functions.
   c. Does it make sense in terms of the problem situation to graph the functions outside of Quadrant I? Explain your reasoning.
   d. Explain why the graphs of these functions do not intersect.
   e. Ramona believes that she can add the two functions to determine the total height of the rocket at any given time. Write a function $S(x)$ that represents the sum of $H_1(x)$ and $H_2(x)$. Show your work.

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f. Is Ramona correct? Explain your reasoning.

g. Subtract $H_1(x)$ from $H_2(x)$ and write a new function, $D(x)$, that represents the difference. Then, explain what this function means in terms of the problem situation.

2. Determine whether each expression is a polynomial. If so, identify the terms, coefficients, and degree of the polynomial. If not, explain your reasoning.

a. $-2b^4 + 4b - 1$ b. $6 - g^{-2}$

c. $8h^4$ d. $9w - w^3 + 5w^2$

e. $x^{\frac{1}{2}} + 2$ f. $\frac{4}{5}y + \frac{2}{3}y^2$

3. Given $A(x) = x^3 - 5x + 4$, $B(x) = 2x^2 + 5x - 6$, and $C(x) = -x^2 + 3$, determine each function. Write your answer in general form.

a. $D(x) = B(x) + C(x)$ b. $E(x) = A(x) + B(x)$

c. $F(x) = A(x) - C(x)$ d. $G(x) = C(x) - B(x)$

e. $H(x) = A(x) + B(x) - C(x)$ f. $J(x) = B(x) - A(x) + C(x)$

4. Determine each product.

a. $(x - 7)(x - 7)$ b. $(x + 10)(x - 10)$

c. $(x + 6)^2$ d. $(2x + 5)^2$

e. $(2x - 5)(2x - 5)$ f. $(2x - 5)(2x + 5)$

Stretch

Consider the binomials $(x + 3)$, $(2x + 1)$, and $(x - 4)$.

1. Without multiplying, make a conjecture about the degree of the product of these binomials. Explain how you determined your answer.

2. Without multiplying, make a conjecture about the number of terms in the product of these binomials. Explain your reasoning.

3. Two students determine the product of the 3 binomials using two different methods. Student 1 uses a multiplication table, and Student 2 uses the distributive Property. Their work is shown below. Determine which student multiplied correctly and identify the mistake the other student made. Explain how you determined your answer.

Student 1

·	x	3	$2x$	1
x	x^2	$3x$	$2x^2$	x
-4	$-4x$	-12	$-8x$	-4

The product is $3x^2 - 8x - 16$.

Student 2

$(x + 3)(2x + 1)(x - 4) = (2x^2 + 7x + 3)(x - 4)$

$= 2x^3 - x^2 - 25x - 12$

The product is $2x^3 - x^2 - 25x - 12$.

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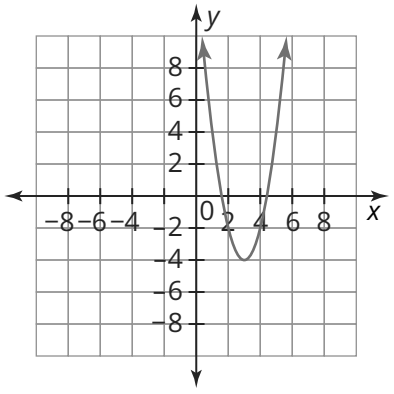
Review

1. Alfonzo is building a deck on his house. He was originally going to make it a square with a side length of x feet. Alfonzo decides to make it a rectangular deck, with 1 foot added to one pair of opposite sides and 2 feet added to the other pair of opposite sides.
   a. Determine the expressions for the length and width of the new deck in terms of x, the length of the sides of the original deck.
   b. Write the function for the area of the new deck, $A(x)$, in terms of x, the length of the sides of the original deck. Does this function have a minimum or maximum? Explain your answer.
2. Analyze each pair of representations. Then, answer each question and justify your reasoning.
   a. Which function's axis of symmetry has a greater x-value?
   b. Which function has a greater absolute minimum?

Function A

$f(x) = x^2 - 4x + 9$

Function B



Function A

$f(x) = 3(x - 2)^2 - 6$

Function B

x	y
1	2
3	5
5	18

3. Write the equation of the function, $g(x)$, whose graph transforms the graph $f(x) = x^2$ by reflecting it across the x-axis, vertically stretching it by a factor of 2, and translating it up 5 units.
4. Graph the function, $g(x)$, whose graph transforms the graph $f(x) = x^2$ by vertically compressing it by a factor of $\frac{1}{3}$ and translating it down 7 units.

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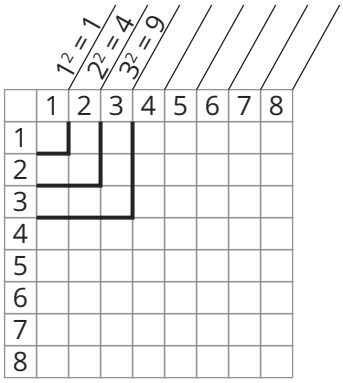
2

Solutions, More or Less

Representing Solutions to Quadratic Equations

Warm Up

1. Complete the grid by continuing to make squares with side lengths of 4 through 8. Connect the side lengths together, and then write an equation using exponents to represent each perfect square.



Learning Goals

- Identify the zeros of a quadratic function, the roots of a quadratic equation, and the *x*-intercepts of a parabola using the equation of a quadratic function.
- Identify the double root of a quadratic equation as the two solutions of a quadratic equation at the minimum or maximum of the function.
- Write solutions of quadratic equations at specific output values using the axis of symmetry and the positive and negative square roots of the output value.
- Identify quadratic equations written as the difference of two perfect squares and rewrite these equations in factored form with a leading coefficient of 1.

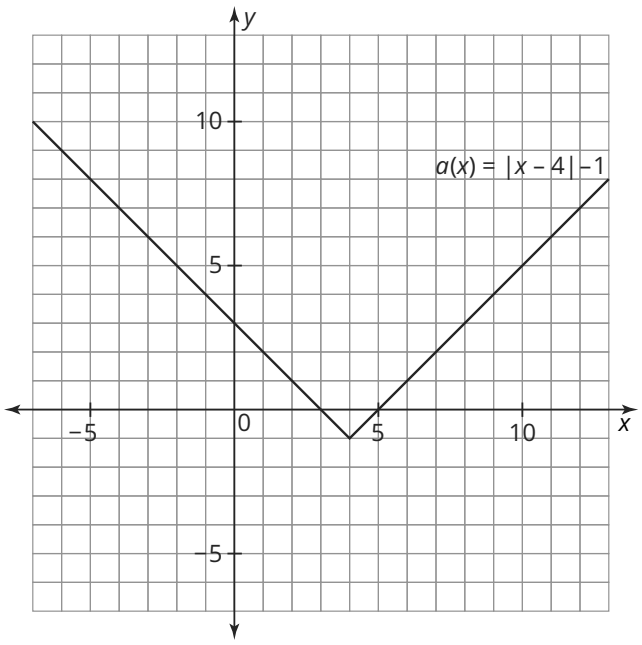
Key Terms

- principal square root
- roots
- double root
- Zero Product Property

You have studied the graphs and equations for quadratic functions. How can you determine solutions of quadratic equations given different output values?

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Plus or Minus



Consider the absolute value function graphed.

1. **Describe how the function is transformed from the basic function $f(x) = |x|$.**

2. **For each $y > -1$, how many solutions does the equation $y = |x - 4| - 1$ have? Use the graph to explain your answer.**

Remember:

Solutions for a function at $y = 0$ are called the zeros of the function.
The symbol $\pm$ means "plus or minus."

3. **Determine the solutions to $|x - 4| - 1 = 0$ and identify the solutions on the graph.**

4. **Use the graph and the function equation to explain why Escher's equation is correct.**

Escher

This absolute value function is symmetric about the line $x = 4$. So, for every y-value greater than -1, the solutions to the absolute value function are $x = 4 \pm (y + 1)$.

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ACTIVITY
2.1

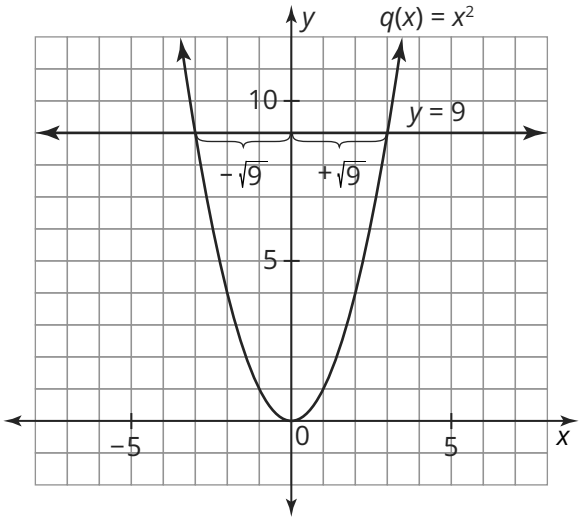
Solutions of a Quadratic Function

Recall that a quadratic function is a function of degree 2, because the greatest power for any of its terms is 2. This means that it has 2 zeros, or 2 solutions at $y = 0$.

The two solutions of a basic quadratic function can be represented as square roots of numbers. Every positive number has two square roots, a positive square root (which is also called the **principal square root**) and a negative square root. To solve the equation $x^2 = 9$, you can take the square root of both sides of the equation.

$$\sqrt{x^2} = \pm\sqrt{9}$$
$$x = \pm 3$$

Solving $x^2 = 9$ on a graph means that you are looking for the points of intersection between $y = x^2$ and $y = 9$.



Remember:

The square root property is $\sqrt{a^2} = \pm a$.

1. **Consider the graph of the function $q(x) = x^2$ shown.**

   a. **What is the equation for the axis of symmetry? Explain how you can use the function equation to determine your answer.**

   b. **Explain how the graph shows the two solutions for the function at $y = 9$ and their relationship to the axis of symmetry. Use the graph and the function equation to explain your answer.**

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c. Describe how you can determine the two solutions for the function at $y = 2$. Indicate the solutions on the graph.

d. Describe how you can determine the two solutions for the function at each *y*-value for $y \geq 0$.

The *x*-coordinates of the *x*-intercepts of a graph of a quadratic function are called the zeros of the quadratic function. The zeros are called the **roots** of the quadratic equation.

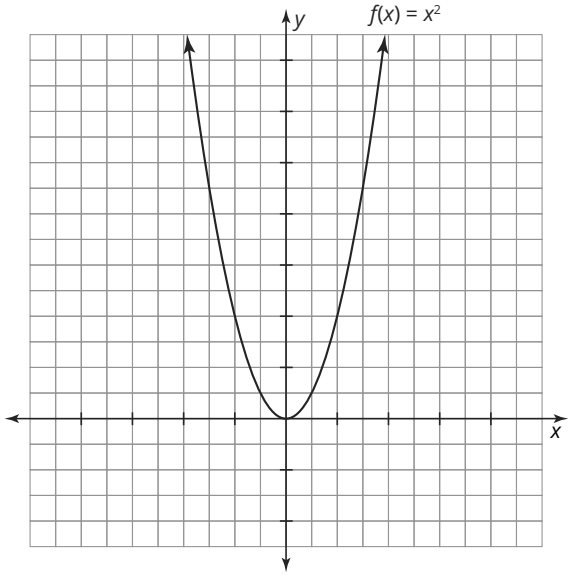
The quadratic function $q(x) = x^2$ has two solutions at $y = 0$. Therefore, it has 2 zeros: $x = +\sqrt{0}$ and $x = -\sqrt{0}$. These two zeros of the function, or roots of the equation, are the same number, 0, so $y = x^2$ is said to have a **double root,** or **1 unique root**.

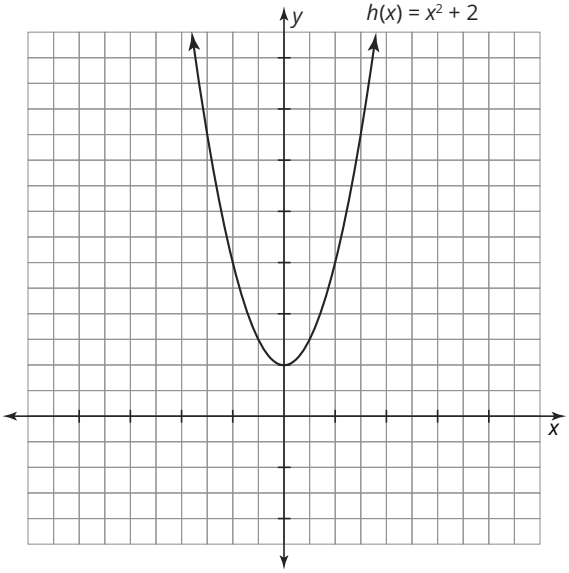
The root of an equation indicates where the graph of the equation crosses the *x*-axis. A double root occurs when the graph just touches the *x*-axis but does not cross it.

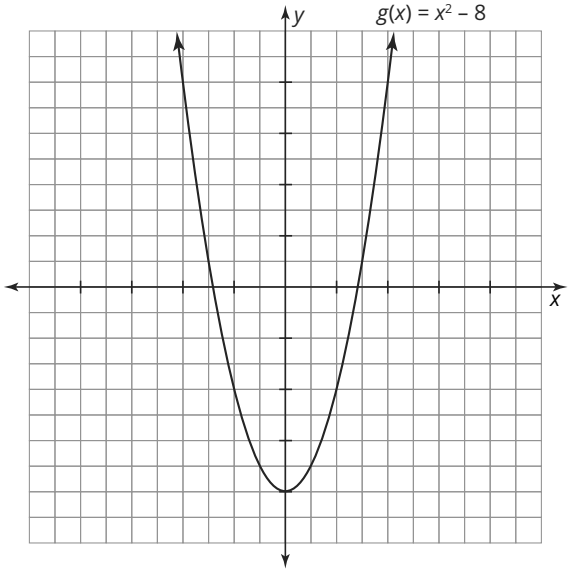
2. Look back at Escher's equation in the Getting Started. How can you write the solutions for the function $q(x) = x^2$ in the same way, using the axis of symmetry? Explain your reasoning.

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The graphs of three quadratic functions, $f(x)$, $h(x)$, and $g(x)$, are shown.







3. Use the graphs to identify the solutions to each equation. Then determine the solutions algebraically and write the solutions in terms of their respective distances from the axis of symmetry.

a. $14 = x^2 + 2$ **b. $x^2 = 10$** **c. $-5 = x^2 - 8$**

d. $19 = x^2 + 4$ **e. $x^2 - 8 = 1$** **f. $6 = x^2$**

4. Consider the graphs of $f(x)$, $h(x)$, and $g(x)$, which function has a double root? Explain your answer.

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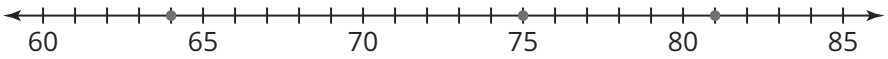
When you are solving quadratic equations you may encounter solutions that are not perfect squares. You can either determine the approximate value of the radical or rewrite it in an equivalent radical form.

Worked Example

You can determine the approximate value of $\sqrt{75}$.

Determine the perfect square that is closest to but less than 75. Then determine the perfect square that is closest to but greater than 75.

$$64 \leq 75 \leq 81$$



Determine the square roots of the perfect squares.

$\sqrt{64} = 8$ $\sqrt{75} = ?$ $\sqrt{81} = 9$

Now that you know that $\sqrt{75}$ is between 8 and 9, you can test the squares of numbers between 8 and 9.

$$8.6^2 = 73.96 \qquad 8.7^2 = 75.69$$

Since 75 is closer to 75.69 than 73.96, 8.7 is the approximate square root of $\sqrt{75}$.

Ask yourself:

Can you name all the perfect squares from 1^2 through 15^2?

Worked Example

You can use prime factors to rewrite $\sqrt{75}$ in an equivalent radical form.

First, rewrite the product of 75 to include any perfect square factors, and then extract the square roots of those perfect squares.

$$\begin{aligned}\sqrt{75} &= \sqrt{3 \cdot 5 \cdot 5} \\ &= \sqrt{3 \cdot 5^2} \\ &= \sqrt{3} \cdot \sqrt{5^2} \\ &= 5\sqrt{3}\end{aligned}$$

Think about:

How could listing the prime factors of a radical expression help to extract square roots of perfect squares?

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5. **Estimate the value of each radical expression. Then, rewrite each radical by extracting all perfect squares, if possible.**

   a. $\sqrt{20}$

   b. $\sqrt{26}$

   c. $\sqrt{18}$

   d. $\sqrt{116}$

6. **Rewrite your answers from Question 3 by extracting perfect squares, if possible. Verify your rewritten answers using the graphs in Question 3.**

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ACTIVITY
2.2

Solutions from Standard Form to Factored Form

Think about:

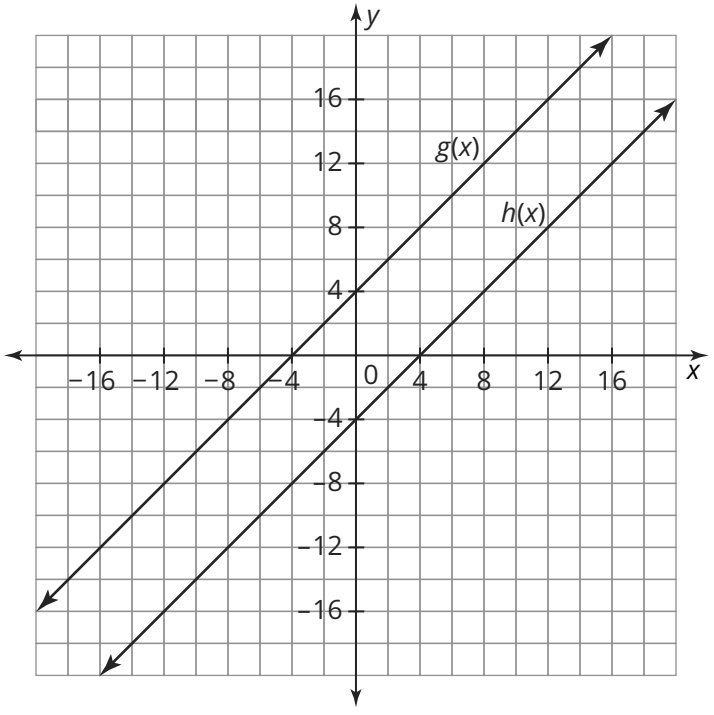
Do you recognize the form of this quadratic?

Recall that a quadratic function written in factored form is in the form $f(x) = a(x - r_1)(x - r_2)$, where $a \neq 0$. In factored form, r_1 and r_2 represent the x-intercepts of the graph of the function.

1. **Determine the zeros of the function $z(x) = x^2 - 16$. Then, write the function in factored form.**

The function $z(x)$ in factored form is a quadratic function made up of two linear factors. Let's analyze the linear factors as separate linear functions, $g(x)$ and $h(x)$. Therefore $z(x) = g(x) \cdot h(x)$.

2. **Complete the table by writing the algebraic expressions to represent $g(x)$ and $h(x)$, and then determine the output values for the two linear factors and the quadratic product. Finally, sketch a graph of $z(x)$.**



x	$g(x)$	$h(x)$	$z(x)$
			$x^2 - 16$
−4			
−2			
0			
2			
4			

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The **Zero Product Property** states that if the product of two or more factors is equal to zero, then at least one factor must be equal to zero.

Worked Example

You can use the Zero Product Property to identify the zeros of a function when the function is written in factored form.

$0 = x^2 - 16$

$0 = (x + 4)(x - 4)$ Rewrite the quadratic as linear factors.

$x - 4 = 0$ and $x + 4 = 0$ Apply the Zero Product Property.

$x = 4$ $x = -4$ Solve each equation for x.

3. Explain how the zeros of the linear function factors are related to the zeros of the quadratic function product.

The function $z(x) = x^2 - 16$ has an a-value of 1 and a b-value of 0. You can use a similar strategy to determine the zeros of a function when the leading coefficient is not 1, but the b-value is still 0.

Worked Example

You can determine the zeros of the function $f(x) = 9x^2 - 1$ by setting $f(x) = 0$ and using the Properties of Equality to solve for x.

$$9x^2 - 1 = 0$$

$$9x^2 = 1$$

$$x^2 = \frac{1}{9}$$

$$x = \pm\frac{1}{3}$$

You can then use the leading coefficient of 9 and the zeros at $\frac{1}{3}$ and $-\frac{1}{3}$ to rewrite the quadratic function in factored form.

$$f(x) = 9\left(x - \tfrac{1}{3}\right)\left(x + \tfrac{1}{3}\right)$$

4. Consider the worked example.

a. Explain why $\sqrt{\frac{1}{9}} = \pm\frac{1}{3}$.

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b. Use graphing technology to verify that $9x^2 - 1 = 9\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right)$. How can you tell from the graph that the two equations are equivalent?

Three students tried to rewrite the quadratic function $f(x) = 9\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right)$ as two linear factors using what they know about the difference of two squares.

Terrell

$9\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right) =$

$(9x - 3)\left(x + \frac{1}{3}\right)$

Jackson

$9\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right) =$

$(4.5x - 1.5)(4.5x + 1.5)$

Raychelle

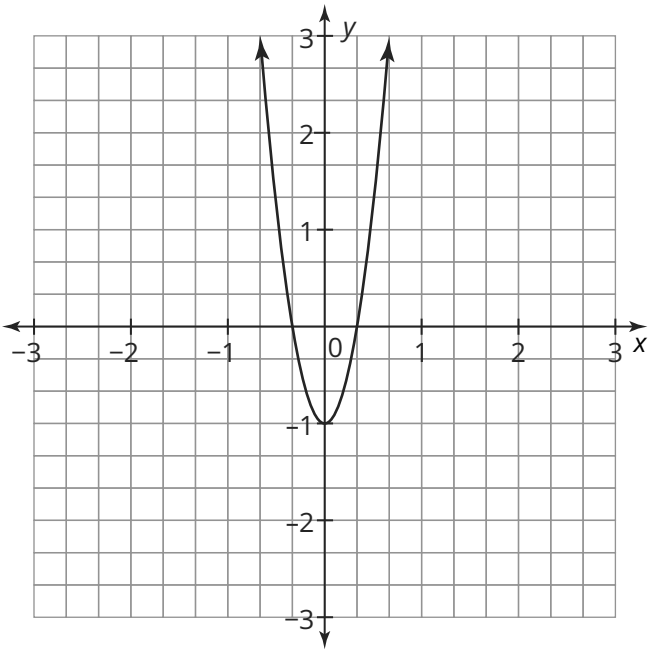
$9\left(x - \frac{1}{3}\right)\left(x + \frac{1}{3}\right) =$

$(3x - 1)(3x + 1)$

Ask yourself:

Are these expressions still in factored form?

5. Explain why Terrell and Jackson are incorrect and why Raychelle is correct.



6. The graph of $f(x) = 9x^2 - 1$ is shown.

a. Use Raychelle's function, $f(x) = (3x - 1)(3x + 1)$, to sketch a graph of the linear factors. Then use graphing technology to verify that $9x^2 - 1 = (3x - 1)(3x + 1)$.

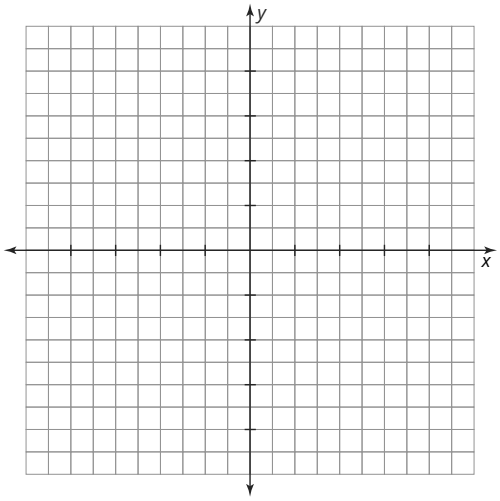
b. How do the zeros of the function relate to its two linear factors?

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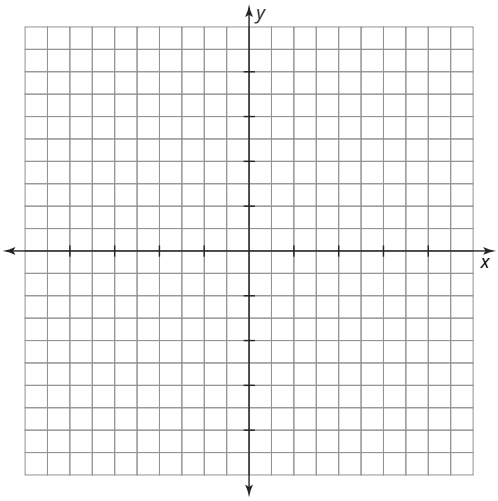
7. For each function:

- **Sketch a graph. Label the axis of symmetry and the vertex.**
- **Use the Properties of Equality to identify the zeros, and then write the zeros in terms of their respective distances from the line of symmetry.**
- **Use what you know about the difference of two squares to rewrite each quadratic as the product of two linear factors. Then use the Zero Product Property to verify the values of x, when $f(x) = 0$.**
- **Use graphing technology to verify that the product of the two linear factors is equivalent to the given function.**

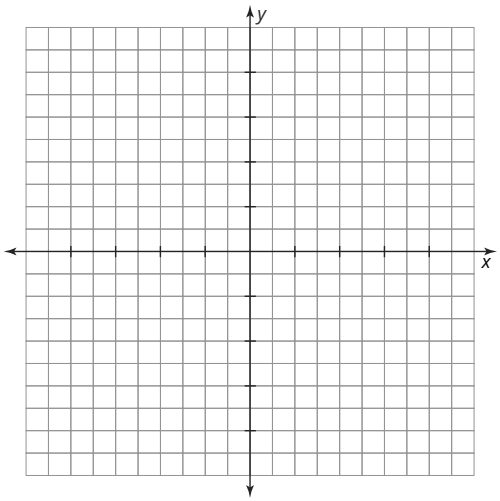
a. $f(x) = 4x^2 - 9$



b. $f(x) = x^2 - 2$



c. $f(x) = 25x^2 - 1$



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NOTES

TALK the TALK

The Difference of Squares

In this lesson you determined the zeros of quadratics written in the form $f(x) = ax^2 - c$.

1. Solve each equation.

a. $x^2 - 25 = 0$

b. $4x^2 - 1 = 0$

c. $9x^2 - 2 = 0$

d. $x^2 - 80 = 0$

2. Rewrite each quadratic function as two linear factors using what you know about the difference of two squares.

a. $f(x) = x^2 - 49$

b. $f(x) = \frac{4}{9}x^2 - 1$

c. $f(x) = 16x^2 - 10$

d. $f(x) = x^2 + 9$

3. Explain how to write any function of the form $f(x) = ax^2 - c$, where a and c are any real numbers, as two linear factors using what you know about the difference of two squares.

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Assignment

Write

Complete each definition.

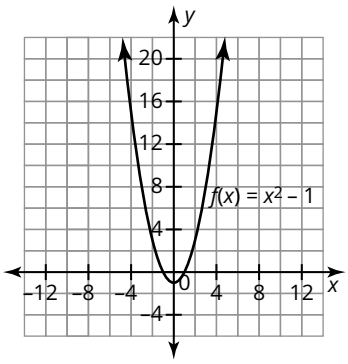
1. The Zero Product Property states that if the product of two or more factors is equal to _____, then at least one factor must be equal to _____.
2. Every positive number has both a _____ square root and a _____ square root.
3. The function $f(x) = x^2$ has a _____ at (0, 0).

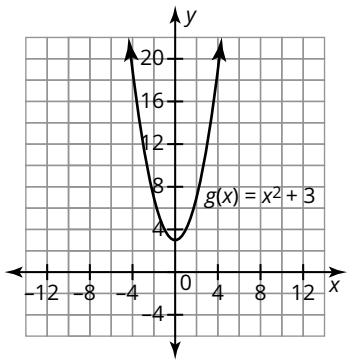
Remember

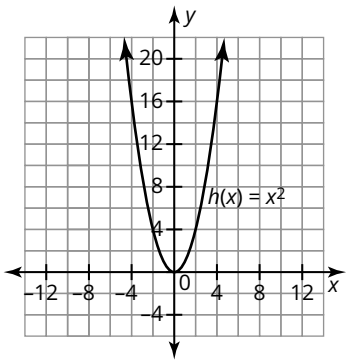
Any quadratic function of the form $f(x) = ax^2 - d$ can be rewritten as two linear factors in the form $(\sqrt{ax} - \sqrt{d})(\sqrt{ax} + \sqrt{d})$.

Practice

1. Determine the solutions for each equation. Identify the solutions on one of the graphs. Then, write the solutions in terms of their respective differences from the axis of symmetry.







a. $8 = x^2 + 3$ b. $7 = x^2$ c. $2 = x^2 - 1$

d. $x^2 = 11$ e. $x^2 + 9 = 13$ f. $14 = x^2 - 1$

2. Estimate the value of each radical expression. Then, rewrite each radical by extracting all perfect squares, if possible.

a. $\sqrt{21}$ b. $\sqrt{80}$ c. $\sqrt{63}$

d. $\sqrt{32}$ e. $\sqrt{98}$ f. $\sqrt{192}$

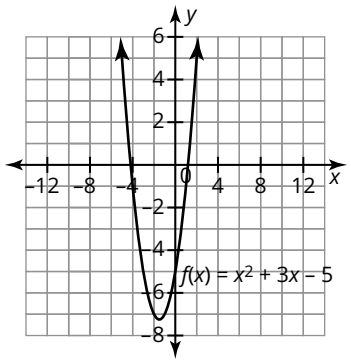
3. Rewrite each quadratic function as two linear factors using what you know about the difference of two squares.

a. $f(x) = 9x^2 - 16$ b. $f(x) = x^2 - 8$

c. $f(x) = 36x^2 - 1$ d. $f(x) = 25x^2 - 12$

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Stretch



1. Consider the graph of the function $f(x) = x^2 + 3x - 5$.
   a. Determine the solutions for the equation $x^2 + 3x - 5 = 5$. Identify the solutions on the graph.
   b. Rewrite the equation from part (a) so that the right side of the equation is 0. What do the solutions from part (a) represent in this new equation?
   c. Use your solutions from part (a) to write a product of two binomials, $(x - a)(x - b)$, where a and b are the solutions from part (a). How does this relate to the left side of the equation in part (b)?

Review

1. Identify the axis of symmetry of the graph of $f(x) = -5(x - 3)(x + 12)$.
2. Write a quadratic function in factored form to represent a parabola that opens downward and has zeros at $(-6, 0)$ and $(-2, 0)$.
3. Determine each product. Show your work.
   a. $(2x - 3)(4x + 7)$ b. $(3x + 5)\left(-\frac{1}{2}x + 16\right)$.
4. Write the equation of the function, $g(x)$, whose graph transforms the graph $f(x) = x^2 + 1$ by reflecting it across the x-axis, shifting it up 6 units, and shifting it to the left 4 units.
5. Graph the function, $g(x)$, whose graph transforms the graph $f(x) = (x - 4)^2$ by vertically stretching it by a factor of 2, reflecting it across the x-axis, and moving it to the left 3 units.

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3

Transforming Solutions

Solutions to Quadratic Equations in Vertex Form

Warm Up

Describe the transformations to the graph of the basic function $f(x) = x^2$ given each equation.

1. $y = (x - 4)^2$

2. $y = \frac{1}{2}(x + 1)^2$

3. $y = -(10 + x)^2 - 3$

4. $y = (8 + x)^2 + 1$

Learning Goals

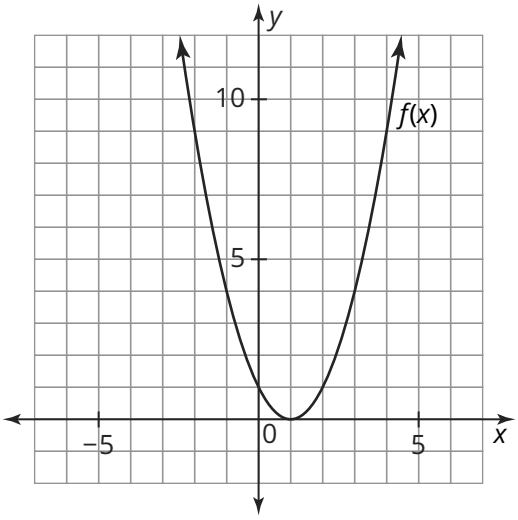
- Identify solutions to and roots of quadratic equations given in the form $f(x) = (x - c)^2$.
- Identify solutions to and roots of quadratic equations given in the form $f(x) = a(x - c)^2$.
- Identify solutions to and roots of quadratic equations given in the form $f(x) = a(x - c)^2 + d$.
- Identify zeros of quadratic functions written in vertex form.

You have explored transformations of quadratic functions and vertex form. How can you use vertex form and transformations to determine solutions to quadratic equations?

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Slide, Slide, Slippity Slide

The coordinate plane shows the graph of the function $f(x) = (x - 1)^2$.



1. **Describe the transformation applied to the basic function $f(x) = x^2$ that produces the graph of this function.**

Lindsay and Casey determined the zeros of the function $f(x) = (x - 1)^2$ algebraically in different ways.

Lindsay

$$0 = (x - 1)^2$$

$$0 = (x - 1)(x - 1)$$

The Zero Product Property says that one or both of the factors is equal to 0.

So, $x = 1$.

The equation has a double root at $x = 1$.

Casey

$$(x - 1)^2 = 0$$

$$\sqrt{(x - 1)^2} = \sqrt{0}$$

$$\pm(x - 1) = 0$$

$+(x - 1) = 0$ | $-(x - 1) = 0$

$x = 1$ | $-x + 1 = 0$

$-x = -1$

$x = 1$

The only unique solution for $y = 0$ is $x = 1$.

2. **How can you use Lindsay's or Casey's work to write solutions to the function in terms of their respective distances from the axis of symmetry?**

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ACTIVITY
3.1 Solutions for Horizontal Translations

You have used graphs to solve equations. In this activity, you will use the graph of a quadratic equation to determine its solutions.

Remember:

Solving $(x - 1)^2 = 9$ on a graph means locating where $y = (x - 1)^2$ intersects with $y = 9$.

Worked Example

Consider the equation $(x - 1)^2 = 9$.
You can use the Properties of Equality to determine the solutions to an equation in this form.
First take the square root of both sides of the equation and then isolate x.

$$(x - 1)^2 = 9$$
$$\sqrt{(x - 1)^2} = \sqrt{9}$$
$$x - 1 = \pm 3$$
$$x = 1 \pm 3$$

1. Consider the graph of $y = (x - 1)^2$ in the Getting Started.

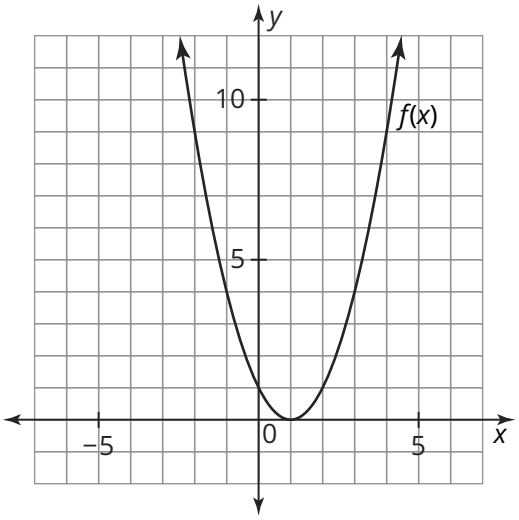
a. Graph the equation $y = 9$ on the same graph.

b. Show the solutions on the graph. Interpret the solutions 1 ± 3 in terms of the axis of symmetry and the points on the parabola $y = (x - 1)^2$.

c. What are the solutions to the equation $(x - 1)^2 = 9$?

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2. For each equation, show the solutions on the graph and interpret the solutions in terms of the axis of symmetry and the points on the parabola. Then write the solutions.



a. $(x - 1)^2 = 4$

b. $(x - 1)^2 = 5$

3. Determine the exact and approximate solutions for each of the given equations.

a. $(r + 8)^2 = 83$

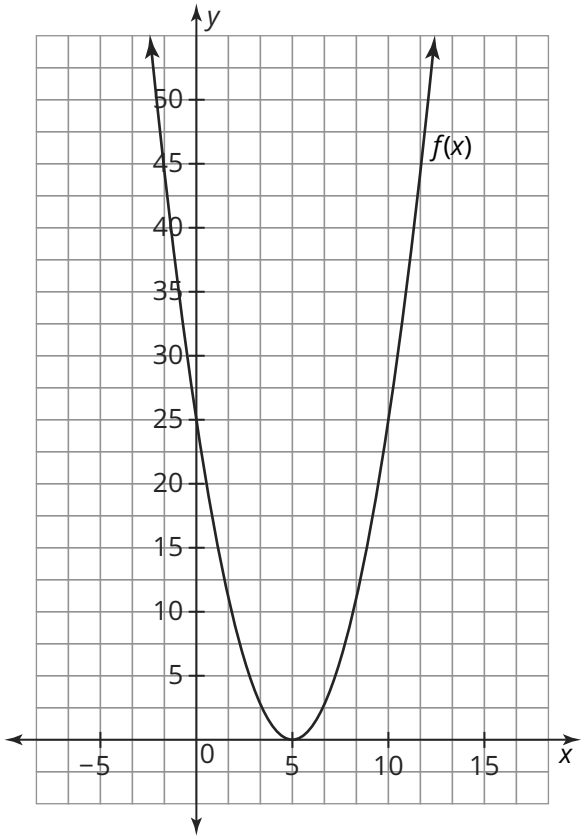
b. $(17 - d)^2 = 55$

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ACTIVITY
3.2 Solutions for Vertical Dilations

You have seen how to solve an equation for a quadratic function in the form $f(x) = (x - c)^2$, which represents a horizontal translation of the function. In this activity, you will consider quadratic equations with an additional vertical dilation. First, let's start with just a horizontal translation.

1. Consider the function $f(x) = (x - 5)^2$.



a. Determine the solutions to $0 = (x - 5)^2$. Solve algebraically and label the solution on the graph.

b. Interpret your solutions in terms of the axis of symmetry and the parabola $y = (x - 5)^2$.

c. Describe the zeros of this function.

Now let's add a dilation factor.

2. Consider the function $g(x) = 2(x - 5)^2$.

a. Write $g(x)$ in terms of $f(x)$ and describe the transformation.

b. Sketch a graph on the same coordinate plane as $f(x)$.

c. How have the zeros changed from $f(x)$ to $g(x)$?

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3. Parker formulated a conjecture about how the solutions of the transformed quadratic equation change from the original equation.

The solutions of the original function are $x = 5 \pm \sqrt{y}$, so the solutions to the transformed equation will be $x = 5 \pm 2\sqrt{y}$.

Is Parker correct? If so, explain why. If not, describe the correct solutions for the transformed quadratic equation.

4. Make a conjecture. How does changing the sign of the *a*-value affect the solutions to the quadratic equations in this form?

5. Solve each quadratic equation. Give both exact and approximate solutions.

a. $(x - 4)^2 = 2$ **b.** $2(x - 1)^2 = 18$ **c.** $-2(x - 1)^2 = -18$

d. $4(x + 5)^2 = 21$ **e.** $-\frac{1}{2}(x + 8)^2 = -32$ **f.** $\frac{2}{3}(12 - x)^2 = 1$

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ACTIVITY
3.3
Solutions for Vertical Translations

You have determined solutions to quadratic equations, given an equation in the form $f(x) = a(x - c)^2$. How can you solve a quadratic equation that also includes a vertical translation in the form $f(x) = a(x - c)^2 + d$?

Remember:

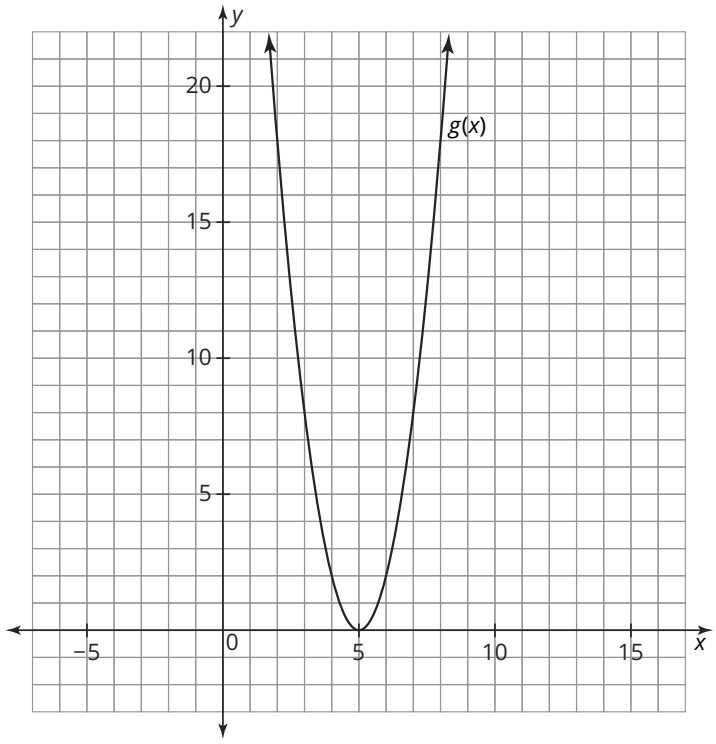
A quadratic function in vertex form is written $f(x) = a(x - k)^2 + h$.

The graph of $g(x) = 2(x - 5)^2$ is shown. You know that the solution to the equation $0 = 2(x - 5)^2$ is $x = 5$.

1. Consider the function $h(x) = 2(x - 5)^2 - 1$.

a. Write $h(x)$ in terms of $g(x)$ and describe the transformation.

b. Sketch a graph of $h(x)$ on the same coordinate plane as $g(x)$.



2. Consider the equation $0 = 2(x - 5)^2 - 1$.

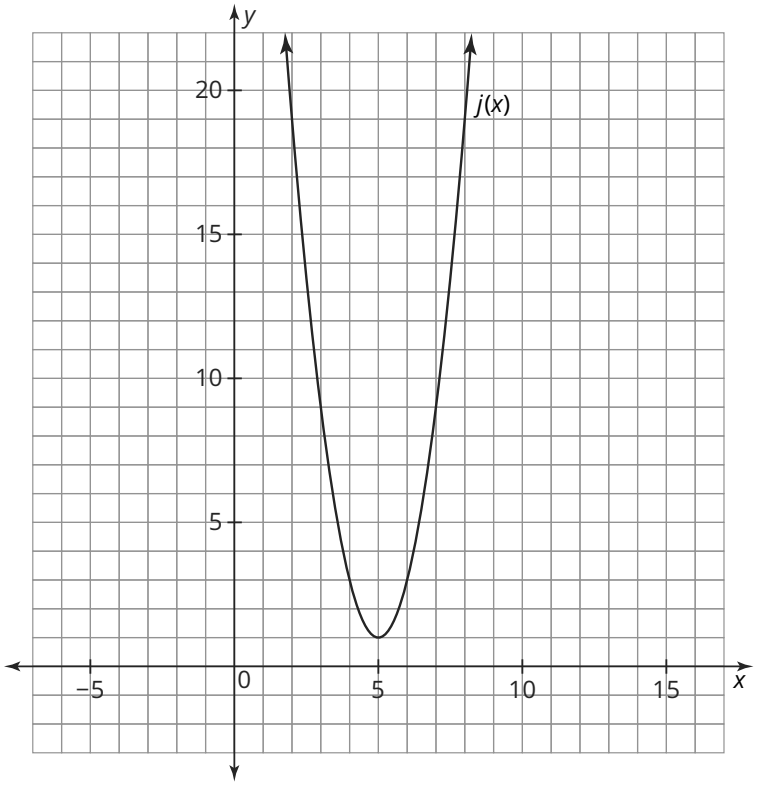
a. Determine the solution algebraically and label the solution on the graph.

b. Interpret the solutions in terms of the axis of symmetry and the parabola $y = 2(x - 5)^2 - 1$.

c. Describe the zeros of this function.

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Now, let's investigate the effect of an equation in the form $f(x) = a(x - c)^2 + d$, where $a > 0$ and $d > 0$. Consider the function $j(x) = 2(x - 5)^2 + 1$ graphed as shown.



Notice the graph of $j(x)$ does not cross the x-axis, which means there are no real zeros for this function.

3. Solve $0 = 2(x - 5)^2 + 1$ algebraically to show that x is not a real number.

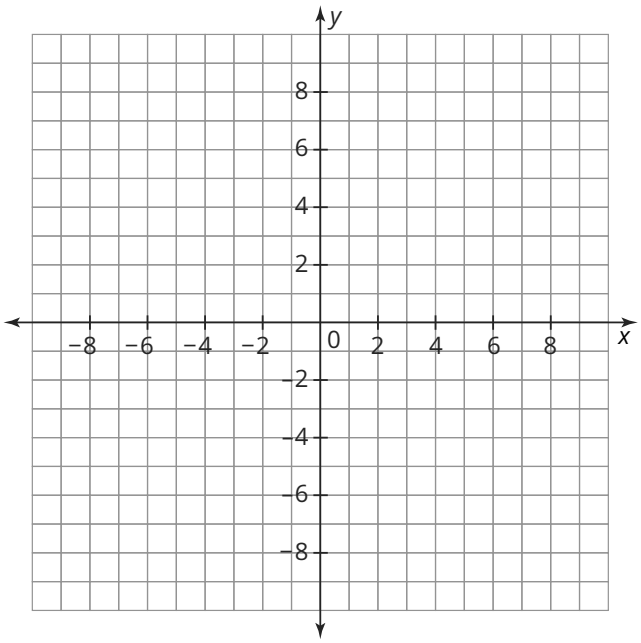
While there are no real zeros in this function, there is another type of zero you will learn about later in this topic.

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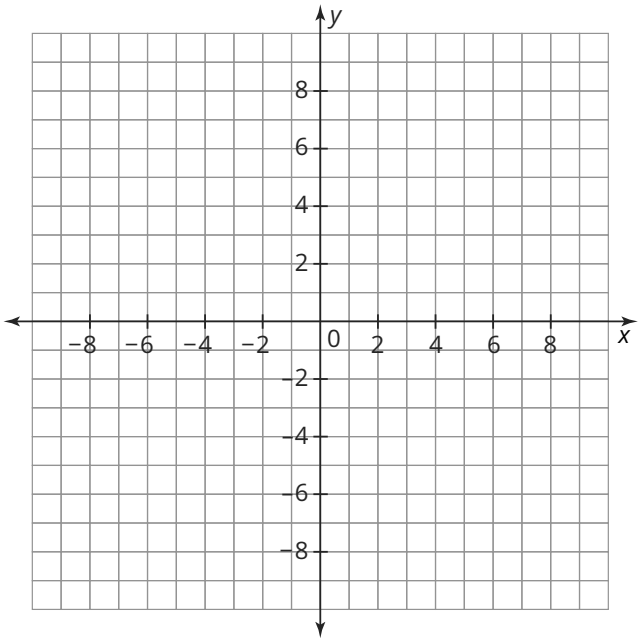
4. **Sketch a graph of each quadratic function. Determine the types of zeros of each function. Solve algebraically and interpret on the graph in terms of the axis of symmetry and the points on the parabola.**

A quadratic function can have 1 unique real zero, 2 real zeros, or no real zeros.

a. $f(x) = -3(x - 2)^2 + 4$



b. $f(x) = \frac{1}{4}(x + 5)^2 + 2$



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NOTES

TALK the TALK

Spell It Out

1. **Describe the solution of any quadratic equation in the form $(x - c)^2 = 0$.**

2. **Describe the solution of any quadratic equation in the form $(x - c)^2 + d = 0$.**

3. **Describe the solution of any quadratic equation in the form $a(x - c)^2 + d = 0$.**

4. **Write an equation and sketch a graph that shows each number of zeros.**

   a. **1 unique real zero**

   b. **2 real zeros**

   c. **no real zeros**

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Assignment

Write

Describe the number of possible real zeros for any quadratic function.

Remember

The solutions to a quadratic equation can be represented as the axis of symmetry plus or minus its distance to the parabola.

Practice

1. Sketch a graph of each quadratic function. Determine the zeros of each function and write each in terms of the axis of symmetry and its distance to the parabola.
   a. $f(x) = (x - 3)^2$
   b. $f(x) = (x + 5)^2$
   c. $f(x) = \left(x - \frac{1}{2}\right)^2$
   d. $f(x) = (x - 6)^2$
   e. $f(x) = \left(x + \frac{15}{7}\right)^2$
   f. $f(x) = (x + 7)^2$

2. Sketch a graph of each quadratic function. Determine the zeros of each function and write in terms of the axis of symmetry and its distance to the parabola.
   a. $f(x) = 2(x - 1)^2 - 1$
   b. $f(x) = \frac{1}{2}(x + 2)^2 - 5$
   c. $f(x) = 4\left(x + \frac{1}{3}\right)^2 - 1$
   d. $f(x) = -3(x - 6)^2$
   e. $f(x) = \frac{3}{4}(x + 5)^2 - \frac{2}{3}$
   f. $f(x) = (x - 4)^2 - 2$

Stretch

A quadratic function has zeros at $x = -2 \pm \sqrt{15}$. Write the function in general form. Show your work.

Review

1. Use the given characteristics to write a function $R(x)$ in vertex form. Then, sketch the graph of $R(x)$ and the basic function $f(x) = x^2$ on a coordinate plane.
   a. The function has an absolute maximum, is vertically dilated by a factor of $\frac{1}{3}$, and is translated 8 units down and 4 units to the left.
   b. The function has an absolute minimum, is vertically dilated by a factor of 4, and is translated 2 units up and 6 units to the right.
2. Estimate the value of the radical expression $\sqrt{54}$. Then, rewrite the radical by extracting all perfect squares, if possible.
3. Rewrite the quadratic function, $f(x) = 16x^2 - 3$, as the product of linear factors.
4. Identify the form of each quadratic equation. Then identify what characteristic of the function can be determined by the structure of the equation.
   a. $y = (x - 7)(x + 5)$
   b. $y = -3(x + 1)^2 - 4$

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Precalculus

1

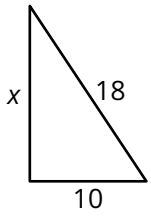
The Deriving Force

Deriving the Triangle Area Formula, the Law of Sines, and the Law of Cosines

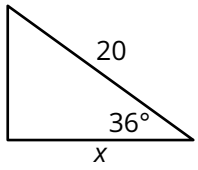
Warm Up

Solve for x in each right triangle.

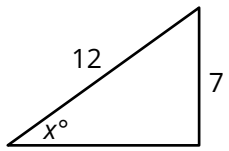
1.



2.



3.



Learning Goals

- Derive the formula for the area of a triangle using the sine function.
- Derive the Law of Sines.
- Derive the Law of Cosines.
- Use trigonometric ratios, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines in applied problems involving right triangles and other triangles.

Key Terms

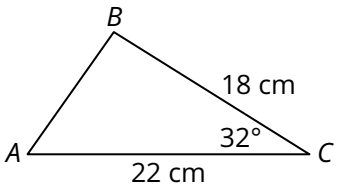
- Law of Sines
- Law of Cosines

You have explored the trigonometric ratios that exist between the side lengths of right triangles. How can these ratios be used to determine unknown side lengths or angle measures of triangles that are *not* right triangles?

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That's Not Right!

Whether you are determining the area of a right triangle, solving for the unknown side lengths of a right triangle, or solving for the unknown angle measurements in a right triangle, the solution paths are fairly straightforward. You can use what you learned previously, such as the area formula for a triangle, the Pythagorean Theorem, and the Triangle Sum Theorem.



1. Consider △*ABC* as shown.

a. Can you use the area formula to determine the area of the triangle? Explain your reasoning.

b. Can you use the Pythagorean Theorem to determine the unknown length of the triangle? Explain your reasoning.

c. Can you use the Triangle Sum Theorem to determine the unknown angle measurements? Explain your reasoning.

2. How could you calculate the area of △*ABC*?

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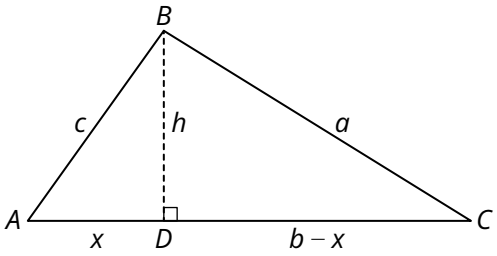
ACTIVITY
1.1

Deriving Another Version of the Area Formula

Solving for unknown measurements of sides or angles of a triangle becomes more involved if the given triangle is not a right triangle.

In this lesson, you will explore how trigonometric ratios are useful when determining the area of any triangle, solving for unknown side lengths of any triangle, and solving for unknown angle measures in any triangle.

1. Analyze $\triangle ABC$.



a. Write the formula for the area of $\triangle ABC$ in terms of b and h.

b. Write the ratio that represents sin C and solve for the height, h.

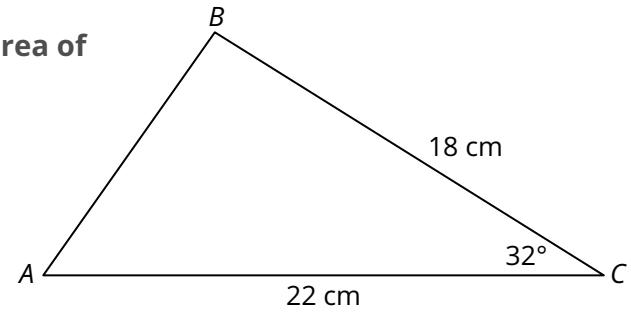
c. Rewrite the formula you wrote for the area of $\triangle ABC$ in part (a) by substituting the expression for the value of h from part (b).

Remember:

The sine of an angle in a right triangle is the ratio of the length of the opposite side to the length of the hypotenuse.

The area formula $A = \frac{1}{2}ab \cdot \sin C$ can be used to determine the area of any triangle if you know the lengths of two sides and the measure of the included angle.

2. Use a trigonometric ratio to determine the area of the triangle.

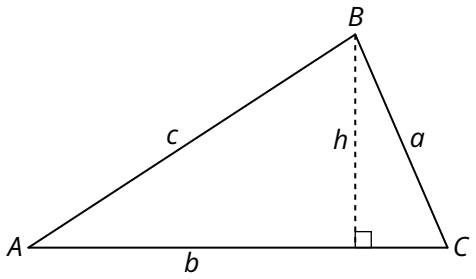


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ACTIVITY
1.2 Deriving the Law of Sines

You have used the trigonometric ratios to solve for unknown side lengths and angle measures in right triangles. Let's explore relationships between side lengths and angle measures in any triangle.

1. Analyze $\triangle ABC$ with height h.



a. Write a ratio to represent sin A, and then solve for the height, h.

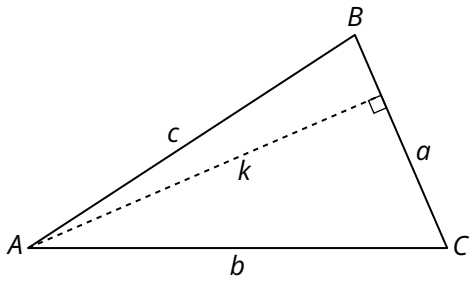
b. Consider the right triangle with C as a vertex and h as a side. Write a ratio that represents sin C, and then solve for the height, h.

c. What can you conclude about the relationship between $c \cdot \sin A$ and $a \cdot \sin C$?

d. Express $c \cdot \sin A = a \cdot \sin C$ as a proportion by dividing both sides of the equation by ac.

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2. **Analyze $\triangle ABC$ using height k.**



   a. **Write a ratio that represents sin B, and then solve for the height, k.**

   b. **Write a ratio that represents sin C, and then solve for the height, k.**

   c. **What can you conclude about the relationship between $c \cdot \sin B$ and $b \cdot \sin C$?**

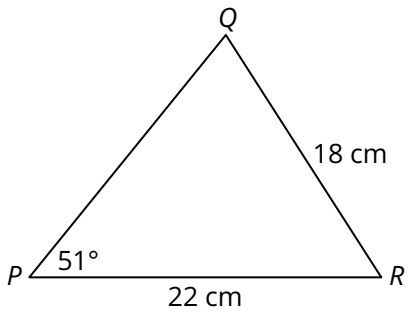
   d. **Express $c \cdot \sin B = b \cdot \sin C$ as a proportion by dividing both sides of the equation by bc.**

3. **Derive the *Law of Sines* by combining the proportions formed in Question 1, part (d) and Question 2, part (d).**

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The **Law of Sines**, or $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$, can be used to determine the unknown side lengths or the unknown angle measures in *any* triangle.

4. Use the Law of Sines to determine the measure of $\angle Q$.





5. In $\triangle ABC$, side c measures 35 inches, side b measures 28 inches, and $m\angle B = 40°$. Taggert calculated $m\angle C$ as shown.

$$\frac{\sin 40}{28} = \frac{\sin C}{35}$$
$$35 \cdot \sin 40 = 28 \cdot \sin C$$
$$22.5 \approx 28 \cdot \sin C$$
$$\sin C \approx 0.8 \text{ and } \sin^{-1} C \approx 53.1°$$

Since $180° - 53.1° = 126.9°$, the measure of angle C could be 53.1° or 126.9°.

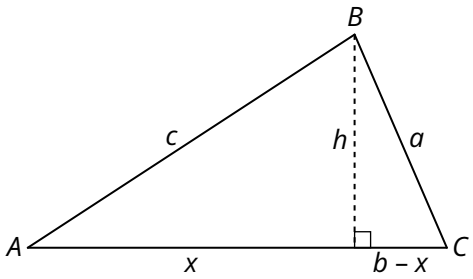
Is Taggert correct? Use a drawing to justify your reasoning.

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ACTIVITY
1.3 Deriving the Law of Cosines

The Law of Sines is one relationship between the side lengths and angle measures of any triangle. Another relationship is called the *Law of Cosines*.

1. Analyze $\triangle ABC$.



a. Write a ratio that represents sin *A*, and then solve for the height, *h*.

b. Write a ratio that represents cos *A*, and then solve for *x*.

c. Solve for a^2 using the Pythagorean Theorem.

d. Substitute the expressions for *h* and *x* into the equation in part (c).

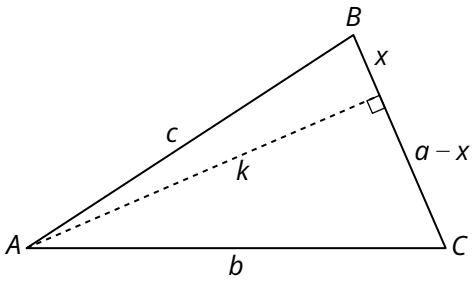
e. Use algebraic properties to rewrite the equation you wrote in part (d).

Remember:

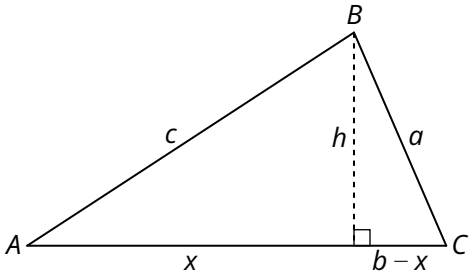
The Pythagorean identity states that $\sin^2\theta + \cos^2\theta = 1$. The symbol θ represents an angle measure.

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2. **Repeat the steps in Question 1 to solve for b^2.**



3. **Repeat the steps in Question 1 to solve for c^2.**



The **Law of Cosines**, or

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$
$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$
$$c^2 = a^2 + b^2 - 2ab \cdot \cos C$$

can be used to determine the unknown lengths of sides or the unknown measures of angles in *any* triangle.

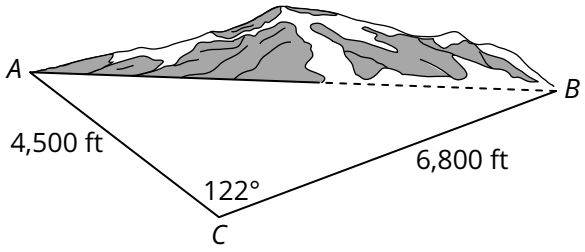
4. **Why is the Pythagorean Theorem considered to be a special case of the Law of Cosines?**

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ACTIVITY
1.4 Applying Trigonometric Laws

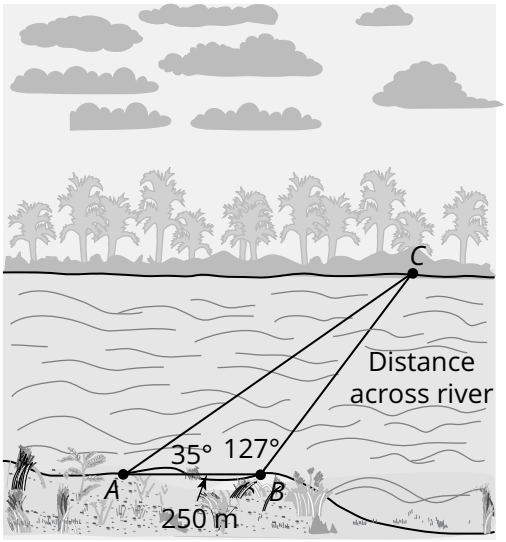
A surveyor was hired to determine the approximate length of a proposed tunnel, which will be necessary to complete a new highway. A mountain stretches from point *A* to point *B* as shown. The surveyor stands at point *C* and measures the distance from where she is standing to both points *A* and *B*, then measures the angle formed between these two distances.

1. **Use the surveyor's measurements to determine the length of the proposed tunnel.**



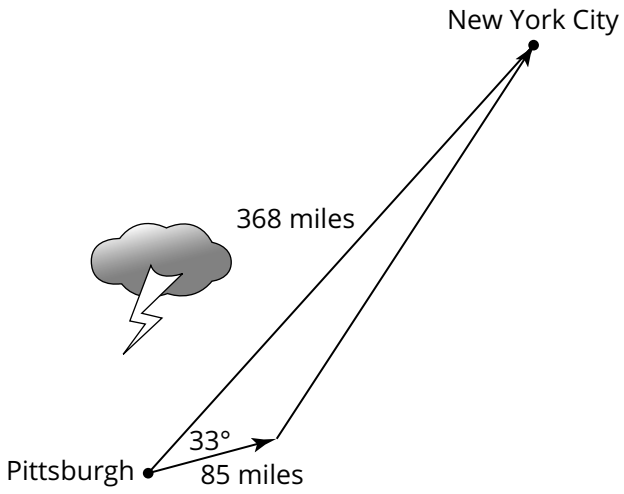
2. **A nature lover decides to use geometry to determine whether she can swim across a river. She locates two points, *A* and *B*, along one side of the river and determines the distance between these points is 250 meters. She then spots a point *C* on the other side of the river and measures the angles formed using point *C* to point *A* and then point *C* to point *B*. She determines the measure of the angle whose vertex is located at point *A* to be 35° and the angle whose vertex is located at point *B* to be 127° as shown.**

   How did she determine the distance across the river from point *B* to point *C*, and what is that distance?



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3. **A typical direct flight from Pittsburgh, Pennsylvania, to New York City is approximately 368 miles. A pilot alters the course of his aircraft 33° for 85 miles to avoid a storm and then turns the aircraft heading straight for New York City, as shown.**



   a. **How many additional miles did the aircraft travel to avoid the storm?**

   b. **If a commercial jet burns an average of 11.875 liters per kilometer, and the cost of jet fuel is $3.16 per gallon, how much did this alteration in route cost the airline company?**

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NOTES

TALK the TALK

Lay Down the Law

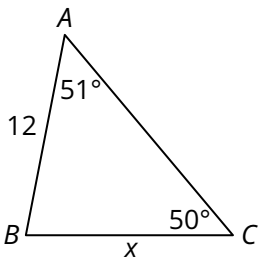
Each of the trigonometric laws you learned in this lesson is useful in determining unknown measures in any triangle, depending on which measures are known.

1. **When is the Law of Sines useful to determine unknown measures?**

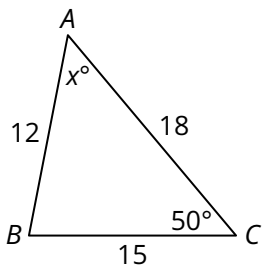
2. **When is the Law of Cosines useful to determine unknown measures?**

3. **For each triangle, state your strategy for solving for *x*—the Law of Sines or the Law of Cosines.**

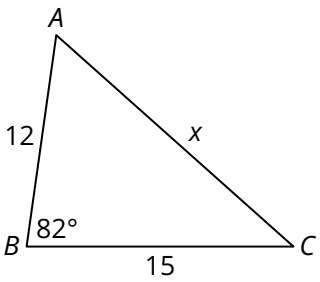
a.



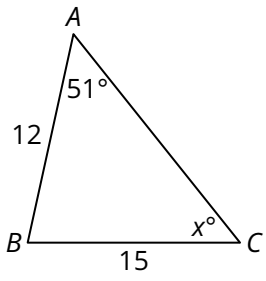
b.



c.



d.



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Assignment

Write

Define each term in your own words.

1. Law of Sines
2. Law of Cosines

Remember

The area formula $A = \frac{1}{2}ab \cdot \sin C$ can be used to determine the area of any triangle if you know the lengths of two sides and the measure of the included angle.

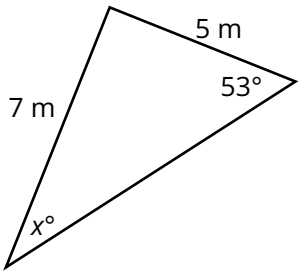
The Law of Sines can be used to determine the unknown side lengths or unknown angle measures in any triangle.

The Law of Cosines can be used to determine the unknown lengths of sides or the unknown measures of angles in any triangle.

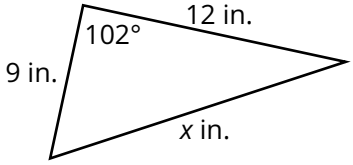
Practice

1. Solve for x in each triangle. Round each answer to the nearest tenth.

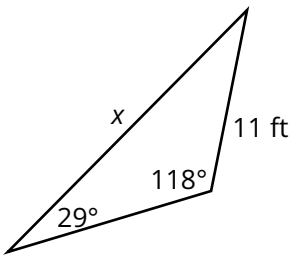
a.



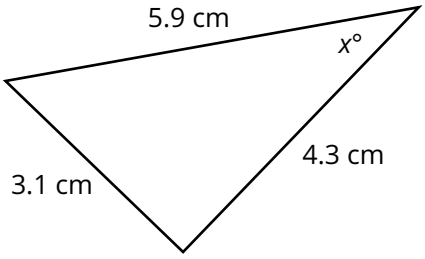
b.



c.

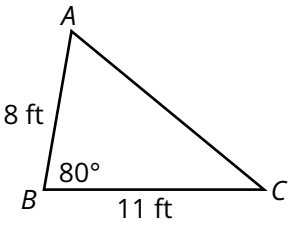


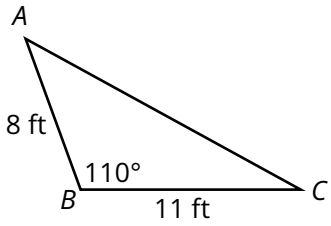
d.



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2. Emily and Joe are designing a fenced backyard play space for their children Max and Caroline. They start out by considering two designs for a triangular play space. They have made measurements in their yard and determined that either design would fit into the space that is available.

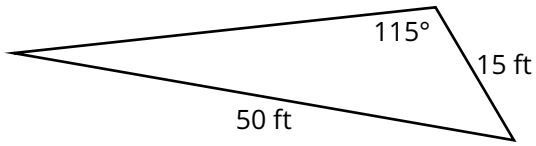




a. Explain how Emily and Joe can use trigonometry to calculate the area and perimeter of the possible play spaces.
b. Calculate the area of the play space for each design.
c. Calculate the perimeter of the play space for each design.
d. Which design do you think Emily and Joe should choose? Explain your reasoning.

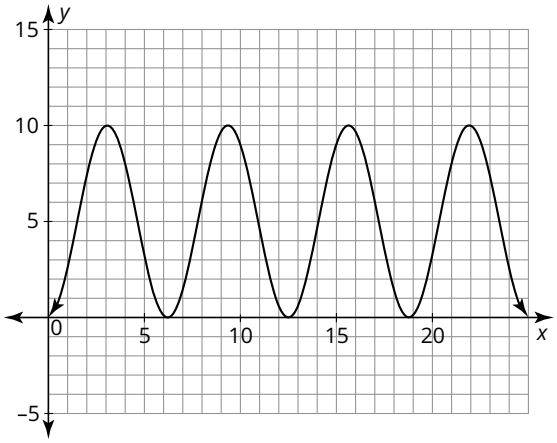
Stretch

1. Consider the triangle shown.



a. Determine the area of the triangle. Round your answer to the nearest tenth.
b. Determine the perimeter of the triangle. Round your answer to the nearest tenth.

2. Consider the graph shown.



a. Is the graph continuous or discrete?
b. Does the graph contain a maximum? If so, what is the maximum?
c. Does the graph contain a minimum? If so, what is the minimum?
d. Approximately where are the *x*-intercepts?
e. Where is the *y*-intercept?
f. Do you notice a pattern in the graph? Explain your reasoning.

Review

1. Compute each geometric series.

a. $\sum_{i=0}^{10} 2^i$

b. $\sum_{i=0}^{8} 5^{i-1}$

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2

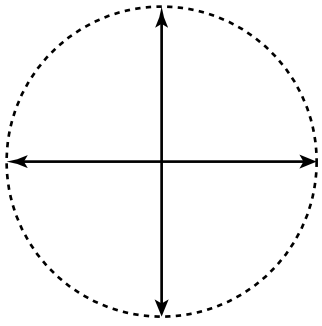
A Sense of Déjà Vu

Periodic Functions

Warm Up

Use a protractor and the axes to draw angles of the given measure in the circle.

1. 45°
2. 30°
3. 180°
4. 270°



Learning Goals

- Model a situation with a periodic function.
- Analyze the period and amplitude of a periodic function.
- Determine the period, amplitude, and midline of a periodic function.

Key Terms

- periodic function
- period
- standard position
- initial ray
- terminal ray
- amplitude
- midline

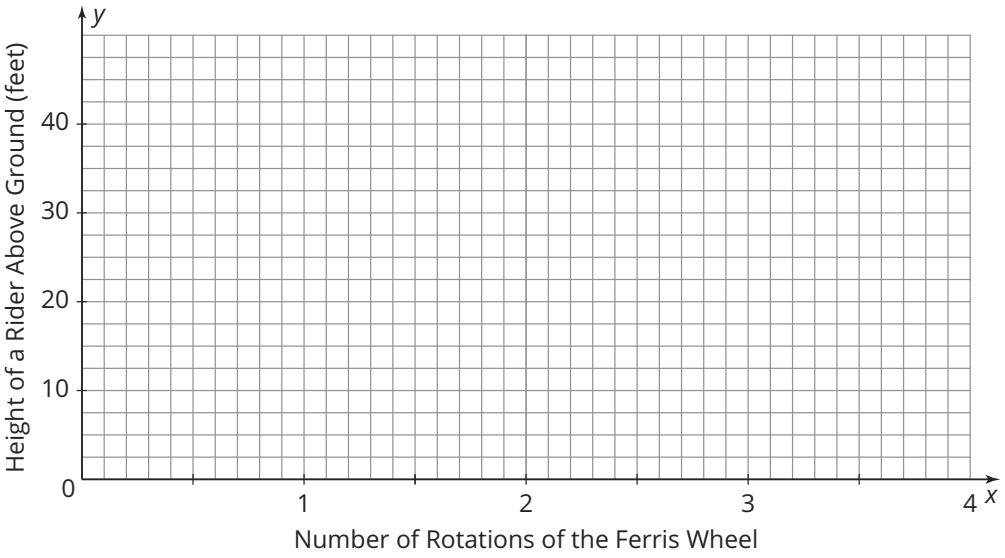
You have learned about many different types of functions. What functions can be defined using points on the circle as the domain?

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A Wheel Good Time

One of the most popular amusement park rides is the Ferris wheel. One Ferris wheel has a diameter of 50 feet. Riders board the cars at ground level, and the wheel moves counterclockwise. Each ride consists of four rotations, and you can assume that the Ferris wheel rotates at a constant rate.

1. **Create a sketch to model the height of a rider above ground with respect to the number of rotations of the Ferris wheel. Include 4 rotations.**



Think about:

Imagine yourself on this Ferris wheel. When will you be on the ground, and when will you be 50 feet above the ground?

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2. **Compete the table to represent the height of a rider above ground as a function of the number of rotations of the Ferris wheel.**

Rotations of the Ferris Wheel	Height of a Rider Above Ground (feet)
0	
$\frac{1}{8}$	
$\frac{1}{4}$	
$\frac{3}{8}$	
$\frac{1}{2}$	
$\frac{5}{8}$	
$\frac{3}{4}$	
$\frac{7}{8}$	
1	

Ask yourself:

What adjustments can you make to your sketch of this situation after completing the table of values?

3. **Describe the characteristics of your graph.**

4. **What do you notice about the shape of the graph for each rotation?**

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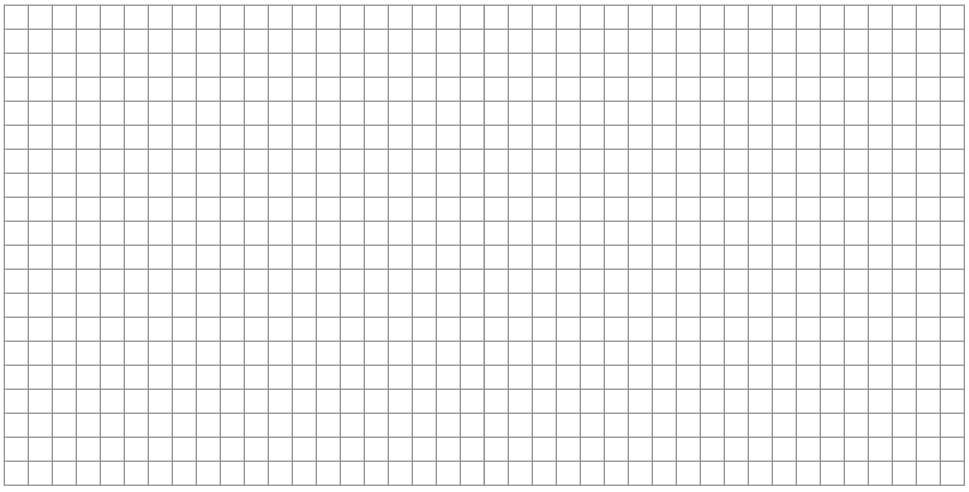
ACTIVITY
2.1 The Underground Ferris Wheel

To model the height of a rider above ground on the Ferris wheel, you used a *periodic function.* A **periodic function** is a function whose values repeat over regular intervals. The **period** of a periodic function is the length of the smallest interval over which the function repeats.

1. **Describe the period of the function that models the height of a rider above ground on the Ferris wheel.**

At a different amusement park, a Ferris wheel was designed so that half of the wheel is actually below the ground. The diameter of this underground Ferris wheel is still 50 feet. The top of the ride reaches 25 feet above ground and the bottom of the ride reaches 25 feet below ground. Riders board the cars at ground level to the right, and the Ferris wheel moves counterclockwise.

2. **Create a sketch to model the height of a rider above ground with respect to the number of rotations of the underground Ferris wheel. Include 4 rotations.**



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3. **Complete the table to represent the height of a rider above ground as a function of the number of rotations of the underground Ferris wheel.**

Rotations of the Ferris Wheel	Height of a Rider Above Ground (feet)
0	
$\frac{1}{8}$	
$\frac{1}{4}$	
$\frac{3}{8}$	
$\frac{1}{2}$	
$\frac{5}{8}$	
$\frac{3}{4}$	
$\frac{7}{8}$	
1	

4. **Describe the characteristics of your graph.**

5. **Describe the period of the function that models the height of a rider above ground on the underground Ferris wheel.**

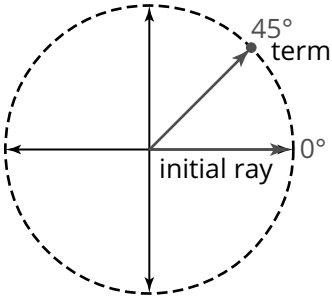
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ACTIVITY
2.2 Periodic Functions

In the last two activities, you modeled the height of a rider above ground as a function of the number of rotations of two different Ferris wheels. You can also model the height of a rider as a function using angle measures.

An angle is in **standard position** when the vertex is at the origin and one ray of the angle is on the *x*-axis. The ray on the *x*-axis is the **initial ray**, and the other ray is the **terminal ray**.

1. **Use the graph on the next page and complete the steps shown to build a periodic function to model the underground Ferris wheel scenario. The position of the car is the intersection of the terminal ray and the circle.**

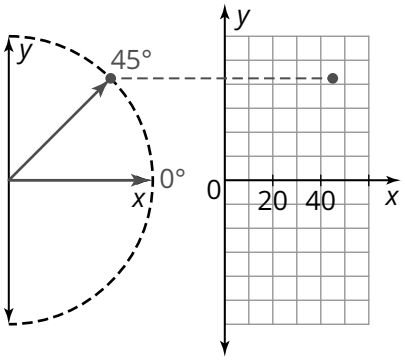


Step 1: Analyze each axis label.

Step 2: Measure a 45° angle in standard position.

Mark and label a point on the Ferris wheel as shown.

The measure of an angle in standard position is the amount of rotation from the initial ray to the terminal ray. When the rotation is counterclockwise, the angle measure is positive. When the rotation is clockwise, the angle measure is negative.



Step 3: Use a straightedge to line up the point on the Ferris wheel with the appropriate location on the coordinate plane. Plot the point.

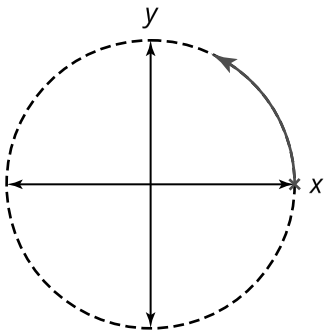
Step 4: Repeat Steps 2 and 3 for each angle measure: 0°, 30°, 60°, 90°, 180°, 270°, 360°.

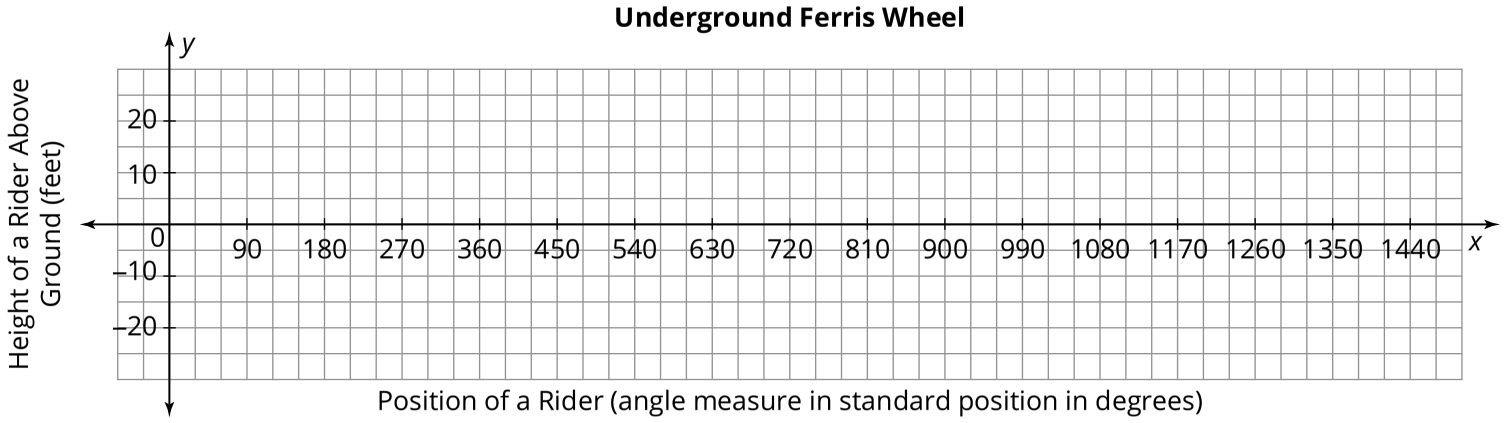
Step 5: Draw a smooth curve to connect the points of your graph.

Step 6: Continue the curve to represent angle measures greater than 360°.

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2. **Determine the period of the function you graphed. What does this value represent in terms of this problem situation?**

3. **Determine any maximum or minimum values of your graph. What does each value represent in terms of this problem situation?**



You can describe angle measures greater than 360°.

4. **At certain angle measures, a rider is at the highest or lowest point.**

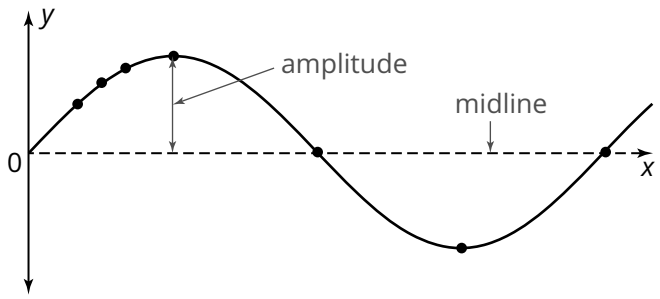
   a. **List 4 angle measures associated with a rider being at the highest point.**

   b. **List 4 angle measures associated with a rider being at the lowest point.**

5. **Describe the symmetries you see in the graph of the function. Explain how these are related to the symmetries associated with the Ferris wheel.**

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The graphs of periodic functions have characteristics that are given special names, such as *amplitude* and *midline.*



The **amplitude** of a periodic function is one-half the absolute value of the difference between the maximum and minimum values of the function.

The **midline** of a periodic function is a reference line whose equation is the average of the minimum and maximum values of the function.

6. Determine the amplitude of each function you graphed in this lesson. Show your work.

7. Identify the midline of each function you graphed in this lesson.

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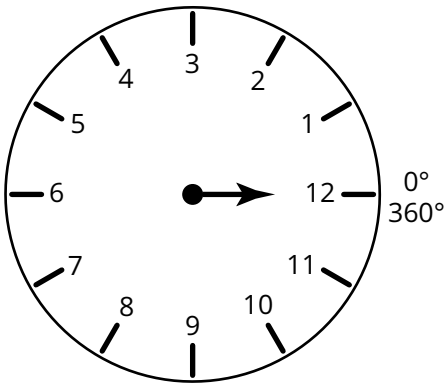
NOTES

TALK the TALK

Rock. Around. The Clock Tonight.

Consider a typical day in the life of you. What do you do every day? At what time?

1. **Plot at least 5 of your daily events and their hours on the altered clock shown.**

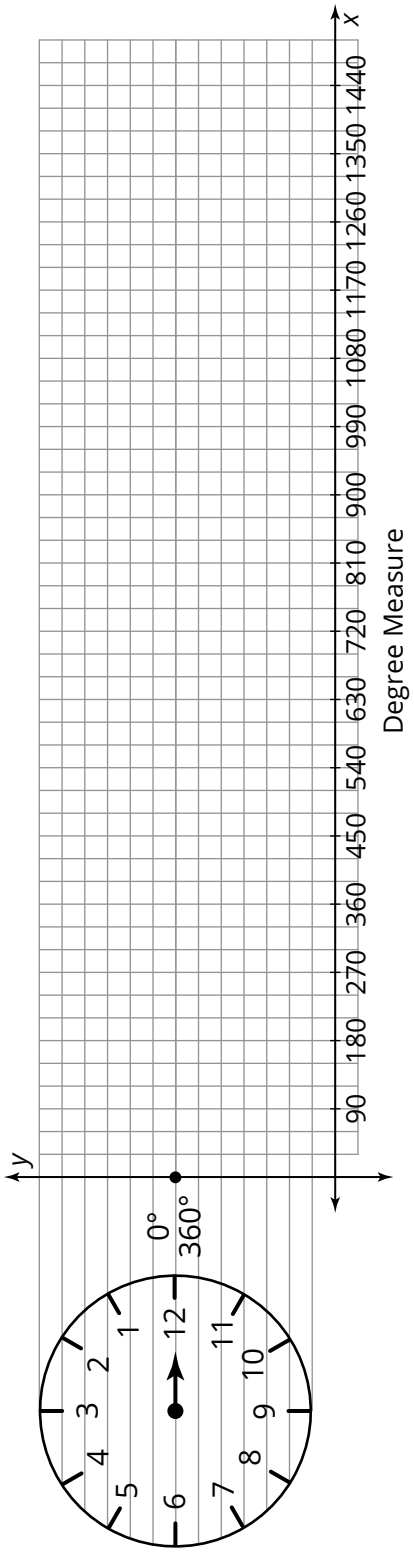


2. **Determine the degree measures of each of your events, using 0° to represent 12:00 midnight and 360° to represent 12:00 noon.**

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NOTES

3. Graph the curve using the same method you used in Activity 1.2. Then, plot your events on the graph. The first point has been plotted for you.



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NOTES

4. **Compare your graphs with your classmates' graphs.**

   a. **What do you notice?**

   b. **How do you distinguish between AM and PM on your graph?**

   c. **How can you tell from your graph whether an event happened at 8:00 or 10:00?**

   d. **How can you tell from your graph when an event happens at the same time every day?**

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Assignment

Write

Write the term that best completes each statement.

1. The terminal ray of an angle in standard position is the ray with its endpoint at the origin that is not the _____.
2. The _____ of a periodic function is one half the absolute value of the difference between the maximum and minimum values of the function.
3. An angle is in _____ when the vertex is at the origin and one ray of the angle is on the *x*-axis.
4. A _____ is a function whose values repeat over regular intervals.
5. The _____ of a periodic function is a reference line whose equation is the average of the minimum and maximum values of the function.
6. The _____ of a periodic function is the length of the smallest interval over which the function repeats.
7. The measure of an angle in standard position is the amount of rotation from the initial ray to the _____.

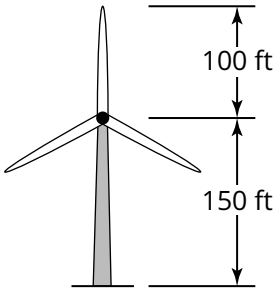
Remember

A periodic function is a function whose values repeat over regular intervals. The period of a periodic function is the length of the smallest interval over which the function repeats.

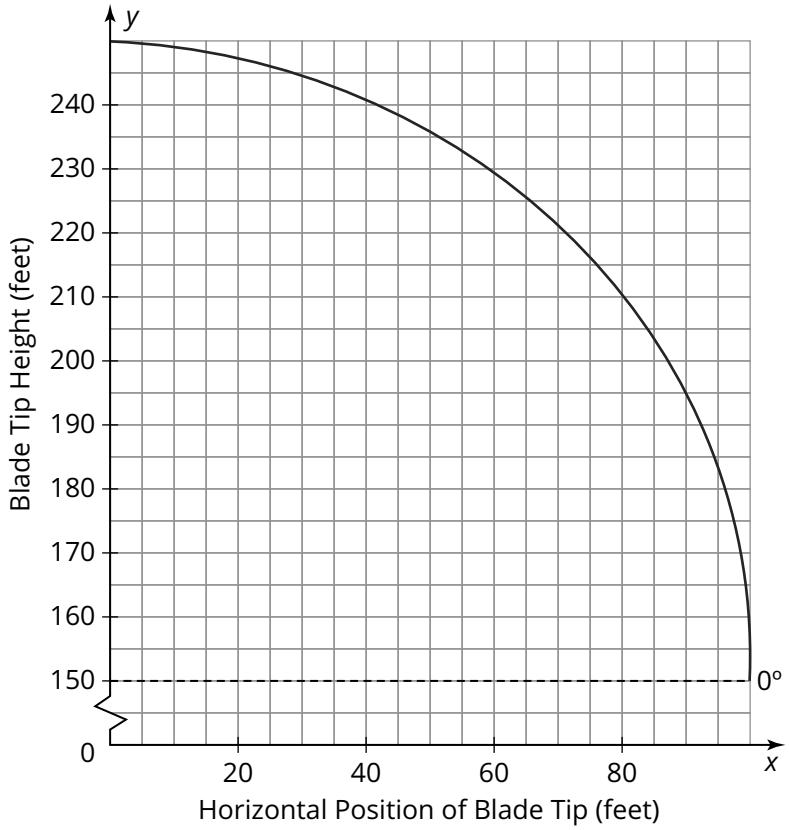
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Practice

1. Wind turbines harness the power of the wind to generate electricity.
   One particular wind turbine consists of three 100-foot-long rotor blades that rotate around the top of a 150-foot vertical shaft.



   a. Use a protractor, a straightedge, and the given graph to estimate the height of the blade tip when the blade is at angles of 0°, 30°, 45°, 60° and 90°. The arc on the graph represents a portion of the blade tip's path. Assume the blade rotates counterclockwise and the blade is at an angle of 0° when the blade tip is directly to the right of the top of the vertical shaft. This position has been labeled as 0° on the graph.

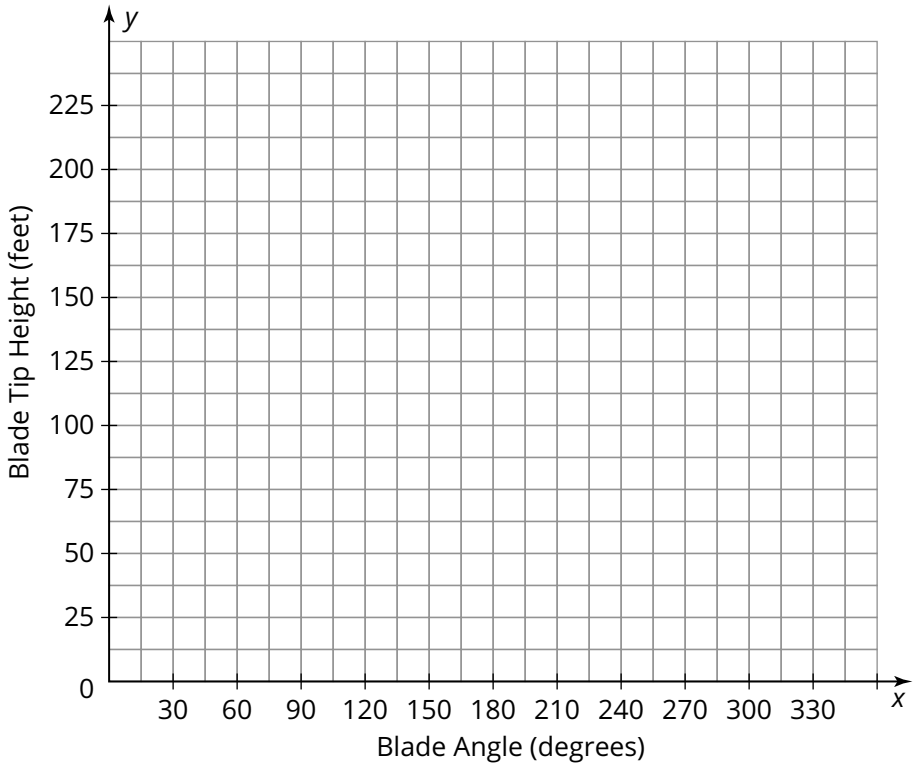


   b. Complete the table using your knowledge of the symmetry of circles.

Blade Angle	120°	135°	150°	180°	210°	225°	240°	270°	300°	315°	330°
Tip Height (feet)											

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c. Graph the blade tip height as a function of the blade angle.



d. Determine the equation of the midline for the periodic function you graphed in part (c). Sketch and label the midline as a dashed line on the graph in part (c).

e. Determine the amplitude of the function you graphed in part (c). Explain your reasoning.

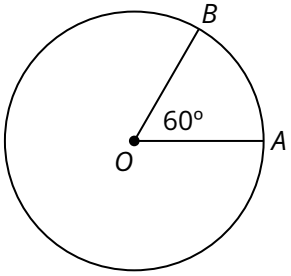
f. Determine the period of the function you graphed in part (c). Explain your reasoning.

g. Determine the height of the blade tip when the blade angle is 570°. Explain your reasoning.

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Stretch

1. The circle with center *O* has a radius of 1 unit.
   a. Determine the arc length *AB*.
   b. Determine the ratio of the arc length to the radius of the circle.
   c. The ratio of the arc length to the radius of the circle is the measure of the central angle in radians. Determine the measure of a central angle of 135° in radians.



Review

1. The following rules are used to create a certain fractal, the Cantor set.

   Stage 0: Begin with a line segment.

   Stage 1: Divide the line segment into thirds and then erase the middle third.

   Stages 2 and up: Repeat Stage 1 for the line segments in the figure.

   a. Complete Stage 2 of the fractal. Stage 0 and Stage 1 are given.

   Stage 0 _____

   Stage 1 _____ _____

   Stage 2

   b. Determine the total length of the line segments at each stage and complete the table. The length of the initial line segment in Stage 0 is 1 in.

   c. Identify the type of sequence represented by the total length of the line segments at Stage *n*.

   d. Write a function to represent the total length of the line segments as a function of the stage, *n*. Describe the type of function you used.

Stage	Total Length of Line Segments (in.)
0	
1	
2	
3	
4	
5	
n	

2. The following rules are used to create a certain fractal, the von Koch curve.

   Stage 0: Begin with a line segment.

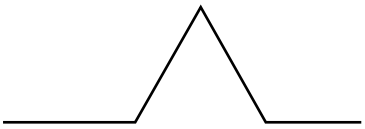
   Stage 1: Replace the middle segment with an equilateral triangle, and remove the side of the triangle corresponding to the initial straight line.

   Stages 2 and up: Repeat Stage 1 for the line segments in the figure.

   a. Complete Stage 2 of the fractal. Stage 0 and Stage 1 are given.

   Stage 0 _____

   Stage 1



   b. Determine the number of line segments at each stage and complete the table.

   c. Identify the type of sequence represented by the number of line segments at Stage *n*.

   d. Write a function to represent the number of line segments as a function of the stage, *n*. Describe the type of function you used.

Stage	Number of Line Segments
0	
1	
2	
3	
4	
5	
n	

3. Identify the number of real zeros of each polynomial.

   a. $2x^4 + x^3 + 3x^2 + 3x - 9 = 0$

   b. $x^5 + 2x^4 + 11x^3 + 22x^2 + 24x + 48 = 0$

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3

The Knights of the Round Table

Radian Measure

Warm Up

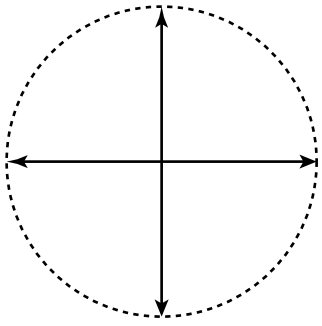
Use a protractor and the axes to draw angles of the given measure in the circle.

1. 50°

2. 25°

3. 135°

4. 225°



Learning Goals

- Determine the radian measure of angles.
- Convert between angle measures in degrees and angle measures in radians.
- Estimate the degree measure of central angle measures given in radians.
- Identify reference angles in radians

Key Terms

- theta (θ)
- unit circle
- radians

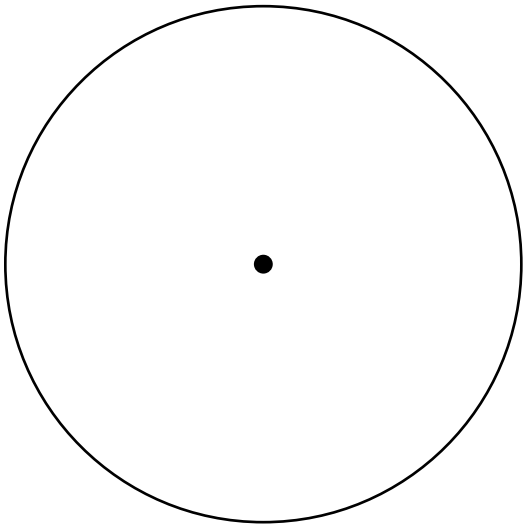
You have measured angles in degrees and learned that movement along a circle can be modeled by a periodic function. Are there other units of measure that describe angles?

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King Arthur's Knights

You may have heard of the legend of King Arthur and his Knights of the Round Table. The round table was used to show that each person sitting at it was equal. In most depictions, the knights also appear to be spaced around the table so that they are an equal distance apart.

But different versions of the legend give different numbers of knights. In many versions, there are 12 knights, but some include 25 or even 150 knights of the round table!



1. **On the circle given, show how 12 knights could be seated at the round table at an equal distance from each other.**

2. **Express the location of each of the twelve knights in terms of the circumference of the circle, $2\pi r$. Write each value in lowest terms.**

3. **Without drawing, describe the locations of the knights if there are 25 Knights of the Round Table spaced an equal distance from each other.**

4. **What if there were 150 knights? What do you think the diameter of the table should be for that many knights to sit comfortably around the table? Justify your answer.**

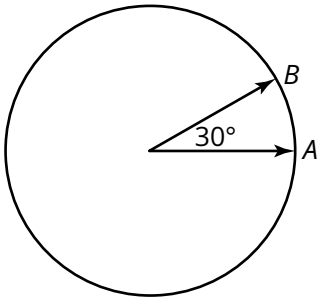
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ACTIVITY
3.1

Measuring Central Angles in Radians

Recall that the measure of an arc of a circle is equal to the degree measure of the central angle that intercepts the arc.

$$m\overset{\frown}{AB} = 30°$$



The length of the intercepted arc is given by the expression:

$$\text{arc length} = 2\pi r \cdot \frac{\text{measure of central angle}}{360°}$$

You can identify the central angle measures of a circle in standard position using the symbol **theta**, written as θ. For example, a central angle measure of 30° can be written as $\theta = 30°$.

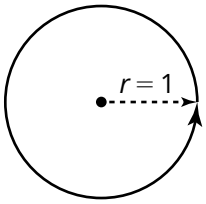
The central angles you will discuss in this lesson are all angles in standard position.

1. **Given any circle with a radius of *r* units:**

   a. **Write an expression in terms of *r* to describe the arc length for a central angle measure of $\theta = 30°$.**

   b. **Write an expression in terms of *r* to describe the arc length for a central angle measure of $\theta = 45°$.**

A powerful way to measure central angles of a circle is to identify arc lengths of the circle in terms of the radius of a *unit circle.* A **unit circle** has a radius of 1 unit.



2. **Consider the unit circle shown.**

   a. **Identify a central angle measure, θ, that represents a complete rotation of the terminal ray around the unit circle.**

   b. **Identify the arc length of this central angle.**

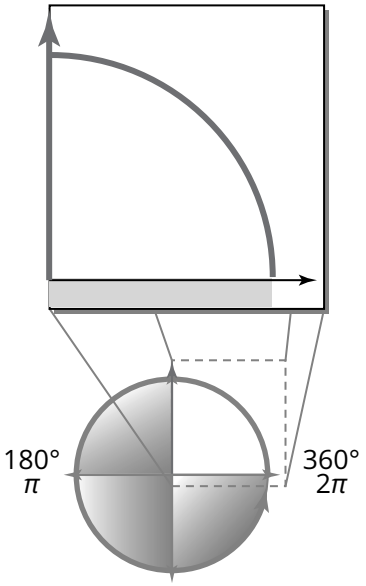
   c. **Identify a central angle measure, θ, and arc length that represent half of a rotation of the terminal ray around the unit circle.**

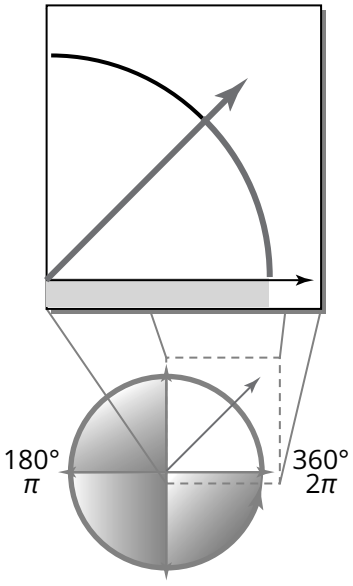
Ask yourself:

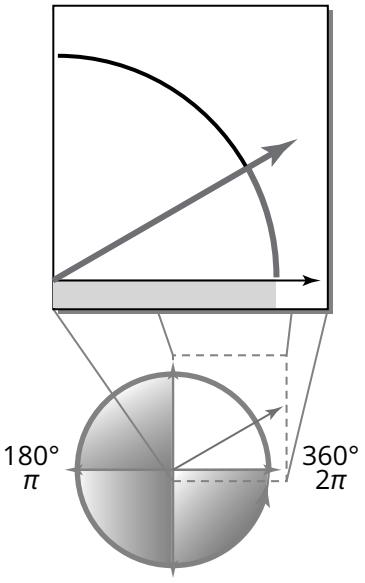
What is the arc length when the radius is 1 unit?

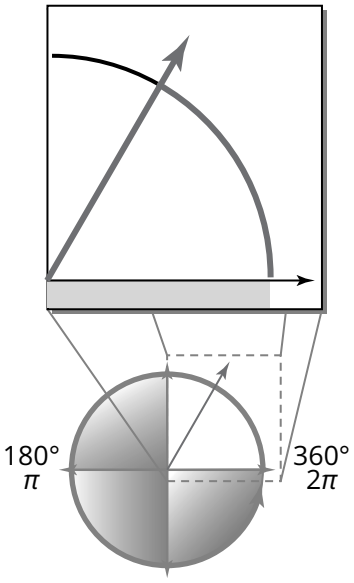
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3. **Use a protractor to determine each central angle measure, θ, in the unit circle. Then label the angle measures and their corresponding arc lengths in units. Explain how you determined your answers.**









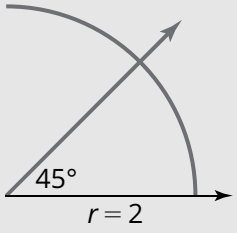
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The unit that describes the measure of an angle theta, θ, in terms of the arc length and radius of a unit circle is called a *radian*. The ratio of the intercepted arc length of a central angle to the length of the radius is the measure of the central angle in **radians**.

There are $\frac{2\pi r}{r}$, or 2π, radians in 360° and $\frac{\pi r}{r}$, or π, radians in 180°.

4. Jaylen and Malik each determined the radian measure for a central angle measuring 45° in a circle with a radius of 2 units.

Jaylen

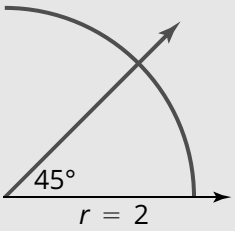


Arc length = $2\pi(2) \cdot \frac{45°}{360°}$

$= 4\pi \cdot \frac{1}{8} = \frac{\pi}{2}$ units

The radian measure of this angle is $\frac{\pi}{2} \div 2$, or $\frac{\pi}{4}$ radian.

Malik



Arc length = $2\pi(2) \cdot \frac{45°}{360°}$

$= 4\pi \cdot \frac{1}{8} = \frac{\pi}{2}$ units

The radian measure of this angle is $\frac{\pi}{2}$ radians.

Explain why Malik's reasoning is incorrect.

5. Use what you know about the symmetry of a circle to label each central angle measure in degrees and radians on the unit circle located at the end of the lesson. Explain how you determined the measures, and show your work.

Use your protractor to verify your angle measures.

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ACTIVITY
3.2

Thinking with Radians: Pi Is a Constant

It is important to keep in mind that values such as $\frac{\pi}{4}$ and $\frac{7\pi}{6}$ are constants. Each of these irrational numbers can be rewritten as non-terminating, non-repeating decimals.

$$\frac{\pi}{4} \approx \frac{3.14}{4} \approx 0.785 \qquad \frac{7\pi}{6} \approx \frac{7(3.14)}{6} \approx 3.6633....$$

You can also write whole-number values for radians.

You can use the abbreviation "rad" when describing measures in radians.

1. Estimate the degree measure of each central angle measure given in radians. Explain your reasoning.

a. 3 radians

b. 6 radians

c. 2 radians

d. 4 radians

e. 1 radian

f. 5 radians

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2. **What is the arc length of a central angle that has a measure of 1 radian on the unit circle? Explain your reasoning.**

The formulas you can use to convert the units to measure angles from radians to degrees and degrees to radians are shown.

Radians to Degrees: x radians $\cdot \frac{180°}{\pi \text{ radians}}$

Degrees to Radians: x degrees $\cdot \frac{\pi \text{ radians}}{180°}$

Notice that the ratios in the formulas are forms of 1.

3. **Use the formulas to convert each angle measure in Question 1 to degrees.**

   How close were your estimates?

4. **Corinne made the statement regarding radian measures.**

> Corinne
>
> The complement of an angle measure θ in radians is $\left(\frac{\pi}{2} - \theta\right)$ radians.

   Explain why Corinne is correct. Write a similar statement using degrees.

5. **What is the supplement of an angle measure θ in radians? Explain your reasoning.**

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NOTES

TALK the TALK

Degrees Are Rad Too

You can use degrees or radians as units of measure to describe angles.

1. **Convert each angle in degree measure to radian measure.**

   a. **500°**

   b. **390°**

   c. **150°**

2. **Convert each angle in radian measure to degree measure.**

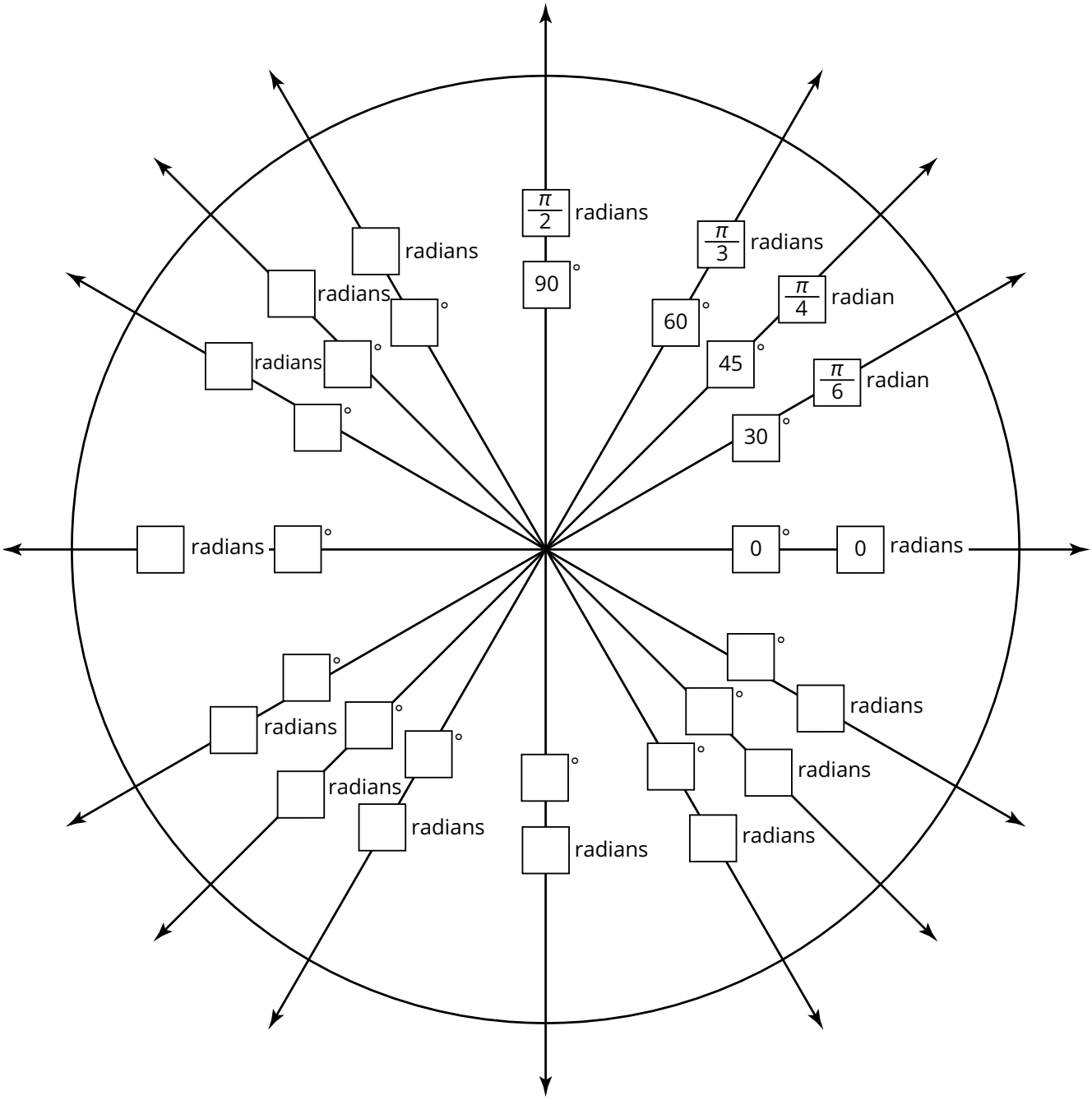
   a. $\frac{\pi}{10}$

   b. $\frac{7\pi}{6}$

   c. $\frac{14\pi}{15}$

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Central Angle Measures in Degrees and Radians


$\frac{\pi}{2}$ radians
90°
$\frac{\pi}{3}$ radians
60°
$\frac{\pi}{4}$ radian
45°
$\frac{\pi}{6}$ radian
30°
0°
0 radians
radians
radians

Assignment

Write

Complete each sentence.

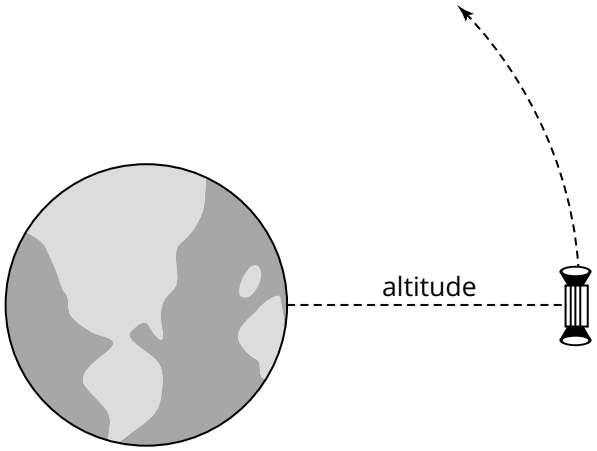
1. A unit circle has a radius of _____.
2. A symbol used to identify the central angle measure of a circle in standard position is _____.
3. There are 2π _____ in 360°.

Remember

The ratio of the intercepted arc length of a central angle to the radius is the measure of the central angle in radians. There are π radians in 180°.

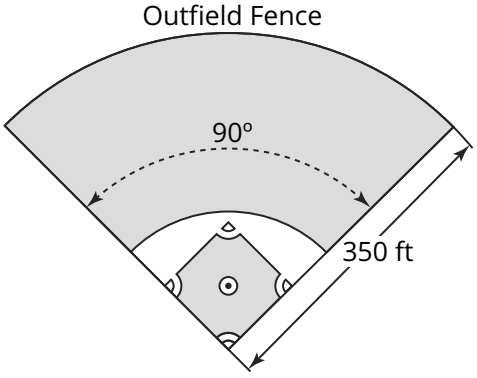
Practice

1. A Global Positioning System (GPS) satellite completes 1 orbit of Earth every 12 hours. The satellite follows a circular path with its center at the center of Earth.



   a. Determine the angle of rotation, in radians, that corresponds to 1 complete orbit of the satellite around Earth.
   b. Determine the radius of the circular path the satellite follows during its orbit if Earth's radius is 3,959 miles and the altitude of the satellite is 12,645 miles.
   c. Determine the angle of rotation, in radians, that corresponds to an 8-hour time period.
   d. Determine the distance traveled by the satellite in an 8-hour time period.
   e. The computer onboard the satellite had to be remotely shut down and rebooted in order to repair a software glitch. The satellite traveled a distance of 27,000 miles during that time. How long did it take to shut down and reboot the computer?

2. The outfield fence on a baseball field needs to be replaced. The fence is an arc with its center at home plate and a central angle of 90°. The distance from home plate to any point on the fence is 350 feet.

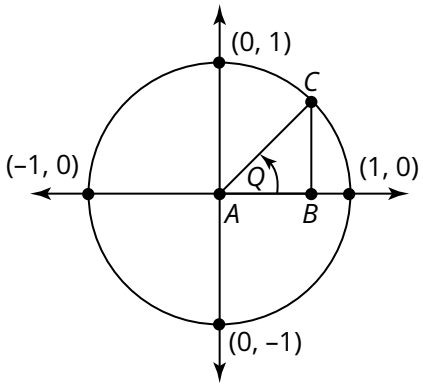


   a. Determine the central angle of the outfield fence in radians.
   b. Determine the length of the outfield fence that needs to be replaced.

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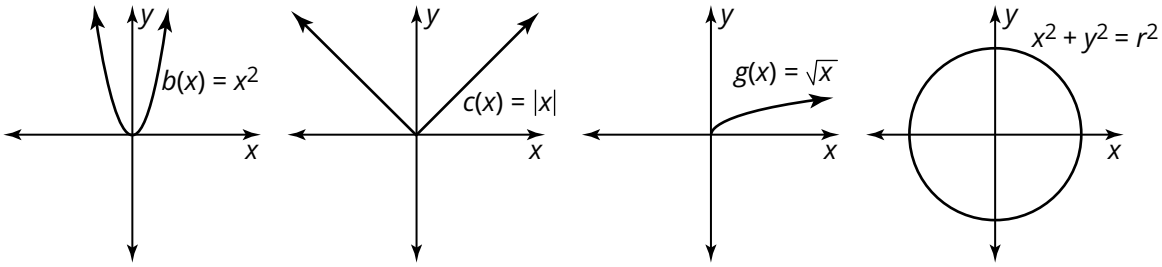
Stretch

1. An automobile tire has a diameter of 28 inches.
   a. What angle does the wheel turn through if the car has moved 2 feet? Give the answer in both radians and degrees.
   b. If the tire makes 10 turns in 1 second, how fast is the car going in miles per hour?
2. A unit circle is shown. Determine the coordinates of points B and C on the triangle for the different measures of θ.
   a. $\theta = \frac{\pi}{6}$ radians
   b. $\theta = \frac{\pi}{4}$ radians
   c. $\theta = \frac{\pi}{3}$ radians



Review

1. Consider the relations shown.



   Graph each relation to create a picture.

   $y = g(-x - 1) + 4$, $\quad -5 \le x \le -1$

   $y = g(x - 1) + 4$, $\quad 1 \le x \le 5$

   $y = -2c(x) + 6$, $\quad -3 \le x \le 3$

   $x^2 + (y - 7)^2 = 1$

2. Identify the number of complex zeros for the polynomial equation.
   a. $12x^5 - 20x^4 + 19x^3 - 6x^2 - 2x + 1 = 0$
   b. $5x^4 + 3x^3 + 3x^2 + 3x - 2 = 0$

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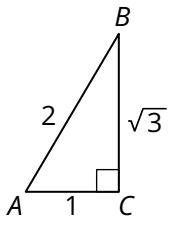
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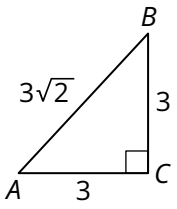
What Goes Around

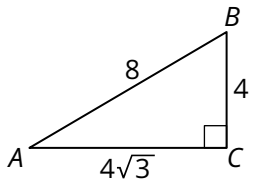
The Sine and Cosine Functions

Warm Up

Determine the sine ratio and cosine ratio of $\angle A$ in each triangle.

1. 

2. 

3. 

Learning Goals

- Define the sine and cosine functions.
- Calculate values for the sine and cosine of reference angles.
- Define the sine and cosine of an angle as a coordinate of a point on the unit circle.
- Graph and compare the sine and cosine functions.

Key Terms

- sine function
- cosine function
- trigonometric function
- periodicity identity

You have previously explored the relationship of the side lengths in special right triangles, and you know how to determine the sine and cosine ratios of angles in a right triangle. How can these relationships on a unit circle be represented as functions on a coordinate plane?

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The Right Triangle Connection

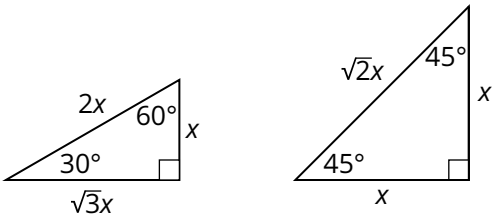
Recall that the sine ratio (sin), given a reference angle, θ, is the ratio of the length of the opposite side to the length of the hypotenuse in a right triangle.

$$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

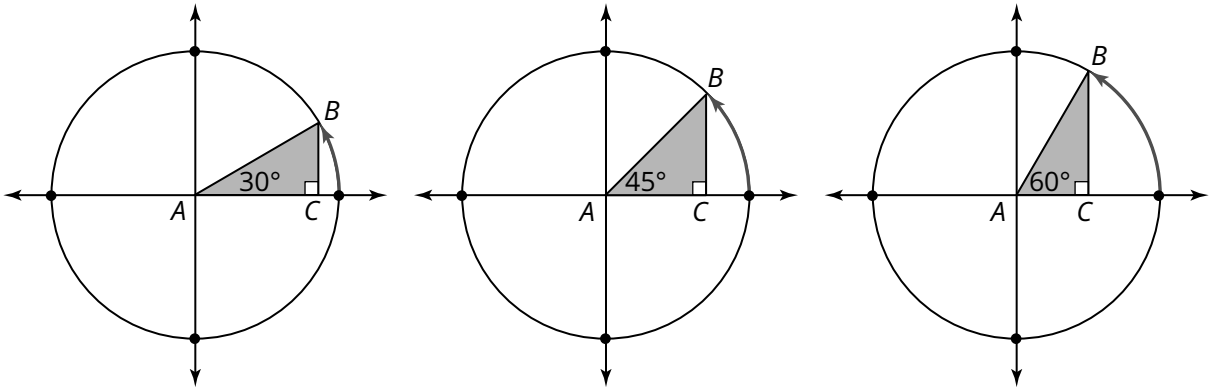
The cosine ratio (cos), given a reference angle, θ, is the ratio of the length of the adjacent side to the length of the hypotenuse.

$$\cos\theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

The side-length relationships for a 30° -60° -90° triangle and a 45° -45° -90° triangle are shown.



The diagram shows a right triangle *ABC* placed on a unit circle centered at the origin. The central angle measures $\theta = 30°$, $\theta = 45°$, and $\theta = 60°$ are shown.



1. **What is the length of the hypotenuse *c* in each circle? Label the measures on each triangle.**

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2. **Label the side lengths of the triangles in each diagram in radical form.**

3. **The hypotenuse of each right triangle represents the terminal ray of a central angle that intersects the unit circle at point *B*.**

   a. **Complete the table to record the sine and cosine of each angle measure, θ, and the coordinates of the point where the terminal ray intersects the unit circle. Explain your reasoning.**

θ	cos θ	sin θ	Coordinates of Point *B*, (Intersection of Terminal Ray and Unit Circle)
30°			
45°			
60°			

   b. **Write the coordinates of the intersection of the terminal ray and the unit circle at 0°.**

   c. **Write the coordinates of the intersection of the terminal ray and the unit circle at 90°.**

4. **Jorge conjectured that the coordinates of the point where the terminal ray of a central angle θ intersects the unit circle can always be written as (cos θ, sin θ). Do you think Jorge's conjecture is correct? Explain your reasoning.**



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ACTIVITY
4.1

Unit Circle Coordinates in Quadrant I

In the unit circle, you will label the first quadrant now. Then you will be able to determine the coordinates of the points in the other quadrants in the next activity.

Use the unit circle located at the end of this lesson and your answers to the questions in the Getting Started to complete this activity.

1. **Determine the coordinates of the points in the first quadrant on the unit circle. Label the coordinates.**

2. **Use the unit circle to evaluate each measure.**

   $\sin(\frac{\pi}{6}$ radian) = _____

   $\cos(\frac{\pi}{6}$ radian) = _____

   $\sin(\frac{\pi}{4}$ radian) = _____

   $\cos(\frac{\pi}{4}$ radian) = _____

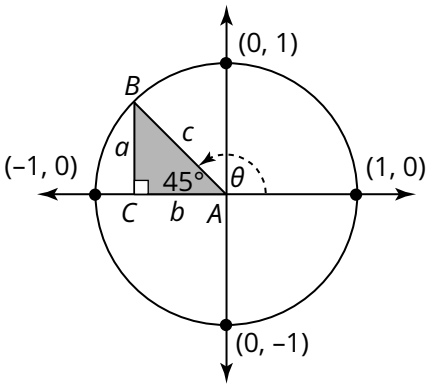
3. **For each angle measure in Question 2, evaluate the sine and cosine of the complement. Explain your reasoning.**

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ACTIVITY
4.2

Unit Circle Coordinates Beyond Quadrant I

Now that you have identified values of sine and cosine in the first quadrant, how can you use that knowledge to identify values in other quadrants?



1. **The diagram shows a 45° central angle positioned in the second quadrant on the unit circle.**

   a. **State the measure of θ in degrees and in radians. Explain how you determined your answer.**

   b. **Identify the coordinates of the point at which the terminal ray of the angle intercepts the circle. Explain how you determined your answer.**

   c. **What do you notice about the coordinates of this point and the coordinates of the symmetrical point in the first quadrant?**

Remember:

When creating a triangle using a terminal ray, the right triangle drawn must always be bound to the *x*-axis.

2. **Use what you know about symmetry to label the coordinates of the remaining points on the unit circle located at the end of the lesson.**

3. **Look back at Jorge's conjecture in the Getting Started. Is his conjecture correct? Explain your reasoning.**

Think about:

Does the cosine have a negative or a positive value? Does the sine have a negative or positive value?

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4. **Describe when the values of cosine and sine are positive and negative in the unit circle. Label this information on the unit circle at the end of the lesson.**

5. **Ray makes this conclusion.**

Ray
Many different central angle measures have the same sine or cosine values.



Provide examples to support Ray's conclusion.

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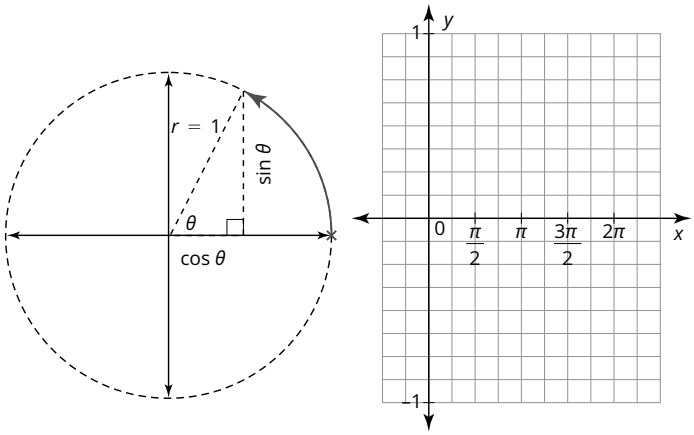
ACTIVITY
4.3 Sine and Cosine Functions

Let's consider how to represent the values from your unit circle as functions on a coordinate plane.

1. **Use your completed unit circle to graph the function $y = \sin x$.**

   a. **As the terminal ray traverses the unit circle counterclockwise in standard position, plot the output value, $\sin \theta$, that corresponds to the input value, θ, which is the radian measure of the central angle, from 0 to 2π radians.**

Plot the output values from left to right on the graph as you move counterclockwise around the unit circle.

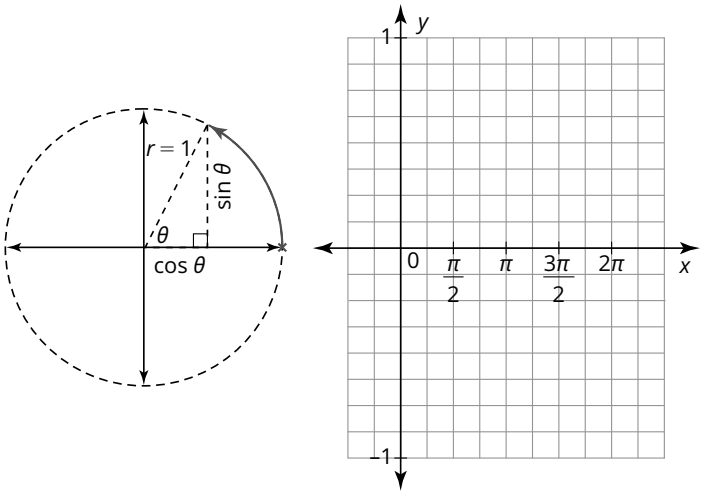


   b. **What coordinate values on the unit circle did you use to create the graph of $y = \sin x$?**

2. **Use your completed unit circle to graph the function $y = \cos x$.**

   a. **As the terminal ray traverses the unit circle counterclockwise in standard position, plot the output value, $\cos \theta$, that corresponds to the input value, θ, which is the radian measure of the central angle, from 0 to 2π radians.**

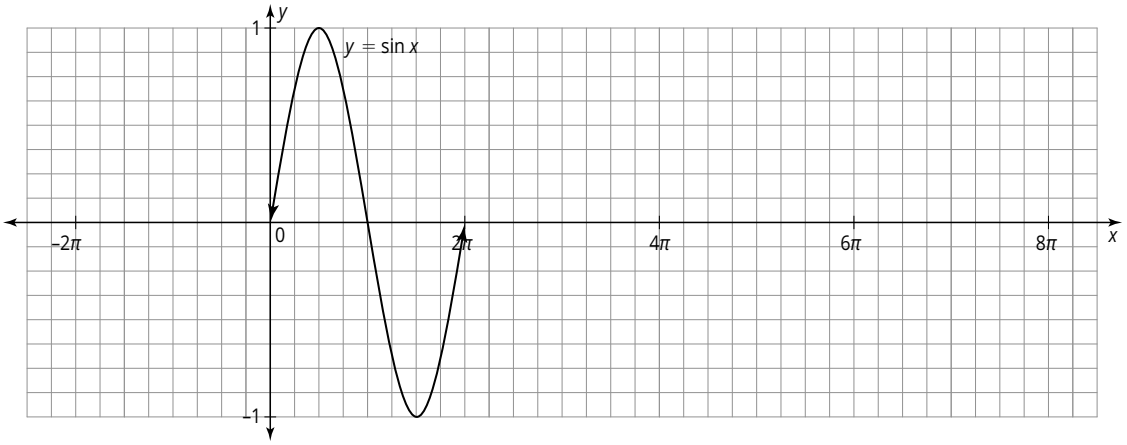
   b. **What coordinate values on the unit circle did you use to create the graph of $y = \cos x$?**

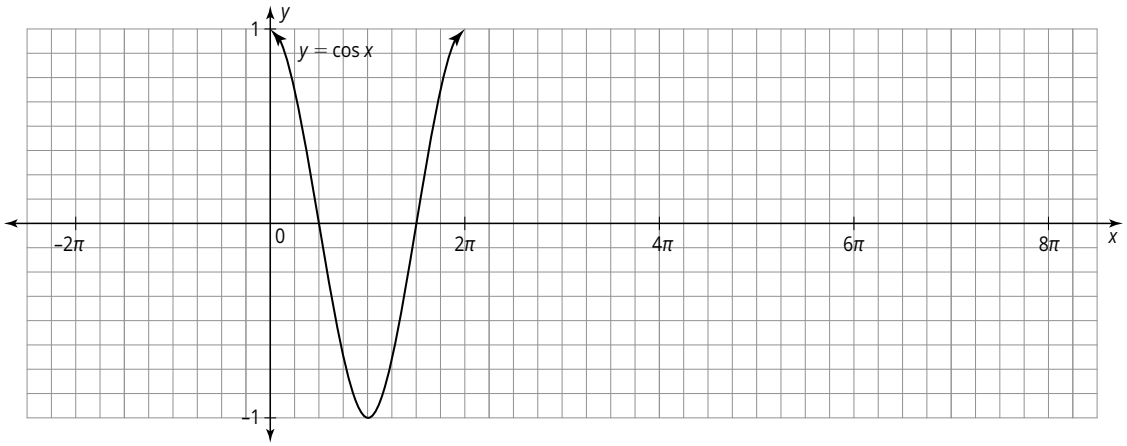


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You have graphed the *sine function* and *cosine function*. The **sine function** and **cosine function** are periodic **trigonometric functions**. Each of these trigonometric functions takes angle measures (θ values) as inputs and outputs real number values, which correspond to coordinates of points on the unit circle.

3. Consider the functions $y = \sin x$ and $y = \cos x$.





a. Extend the graphs of the functions $y = \sin x$ and $y = \cos x$ over the domain $0 \leq x \leq 8\pi$.

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b. Determine the values of sin x and cos x at 4π, 6π, and 8π radians.

c. Describe how you can determine each value from part (b) on the unit circle for each function.

4. Now consider a domain of $-2\pi \leq x \leq 8\pi$ for the functions $y = \sin x$ and $y = \cos x$.

a. Extend the graphs of the functions $y = \sin x$ and $y = \cos x$ in Question 3 through $x = -2\pi$.

b. Determine each sine value.

$\sin(-\frac{\pi}{2}) =$ _____

$\sin(-\pi) =$ _____

$\sin(-\frac{3\pi}{2}) =$ _____

$\sin(-2\pi) =$ _____

c. Determine each cosine value.

$\cos(-\frac{\pi}{2}) =$ _____

$\cos(-\pi) =$ _____

$\cos(-\frac{3\pi}{2}) =$ _____

$\cos(-2\pi) =$ _____

Ask yourself:

Can the sine and cosine functions output any real number, given any angle measure input?

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5. **Consider the values of $\sin(x + 2\pi)$. How do these values compare to the values of $\sin x$?**

6. **Consider the values of $\cos(x + 2\pi)$. How do these values compare to the values of $\cos x$?**

The period of the sine function is 2π radians, and the period of the cosine function is 2π radians. Thus, you can write two *periodicity identities*:

- $\sin(x + 2\pi) = \sin x$
- $\cos(x + 2\pi) = \cos x$

Each of these is called a **periodicity identity** because they are each based on the period of the function, 2π.

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TALK the TALK

Comes Around

1. Complete the table.

Angle Measure (θ)		$\cos\theta$	$\sin\theta$
radians	degrees		
0	0°	1	0
$\frac{\pi}{6}$	30°		
$\frac{\pi}{4}$	45°		
$\frac{\pi}{3}$	60°		
$\frac{\pi}{2}$	90°		
$\frac{2\pi}{3}$	120°		
$\frac{3\pi}{4}$	135°		
$\frac{5\pi}{6}$	150°		
π	180°		

Angle Measure (θ)		$\cos\theta$	$\sin\theta$
radians	degrees		
$\frac{7\pi}{6}$	210°		
$\frac{5\pi}{4}$	225°		
$\frac{4\pi}{3}$	240°		
$\frac{3\pi}{2}$	270°		
$\frac{5\pi}{3}$	300°		
$\frac{7\pi}{4}$	315°		
$\frac{11\pi}{6}$	330°		
2π	360°		

2. Compare and contrast the functions $y = \sin x$ and $y = \cos x$. Describe the similarities and differences between the two functions.

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NOTES

3. **Identify each of the characteristics for $y = \sin x$ and $y = \cos x$.**

	$y = \sin x$	$y = \cos x$
y-intercept(s)		
Domain		
Range		
Period		
Minimum Output Value		
Maximum Output Value		
Amplitude		
Midline		

4. **Describe the intervals of increase and decrease for both the sine and cosine functions. Explain your reasoning.**

5. **Identify the *x*-intercepts for each function.**

   a. ***x*-intercepts for $y = \sin x$**

   b. ***x*-intercepts for $y = \cos x$**

6. **Use the language of transformations to explain how the sine and cosine functions are related.**

Ask yourself:

How can you write this relationship mathematically?

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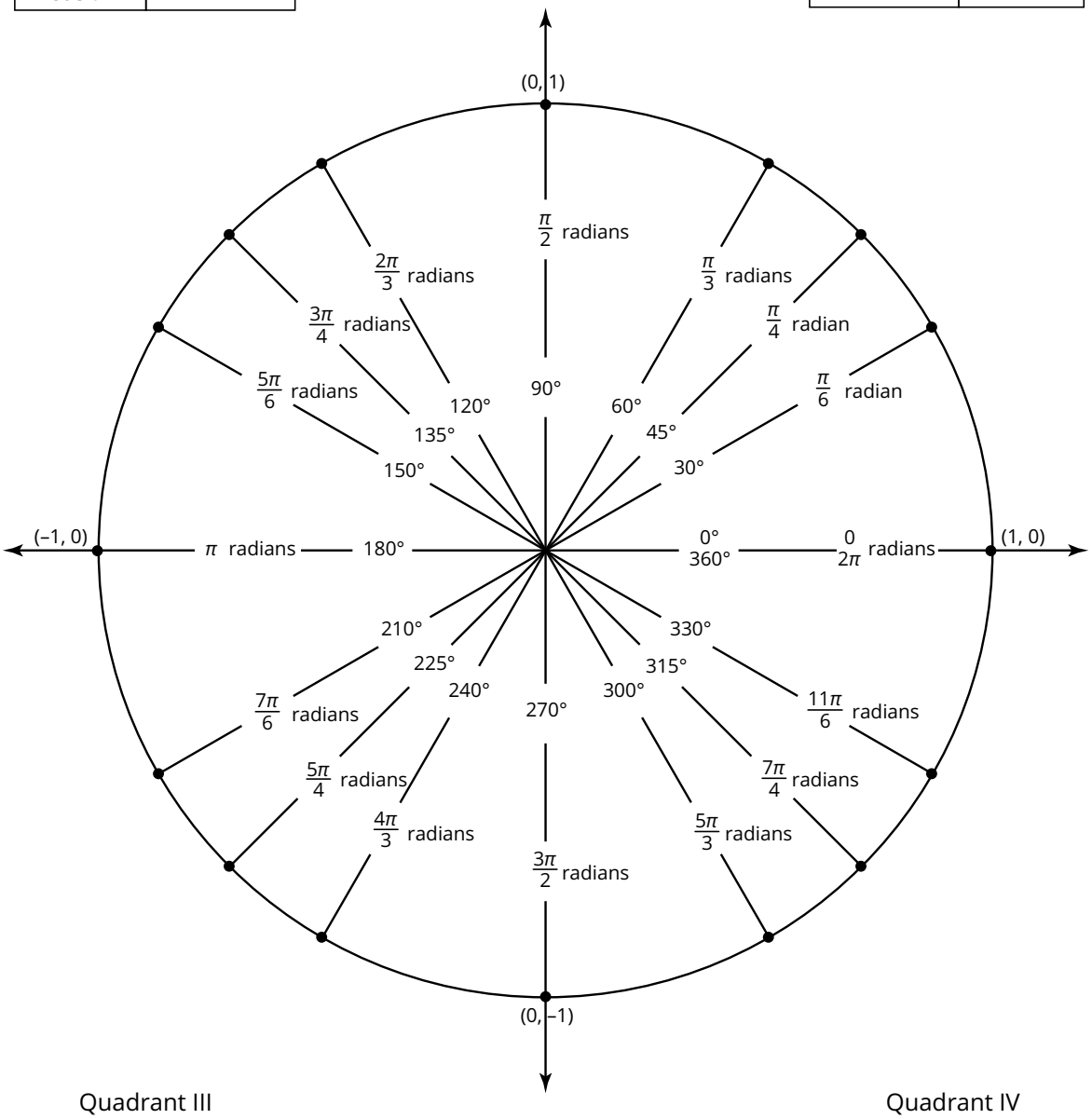
Sine and Cosine on the Unit Circle

Quadrant II

$\sin\theta$	
$\cos\theta$	

Quadrant I

$\sin\theta$	
$\cos\theta$	



Quadrant III

$\sin\theta$	
$\cos\theta$	

Quadrant IV

$\sin\theta$	
$\cos\theta$	

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Assignment

Write

Write a definition for each term in your own words.

1. sine function
2. cosine function
3. trigonometric function
4. periodicity identity

Remember

The cosine of the central angle measure of a unit circle is the x-coordinate of the point where the terminal ray intersects the unit circle and the sine of the same central angle measure is the y-coordinate of the same point.

The sine function, $y = \sin x$, and cosine function, $y = \cos x$, are periodic trigonometric functions that take angle measures (θ values) as inputs and outputs real number values, which correspond to coordinates of points on the unit circle. The period of each function is 2π radians, therefore $\sin(x + 2\pi) = \sin x$ and $\cos(x + 2\pi) = \cos x$.

Practice

1. Determine θ and $\cos\theta$ when $\sin\theta = \frac{\sqrt{3}}{2}$ and $\cos\theta$ is negative. Restrict values for θ such that $0 \leq \theta \leq 2\pi$.
2. Determine θ and $\sin\theta$ when $\cos\theta = -\frac{\sqrt{2}}{2}$ and $\sin\theta$ is negative. Restrict values for θ such that $0 \leq \theta \leq 2\pi$.
3. Determine 3 values for θ such that $\sin\theta = -\frac{\sqrt{3}}{2}$.
4. Determine 3 values for θ such that $\cos\theta = \frac{\sqrt{2}}{2}$.
5. Determine 3 values for θ such that $\cos\theta = 0$.
6. Determine the value of each ratio.
   a. $\sin\left(\frac{15\pi}{4}\right)$
   b. $\cos\left(\frac{17\pi}{6}\right)$
   c. $\sin\left(\frac{25\pi}{6}\right)$
   d. $\cos\left(\frac{19\pi}{4}\right)$

Stretch

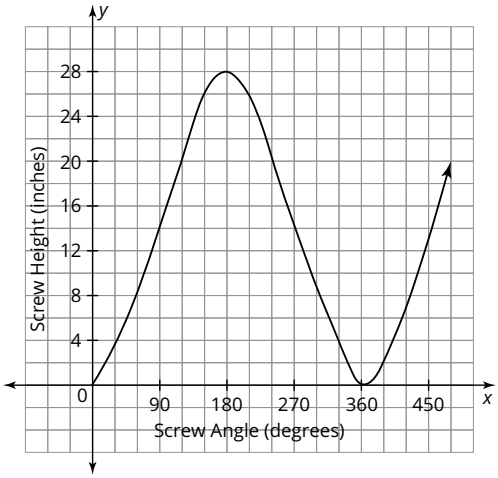
1. Determine θ and $\sin\theta$ when $\cos\left(\frac{\theta}{2}\right) = -\frac{\sqrt{3}}{2}$. Restrict values for θ such that $0 \leq \theta \leq 2\pi$.
2. Complete the table of values for the functions shown.

		Function			
		$\sin\theta$	$2\sin\theta$	$\sin\theta + 1$	$\sin(\theta + \pi)$
Angle Measure (θ)	0				
	$\frac{\pi}{6}$				
	$\frac{\pi}{4}$				
	$\frac{\pi}{3}$				
	$\frac{\pi}{2}$				

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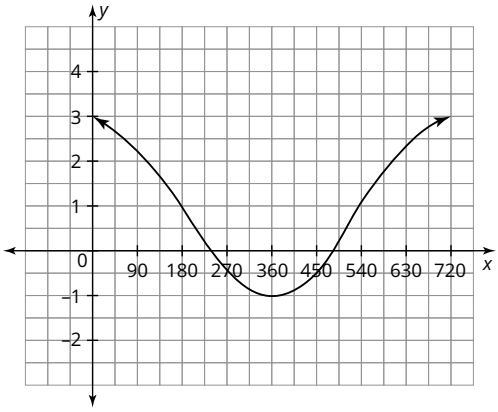
Review

1. Ahmed is riding his bike. The tires on the bike have a diameter of 28 inches. He runs over a screw, but is able to keep riding the bike. Assume the tire rotates clockwise and the screw is at an angle of 0° when it is at ground level. The graph shows the height of the screw above the ground as a function of the angle of the screw.



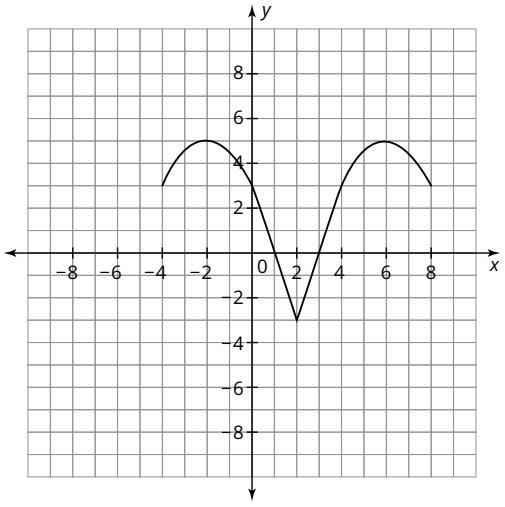
   a. Determine the amplitude of the function.
   b. Determine the period of the function.
   c. Determine the height of the screw when the screw angle is 630°.

2. Consider the periodic function shown, with x in degrees.



   a. Determine the amplitude of the function.
   b. Determine the period of the function.
   c. Determine the value of the function when $x = 900°$.

3. Write the equations of the two relations used to create this bird in terms of the function $f(x) = x^2$. Include any restrictions on the domains.



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5

The Sines They Are A-Changin'

Transformations of Sine and Cosine Functions

Warm Up

Determine the output for each function when $x = \frac{\pi}{2}$.

1. $y = 2 \sin x$
2. $y = \cos x - 3$
3. $y = \sin(2x)$

Learning Goals

- Transform the graphs of the sine and cosine functions.
- Determine the amplitude, frequency, and phase shift of transformed functions.
- Graph transformed sine and cosine functions using a description of the period, phase shift, and amplitude.

Key Terms

- frequency
- phase shift

You have graphed the basic sine and cosine functions and reasoned that adding 2π to the argument of each function translates the function onto itself. How do the A-, B-, C-, and D-values in the transformation function form, $g(x) = Af(B(x - C)) + D$ affect the graphs of the basic sine and cosine functions?

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The Sines They Are *A*-Changin'

The table shows the characteristics of the graphs of the sine and cosine functions.

	$y = \sin x$	$y = \cos x$
***y*-intercept**	(0, 0)	(0, 1)
Domain	$(-\infty, \infty)$	$(-\infty, \infty)$
Range	$[-1, 1]$	$[-1, 1]$
Period	2π	2π
Minimum Output Value	-1	-1
Maximum Output Value	1	1
Amplitude	1	1
Midline	$y = 0$	$y = 0$

Recall that transformations performed on any function $f(x)$ to form a new function $g(x)$ can be described by the transformation function form.

$$g(x) = Af(B(x - C)) + D$$

Ask

In general, what effect does multiplying a function $y = f(x)$ by a constant, A, have on the graph of the function?

1. Which characteristics of the transformed function $y = A \sin x$ differ from those of the basic function $y = \sin x$ if $|A| > 0$? Which characteristics remain the same? Explain your predictions.

	$y = A \sin x$	
	Will Change	**Won't Change**
***y*-intercept**		
Domain		
Range		
Period		
Minimum Output Value		
Maximum Output Value		
Amplitude		
Midline		

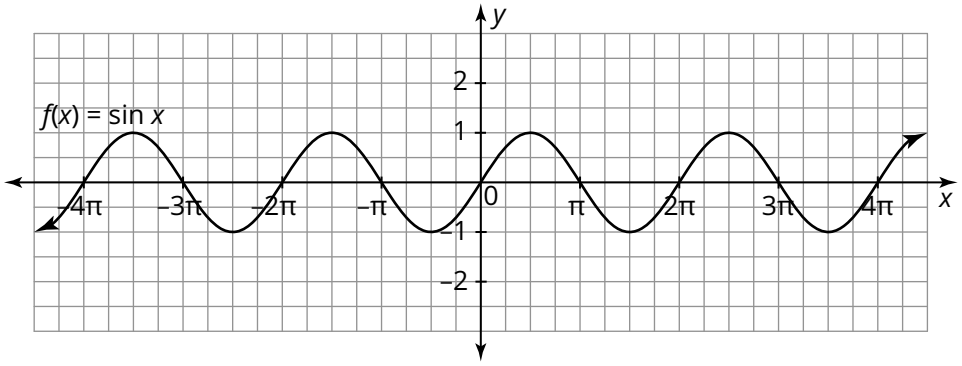
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ACTIVITY
5.1

Amplitude

Let's investigate how the *A*-value affects the graph of $y = \sin x$.

1. A graph of the function $f(x) = \sin x$ is shown. Sketch the graphs of the functions $g(x) = 2 \sin x$ and $h(x) = \frac{1}{2} \sin x$ on the same coordinate plane.



Ask yourself:

How is each value of the basic function affected by the transformation?

2. What similarities and differences do you notice about the three functions with respect to their periods, intercepts, and maximum and minimum values?

3. How do your graphs of the transformed functions compare with your predictions in the Getting Started?

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Remember:

The amplitude of a sine or cosine function is one-half the absolute value of the difference between the maximum and minimum values of the function.

4. Determine the maximum, minimum, and amplitude of each function you graphed.

a. $g(x) = 2 \sin x$

b. $h(x) = \frac{1}{2} \sin x$

5. Determine the maximum, minimum, and amplitude of each cosine function.

a. $f(x) = \cos x$

b. $g(x) = 3 \cos x$

c. $h(x) = \frac{1}{4} \cos x$

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ACTIVITY
5.2 Period and Frequency

Let's consider what effect multiplying the argument of a sine or cosine function by a constant, B, has on the graph of the function. The transformed function can be written as $y = \sin(Bx)$ or $y = \cos(Bx)$

1. Which characteristics of the transformed function $y = \cos(Bx)$ differ from those of the basic function $y = \cos x$ if $|B| > 0$? Which characteristics remain the same? Explain your predictions.

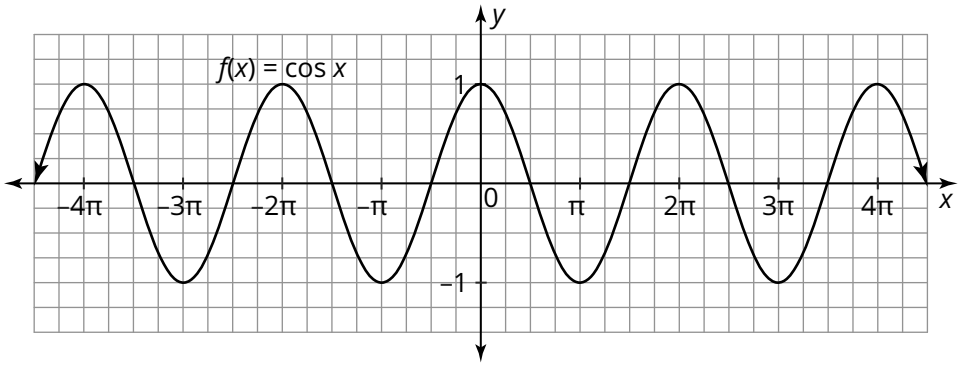
	$y = \cos(Bx)$	
	Will Change	**Won't Change**
***y*-intercept**		
Domain		
Range		
Period		
Minimum Output Value		
Maximum Output Value		
Amplitude		
Midline		

Ask yourself:

In general, what effect does multiplying the argument of a function $y = f(x)$ by a constant, B, have on the graph of the function?

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2. **A graph of the function $f(x) = \cos x$ is shown. Sketch the graphs of the functions $g(x) = \cos(4x)$ and $h(x) = \cos\left(\frac{1}{2}x\right)$ on the same coordinate plane.**



3. **What similarities and differences do you notice about the three functions with respect to their periods, intercepts, and maximum and minimum values?**

4. **How do your graphs of the transformed functions compare with your predictions in Question 1?**

5. **How do the equations of the functions you graphed relate to the similarities and differences in the graphs?**

Recall that the period of a periodic function is the length of the smallest interval over which the function repeats.

Think about:

What pattern do you see in the periods and the *B*-values?

6. **Determine the period of each function from the graph.**

   a. $f(x) = \cos(x)$

   b. $g(x) = \cos(4x)$

   c. $h(x) = \cos\left(\frac{1}{2}x\right)$

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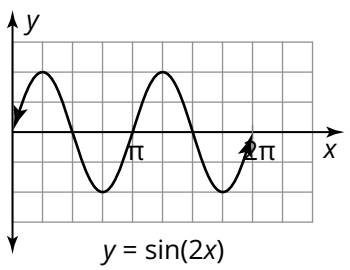
The *B*-value stretches or compresses a periodic function horizontally, so changes to the *B*-value have an effect on the period of the function.

Worked Example

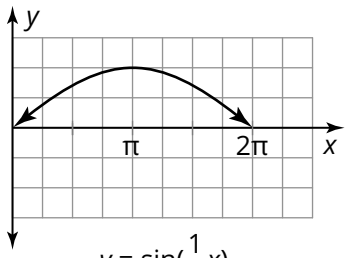
The basic function $y = \sin x$ has a period of 2π radians. You can determine the period of the transformed sine function by interpreting the *B*-value.

When the *B*-value is 2, there are 2 repetitions of the function in the original period, so the period is $\frac{1}{|B|} \cdot 2\pi$, or $\frac{1}{2} \cdot 2\pi = \pi$ radians.

When the *B*-value is $\frac{1}{2}$, there is $\frac{1}{2}$ of a repetition of the function in the original period, so the period is $\frac{1}{|B|} \cdot 2\pi$, or $2 \cdot 2\pi = 4\pi$ radians.



$y = \sin(2x)$



$y = \sin(\frac{1}{2}x)$

7. Write an expression to describe the period of the functions $y = \sin(Bx)$ and $y = \cos(Bx)$.

Frequency is related to the period of the function. The **frequency** of a periodic function is the reciprocal of the period and specifies the number of repetitions of the graph of a periodic function per unit.

8. Write an expression to describe the frequency of the functions $y = \sin(Bx)$ and $y = \cos(Bx)$. Explain your reasoning.

9. Determine the period and frequency of each sine function.

a. $f(x) = \sin(3x)$

b. $g(x) = \sin\left(\frac{2}{3}x\right)$

c. $h(x) = \sin\left(\frac{1}{4}x\right)$

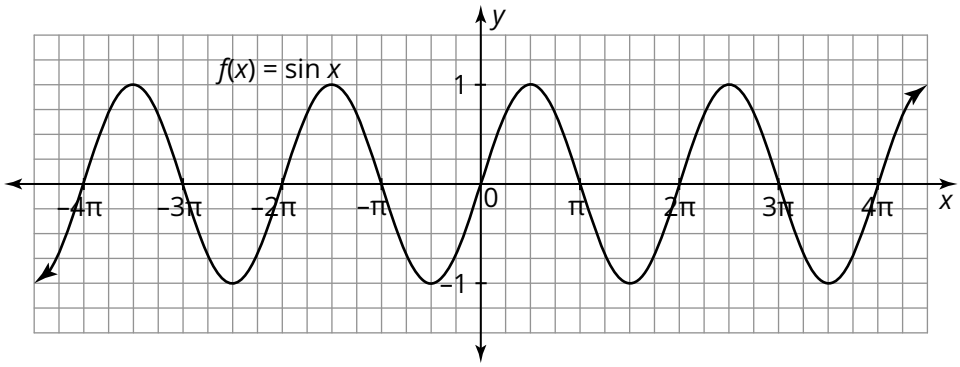
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ACTIVITY
5.3 Phase Shifts and More

Now consider what effect subtracting a constant, C, from the argument of a sine or cosine function has on the graph of the function. The transformed function can be written as $y = \sin(x - C)$ or $y = \cos(x - C)$.

1. **Sketch graphs of the functions shown over the domain $-4\pi \leq x \leq 4\pi$.**

   a. $g(x) = \sin\left(x + \frac{\pi}{2}\right)$
   b. $h(x) = \sin(x - \pi)$



2. **What similarities and differences do you notice about the three functions in terms of their maximums, minimums, periods, and amplitudes?**

3. **How do the equations of the functions you graphed relate to the similarities and differences in the graphs?**

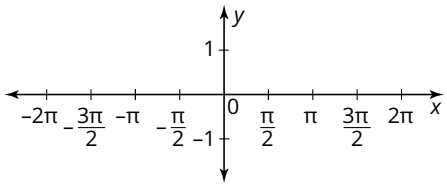
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Transforming a periodic function by subtracting a *C*-value from the argument of the function results in horizontal translations of the function. These transformations act just as they have on other functions you have studied. For periodic functions, horizontal translations are called **phase shifts**.

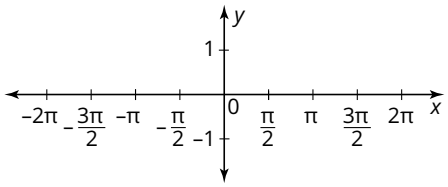
4. Predict the effect of adding a constant, *D*, to a sine or cosine function $y = f(x)$.

5. Use what you know about transformations to sketch the graph of each function.

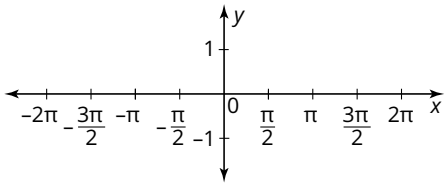
a. $y = -\sin x$



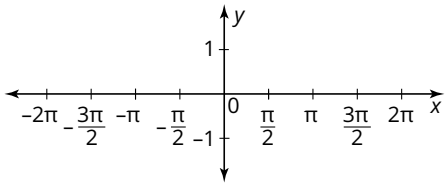
b. $y = \sin(-x)$



c. $y = -\cos x$



d. $y = \cos(-x)$



e. Compare and contrast the graphs you sketched. What do you notice?

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6. Complete the table to describe the graph of each function as a transformation of $y = f(x)$.

Sine or Cosine Function	Equation Information	Description of Transformation of Sine of Cosine Graph	Effect on Period, Amplitude, Midline, Phase Shift
$y = Af(x)$	$\lvert A\rvert > 1$	vertical stretch by a factor of $\lvert A\rvert$ units	
	$0 < \lvert A\rvert < 1$	vertical compression by a factor of $\lvert A\rvert$ units	
	$A < 0$	reflection across the x-axis	
$y = f(Bx)$	$\lvert B\rvert > 1$	horizontal compression by a factor of $\frac{1}{\lvert B\rvert}$	
	$0 < \lvert B\rvert < 1$	horizontal stretch by a factor of $\frac{1}{\lvert B\rvert}$	
	$B < 0$	reflection across the y-axis	
$y = f(x - C)$	$C > 0$	horizontal shift right C units	
	$C < 0$	horizontal shift left C units	
$y = f(x) + D$	$D > 0$	vertical shift up D units	
	$D < 0$	vertical shift down D units	

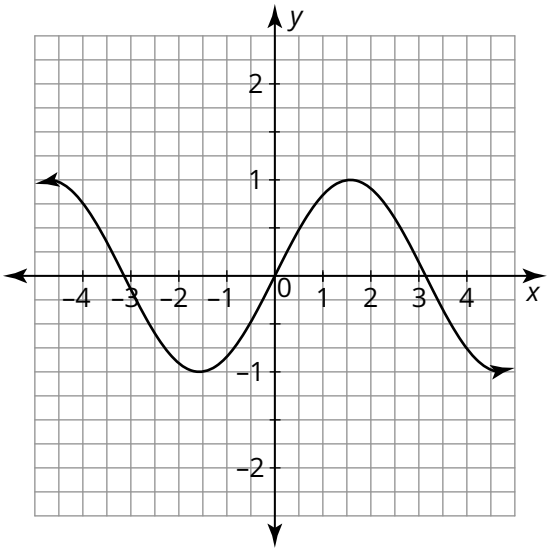
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NOTES

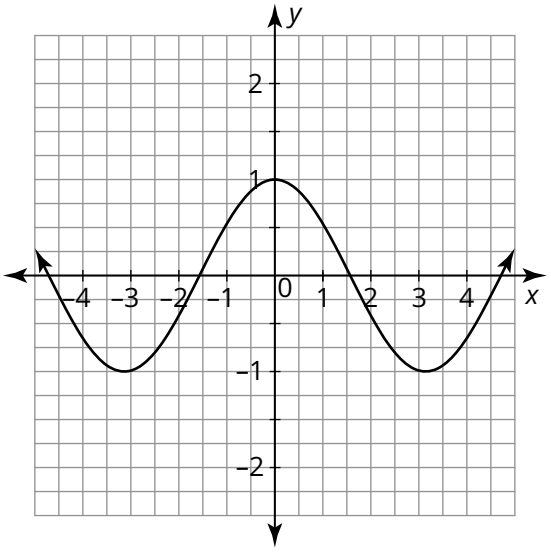
TALK the TALK

Shifting Perspectives

1. **Identify the function graphed.**

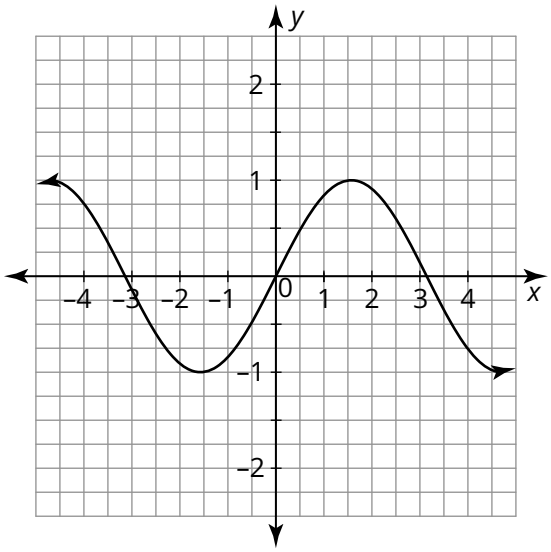


2. **Identify the function graphed.**

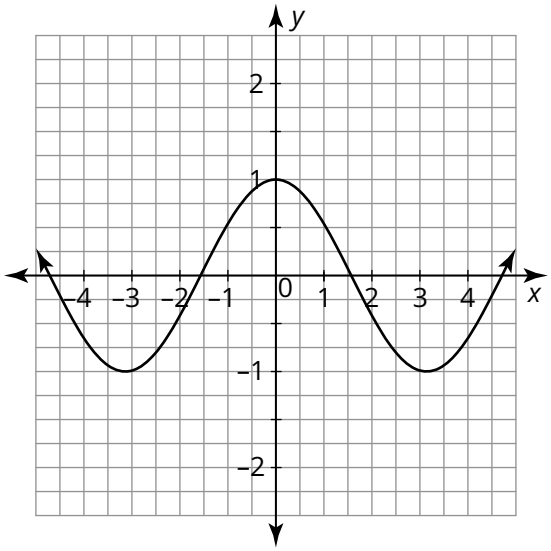


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3. **The graph shows $y = \sin x$. Rewrite the sine function as two different transformed cosine functions.**



4. **The graph shows $y = \cos x$. Rewrite the cosine function as two different transformed sine functions.**



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Assignment

Write

Write the word(s) that best completes each statement.

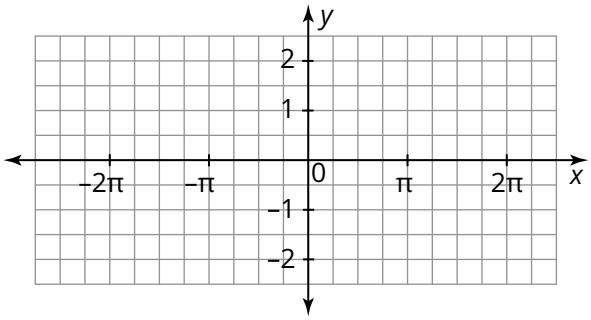
1. The _____ of a periodic function is the reciprocal of the period and specifies the number of repetitions of the graph of a periodic function per unit.
2. For periodic functions, a horizontal translation is called a _____.

Remember

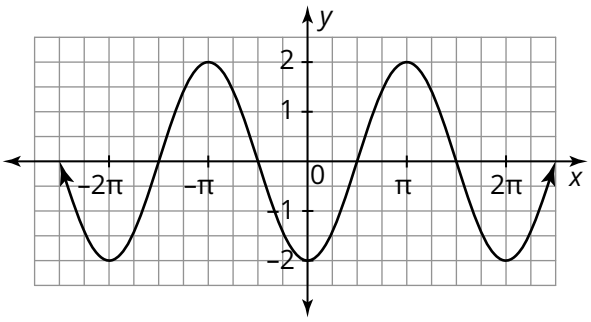
Given the transformed functions $y = A\sin(B(x - C)) + D$ and $y = A\cos(B(x - C)) + D$, the A-value affects the range, minimum and maximum output values, and the amplitude of the basic function, the B-value affects the period and frequency of the basic function, the C-value is interpreted as the phase shift, and the D-value affects the midline.

Practice

1. To create the function $m(x)$, the function $f(x) = \sin x$ is first reflected across the x-axis. Then, the amplitude is increased to 1.5 and the period was changed to π radians.
   a. Graph the function $m(x)$.
   b. Write the function $m(x)$.



2. Consider the given graph of a trigonometric function.
   a. Write the function $g(x)$ that matches the given graph if the function $g(x)$ is a transformation of the function $f(x) = \sin x$.
   b. Determine the amplitude, period, frequency, and phase shift of $g(x)$.
   c. Write the function $h(x)$ that matches the given graph if the function $h(x)$ is a transformation of the function $f(x) = \cos x$.
   d. Determine the amplitude, period, frequency, and phase shift of $h(x)$.

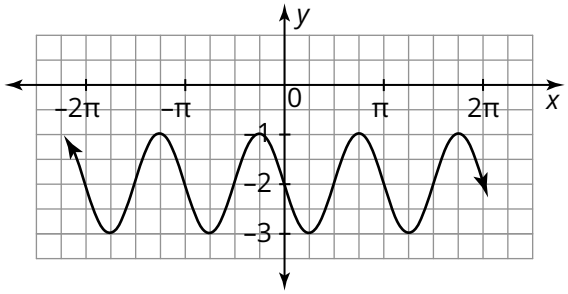


3. The function $f(x) = \sin x$ has been horizontally stretched by a factor of 2 and shifted up 3 units to create the function $t(x)$. Write the function $t(x)$.
4. The function $f(x) = \cos x$ has been vertically compressed by a factor of $\frac{1}{4}$ and shifted $\frac{3\pi}{2}$ radians to the right to create the function $p(x)$. Write the function $p(x)$.

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Stretch

1. Consider the given graph of a trigonometric function.



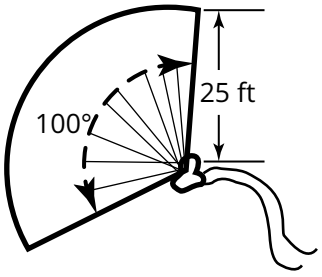
   a. Write the function $g(x)$ if $g(x)$ is a transformation of $f(x) = \sin x$.
   b. Determine the amplitude, period, frequency, and phase shift of $g(x)$.
   c. Write the function $h(x)$ if $h(x)$ is a transformation of $f(x) = \cos x$.
   d. Determine the amplitude, period, frequency, and phase shift of $h(x)$.

2. The tangent of θ is the ratio of sin θ to cos θ. Use your knowledge of the unit circle and the sine and cosine functions to determine tan θ for each value of θ.
   a. 0 radians
   b. $\frac{\pi}{6}$ radians
   c. $\frac{2\pi}{3}$ radians
   d. $\frac{5\pi}{4}$ radians
   e. $\frac{3\pi}{2}$ radians
   f. $\frac{11\pi}{6}$ radians

Review

1. A satellite in a low Earth orbit completes one orbit every 90 minutes. The satellite follows a circular path with its center at the center of the earth. The satellite is at an altitude of 160 kilometers. The radius of the earth is 6371 kilometers.
   a. Determine the angle of rotation, in radians, that corresponds to a 15-minute time period.
   b. Determine the distance traveled by the satellite in a 15-minute time period.

2. Archie is watering his lawn with a sprinkler attached to a hose. The outer path of the spray is an arc with the center at the sprinkler and a central angle of 100°. The distance from the sprinkler to any point on the outer path is 25 feet. Determine the central angle of the outer path in radians and the length of the outer path of the spray.



3. An owner of two large commercial buildings is trying to make the buildings more environmentally friendly. She has the building's bathroom facilities revamped with more modern energy saving equipment. She also places signs in the buildings encouraging the occupants to conserve water. On the first day after the building reconstruction is complete, Building A used 21,150 gallons of water and Building B used 24,325 gallons of water. For the remaining 29 days of the first month, Building A's water usage decreased by 0.5% each day while Building B's water usage decreased by 0.75% each day.
   a. Determine the total amount of water used by each building during the first month. Round decimals to the nearest hundredth.
   b. The cost of water for the state Building A is located in is $.00785 per gallon. After day 15 of the first month after reconstruction, the state raised its rates to $.00795. Determine how much the owner paid for water for the first month after reconstruction was done at the building.

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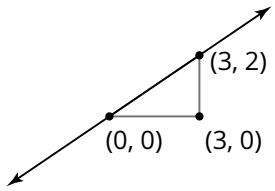
Farmer's Tan

The Tangent Function

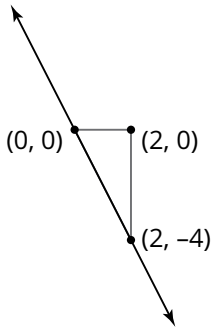
Warm Up

Determine the slope of each line.

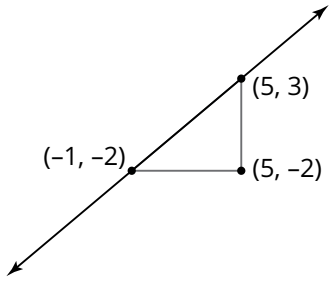
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Learning Goals

- Build the graph of the tangent function using the ratio $\frac{\sin \theta}{\cos \theta}$.
- Analyze characteristics of the tangent function, including period and asymptotes.
- Calculate values of the tangent function for common angles.
- Identify transformations of the tangent function.
- Use symmetry to determine the sine, cosine, and tangent of angle measures given by θ, $\pi - \theta$, $\pi + \theta$, and $2\pi - \theta$ in radians.

Key Term

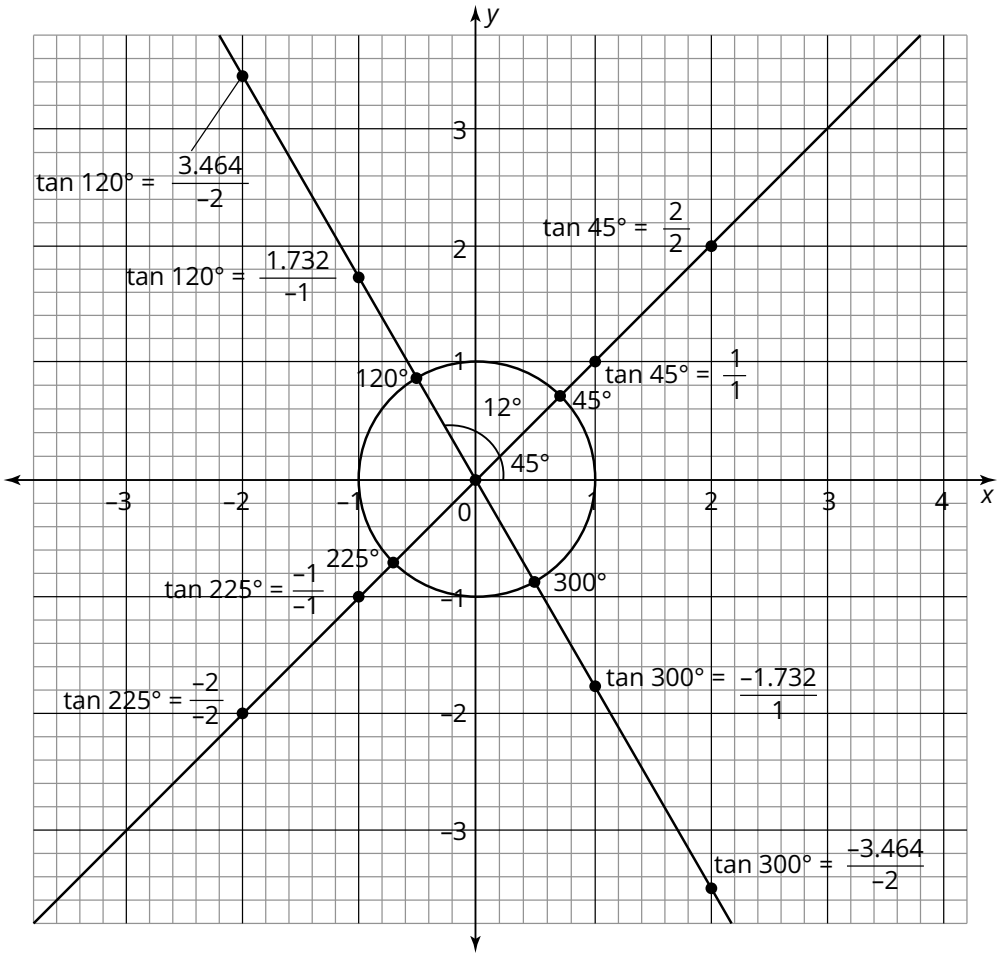
- tangent function

You have learned about the tangent ratio as defined in a right triangle. How can you build the tangent function using a unit circle?

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Let's Not Forget About Similarity

You know that the tangent of an acute angle in a right triangle is the ratio of the opposite side to the adjacent side. You can also determine the tangents of angles directly from the coordinate plane, using similar right triangles and the unit circle centered at the origin.



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1. **Consider the unit circle shown.**

   a. **How are similar triangles used to determine the tangent of a 45° angle?**

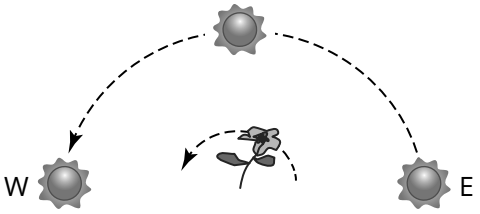
   b. **How are similar triangles used to determine the tangent of a 120° angle?**

2. **Explain why the tangent of a 45° angle is the same as the tangent of a 225° angle, and why the tangent of a 120° angle is the same as the tangent of a 300° angle.**

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ACTIVITY
6.1 Constructing the Tangent Function

Many plants exhibit the ability to track sunlight as the Sun moves across the sky during the day. This movement is called phototropism.



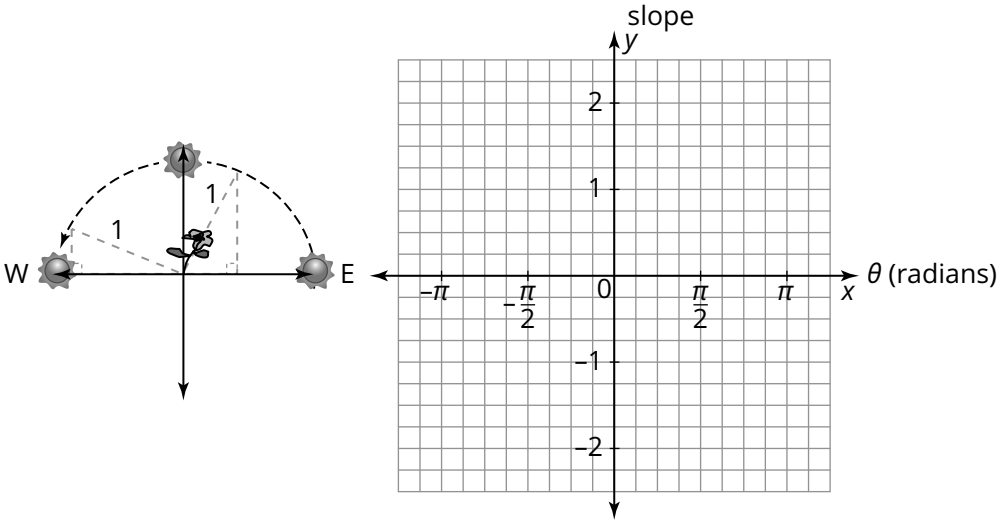
Imagine that flowers face due east in the morning where the Sun rises, and they track the sunlight throughout the day as the Sun moves directly overhead and then to the west.

1. **Suppose you track the slope of the angle that a flower makes with the ground over the course of a day. Create a visual interpretation of the changing slope on the graph as you answer each question.**

   a. **What is the value of the slope at $\theta = 0$ radians, $\frac{\pi}{4}$ radian, and $\frac{\pi}{2}$ radians on the unit circle? Explain your reasoning.**

Ask yourself:

Is the slope defined for all values of theta?



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b. Describe the value of the slope as θ increases from 0 radians and approaches $\frac{\pi}{2}$ radians.

c. What is the value of the slope at $\theta = \frac{3\pi}{4}$ radians and π radians? Explain how you determined each value.



Can you use symmetry to determine other slope values?

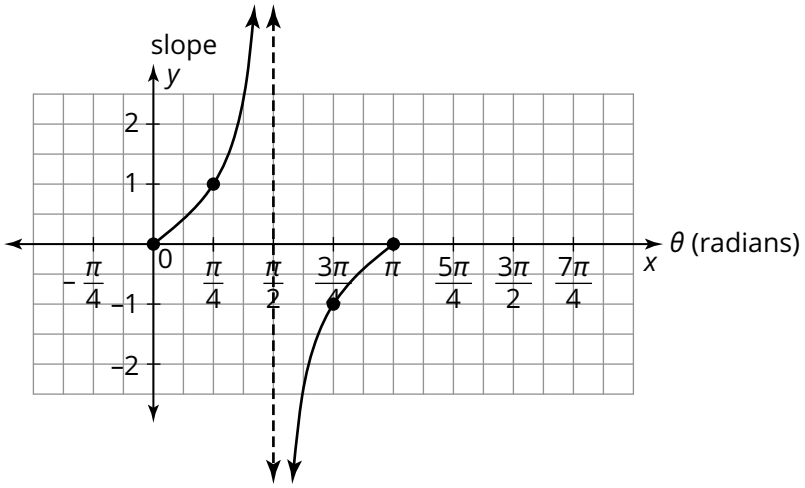
d. Describe the value of the slope as θ decreases from π radians and approaches $\frac{\pi}{2}$ radians.

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At night, flowers do not continue to follow the Sun after it sets.

But suppose the flower represents the terminal ray of a central angle in standard position. Let's continue to model the change in the slope of the terminal ray as it traverses the unit circle.

2. Use your answers to Question 1 and what you know about symmetry to answer each question.



a. Complete the graph of the slope values from $-\frac{\pi}{2}$ radians to 2π radians.

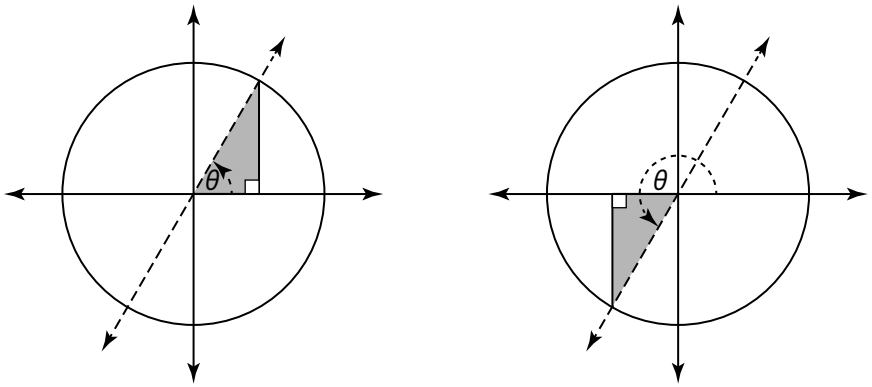
b. For what value(s) of θ is the slope equal to 0?

c. For what value(s) of θ is the slope undefined?

To help you think about slope values, you can remember that the terminal ray is a part of a line.

Worked Example

The triangles shown in the diagram are congruent. The hypotenuse of each triangle represents a terminal ray of a central angle with measure θ.



The slope of the terminal ray shown in Quadrant I is the same as the slope of the terminal ray shown in Quadrant III, because both rays are part of the same line. Both slopes are positive.

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3. **Use the worked example and your completed graph in Question 2 to answer each question.**

   a. **For what value(s) of θ is the slope equal to 1?**

   b. **For what value(s) of θ is the slope equal to −1?**

What special triangle has a "rise" and "run" that are equal?

4. **Use your completed graph to answer each question.**

   a. **Explain why the relation you graphed is a function.**

   b. **Is the function periodic? If so, determine the period of the function. If not, explain why not.**

5. **James said that the period of the function is 2π radians because the graph starting at 2π radians repeats the same values as it does starting at 0 radians. Juli says that the period of the function is $\frac{\pi}{2}$ radians, because there is an asymptote at multiples of $\frac{\pi}{2}$ radians.**

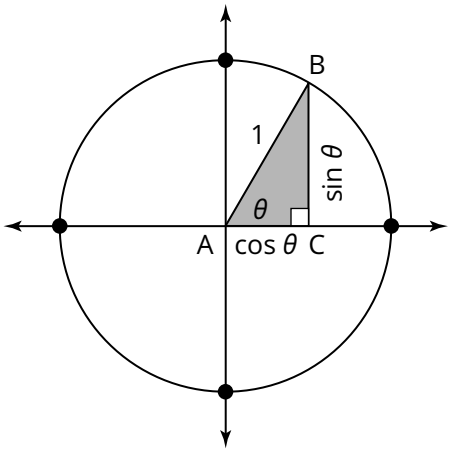
   Who is correct? Explain your reasoning.

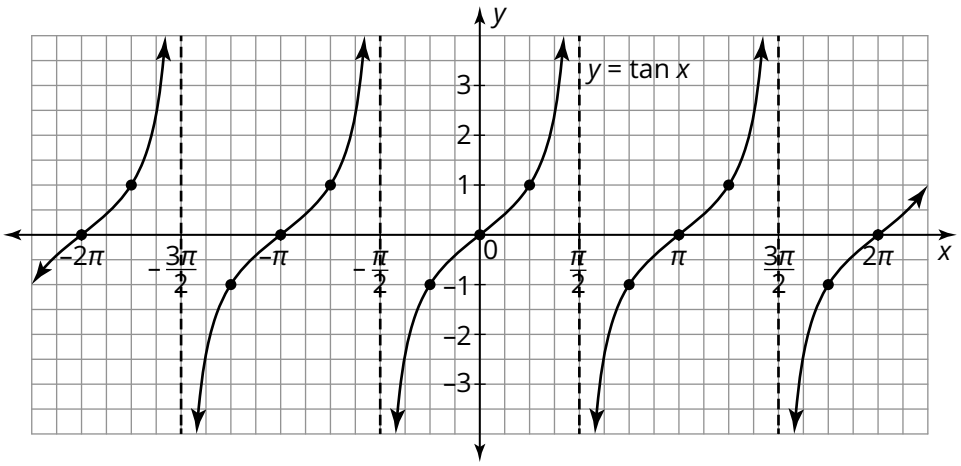


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ACTIVITY
6.2
Exploring the Properties of the Tangent Function

The function that you graphed in the previous problem is the **tangent function**. Recall that the tangent ratio (tan) is the ratio of the lengths of the opposite side and the adjacent side in a right triangle. The tangent ratio is equal to the slope of the hypotenuse, which represents the terminal ray of the central angle on the unit circle.





1. **How can you write the tangent function in terms of sine and cosine, using the unit circle?**

2. **In which quadrants is the tangent function positive and negative? Explain your reasoning. Record this information on the Sine, Cosine, and Tangent on the Unit Circle diagram located at the end of the lesson.**

3. **Use what you know about rational functions to describe the discontinuities in the graph of the tangent function.**

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4. **What is the value of $\tan\left(\frac{n\pi}{2}\right)$ for any odd integer value of n?**

5. **Identify the periodicity identity for the tangent function. Explain your reasoning.**

Remember:

You have identified periodicity identities for both the sine function and cosine function.

6. **The table shows some of the characteristics of the sine and cosine functions that you have identified. Complete the table for the tangent function.**

	$y = \sin x$	$y = \cos x$	$y = \tan x$
***y*-intercept**	(0, 0)	(0, 1)	
Domain	$(-\infty, \infty)$	$(-\infty, \infty)$	
Range	$[-1, 1]$	$[-1, 1]$	
Period	2π	2π	
Minimum Output Value	-1	-1	
Minimum Output Value	1	1	
Amplitude	1	1	
Midline	$y = 0$	$y = 0$	

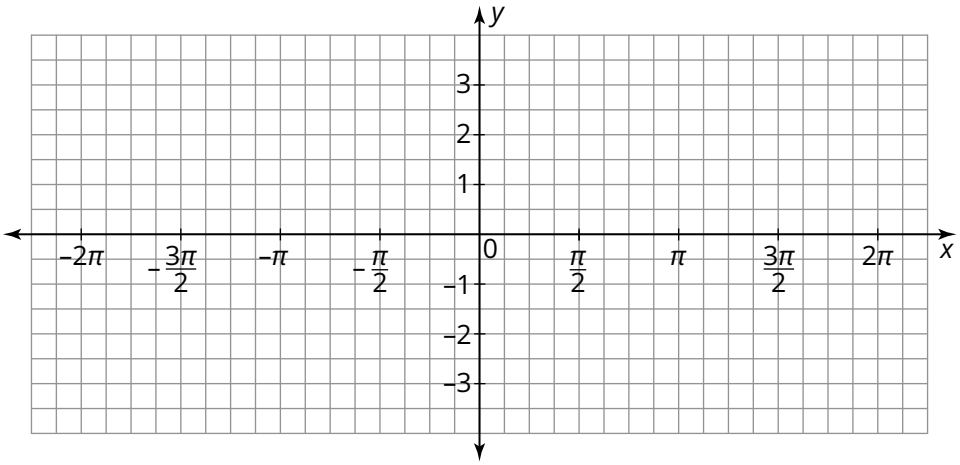
7. **Complete the Sine, Cosine, and Tangent on the Unit Circle diagram located at the end of the lesson by labeling the tangent values for each angle measure.**

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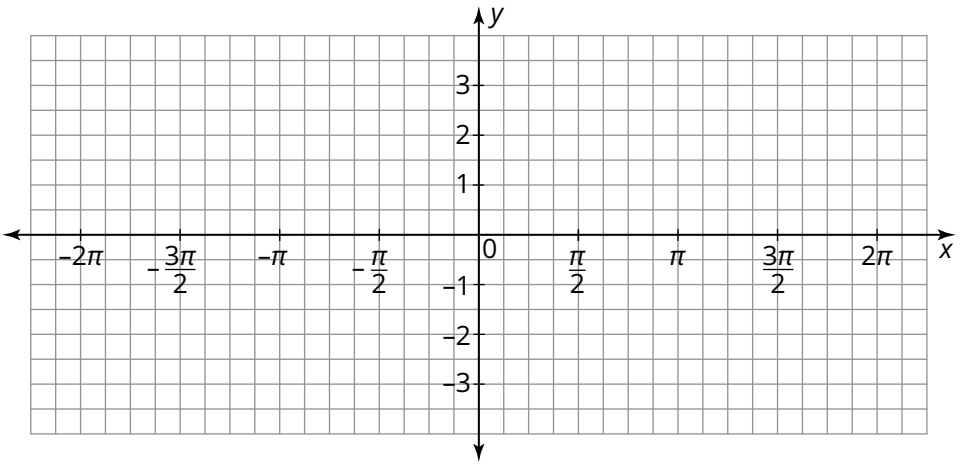
ACTIVITY
6.3
Transformations of the Tangent Function

1. Use what you know about transformations to sketch each graph.

a. $f(x) = -\tan x$



b. $g(x) = \tan(-x)$



c. What do you notice about the graphs in parts (a) and (b)?

Ask yourself:

What happens to the slope of a line when you reflect it across the *x*-axis or the *y*-axis?

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2. Match each equation with its corresponding graph. Explain your reasoning.

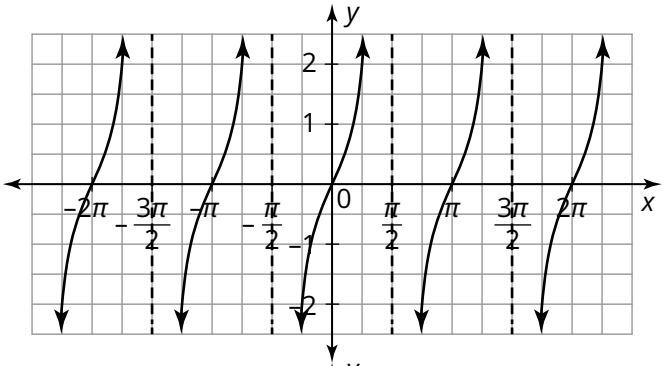
a. $y = \tan\left(\frac{1}{2}x\right)$

b. $y = \tan\left(x + \frac{\pi}{2}\right)$

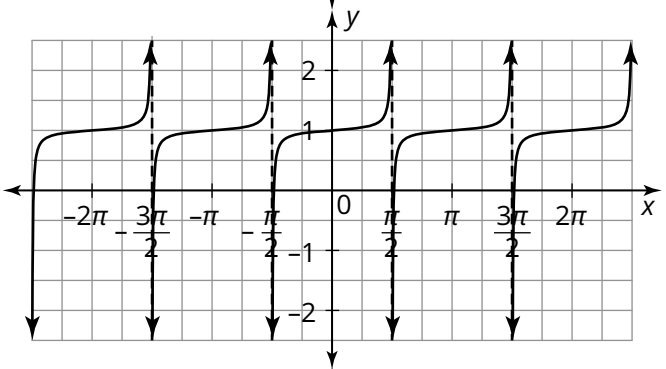
c. $y = \frac{1}{20}\tan x + 1$

d. $y = 2\tan x$

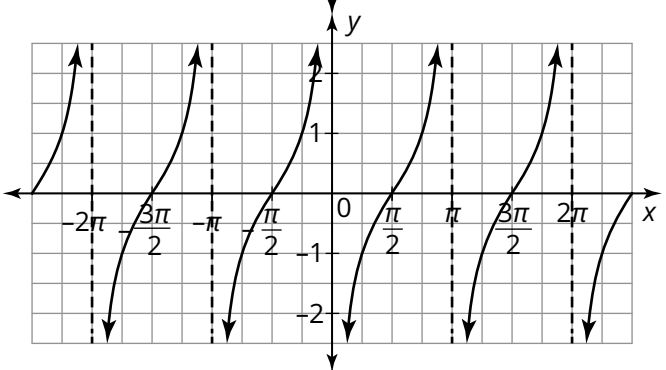
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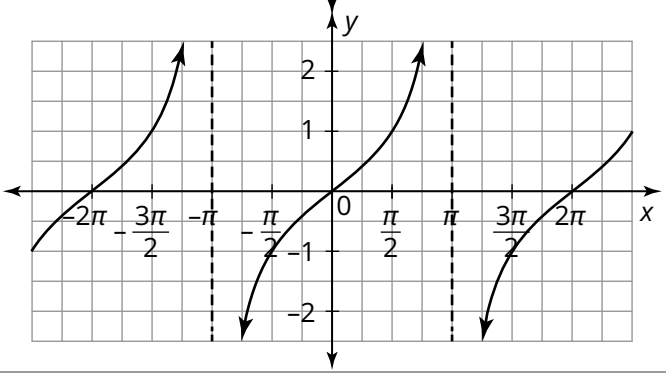
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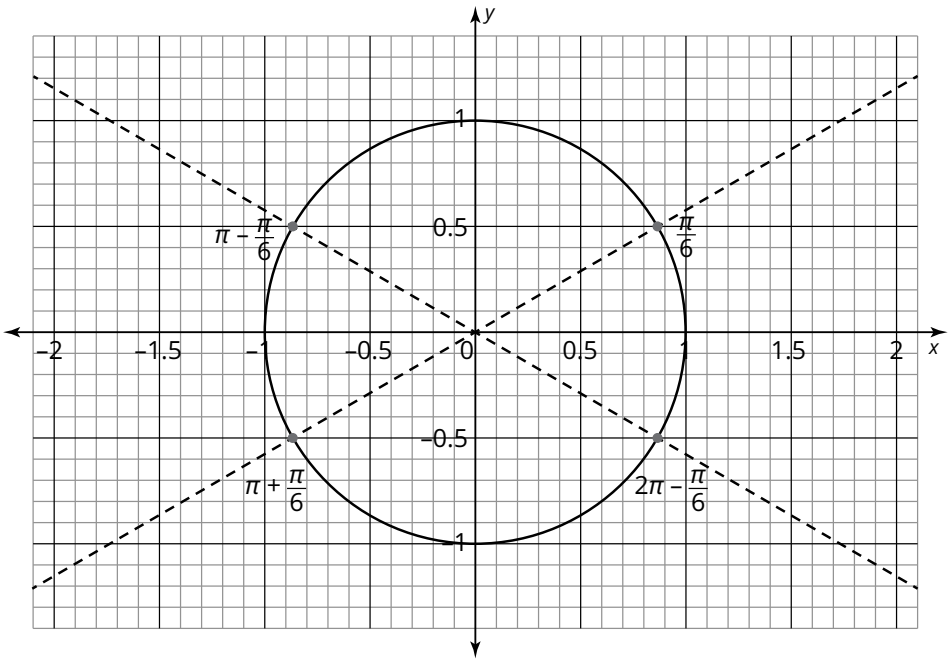
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NOTES

TALK the TALK

Oh, Also, Don't Forget About Symmetry

The locations of $\frac{\pi}{6}$, $\pi - \frac{\pi}{6}$, $\pi + \frac{\pi}{6}$, and $2\pi - \frac{\pi}{6}$ are plotted on the unit circle shown.

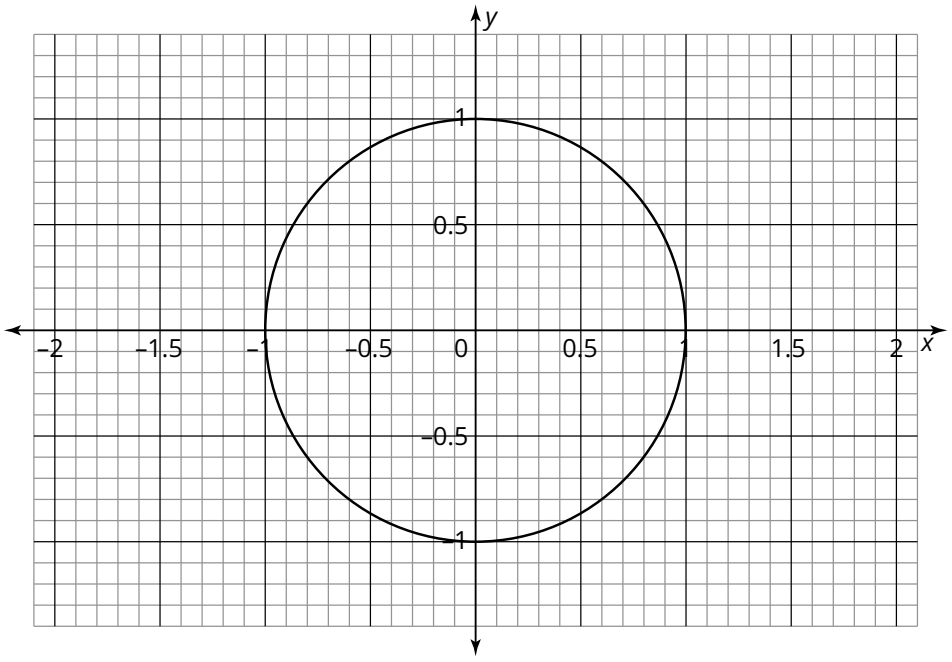


1. **Describe the central angle measure associated with each location, and determine the sine, cosine, and tangent of each angle measure.**

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NOTES

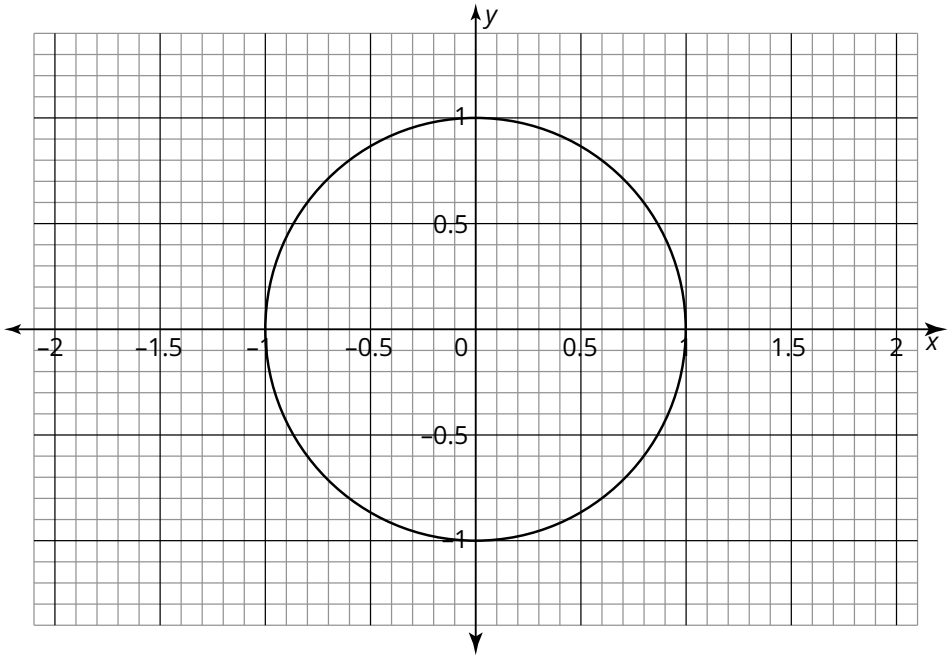
2. **Identify the locations of $\frac{\pi}{4}$, $\pi - \frac{\pi}{4}$, $\pi + \frac{\pi}{4}$, and $2\pi - \frac{\pi}{4}$ on the unit circle. Determine the sine, cosine, and tangent of each central angle measure.**



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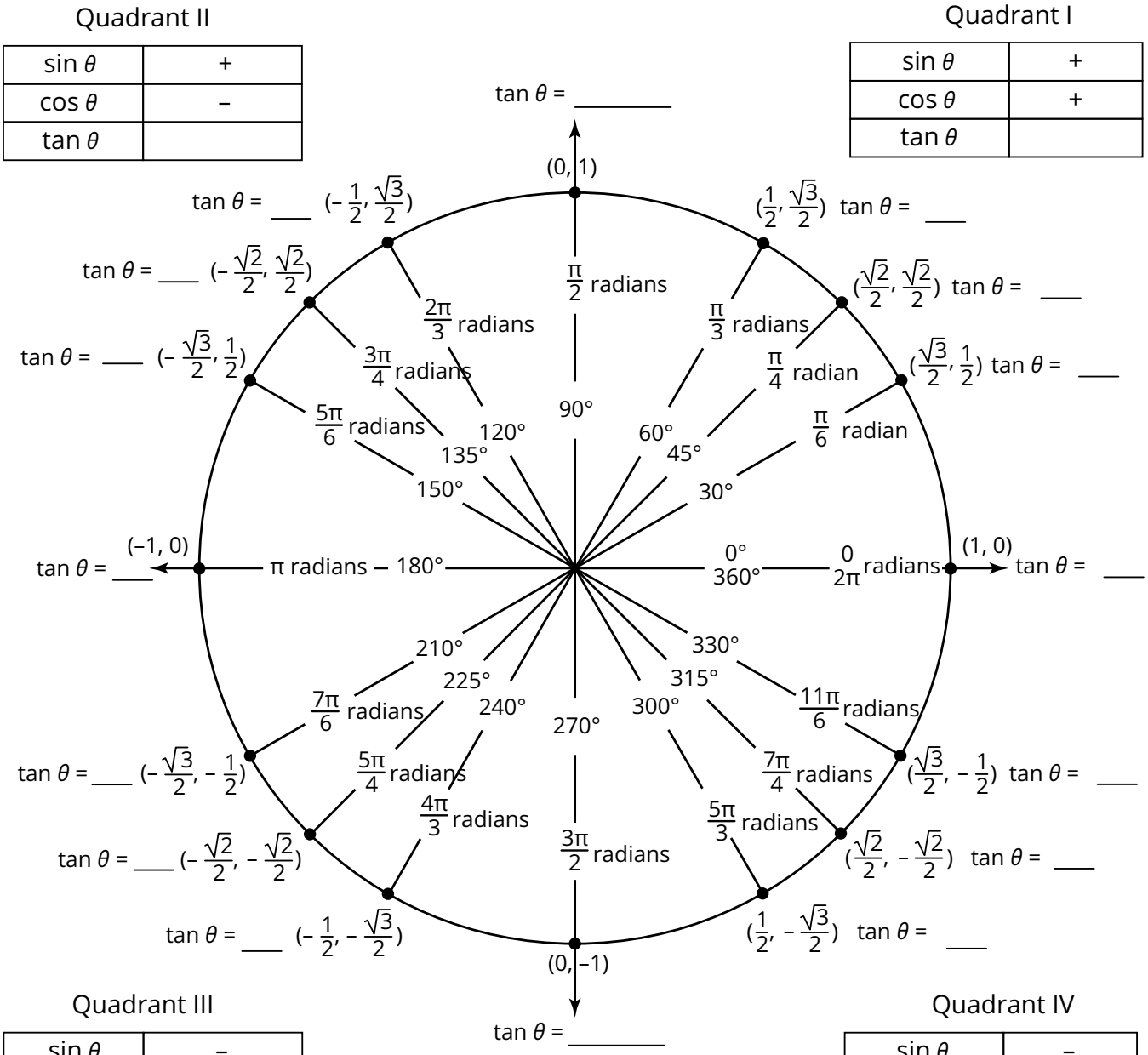
3. **Identify the locations of $\frac{\pi}{3}$, $\pi - \frac{\pi}{3}$, $\pi + \frac{\pi}{3}$, and $2\pi - \frac{\pi}{3}$ on the unit circle. Determine the sine, cosine, and tangent of each central angle measure.**



4. **Explain how you can use symmetry to determine the values of trigonometric functions at certain input values.**

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Sine, Cosine, and Tangent on the Unit Circle



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Assignment

Write

Explain how the tangent function is related to the sine and cosine functions.

Remember

The tangent function is positive when sin θ and cos θ have the same sign, and the tangent function is negative when sin θ and cos θ have different signs.

The period of the function $y = \tan x$ is π radians.

The periodicity identity for the tangent function is written as $\tan(x + \pi) = \tan x$.

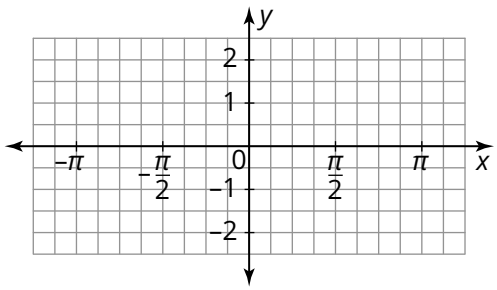
Practice

1. Consider Manuel's incorrect work. Identify the errors and correctly determine $\tan\left(\frac{7\pi}{3}\right)$.

Manuel

$$\tan\left(\frac{7\pi}{3}\right) = \tan\left(\frac{6\pi}{3} + \pi\right)$$
$$= \tan\left(\frac{6\pi}{3}\right)$$
$$= \tan(2\pi)$$
$$= 0$$

2. Given $\tan\theta = -\sqrt{3}$. Determine 2 values for θ such that $\theta < 0$ and 2 values for θ such that $\theta > 2\pi$.
3. Given $\tan\theta = 1$. Determine 2 values for θ such that $\theta < 0$ and 2 values for θ such that $\theta > 2\pi$.
4. Determine $\tan\left(\frac{13\pi}{6}\right)$.
5. Determine $\tan\left(\frac{11\pi}{4}\right)$.
6. To create the function $g(x)$, the function $f(x) = \tan x$ was reflected across the x-axis and shifted $\frac{\pi}{2}$ radians to the right.
   a. Graph the function $g(x)$.
   b. Write the function $g(x)$.

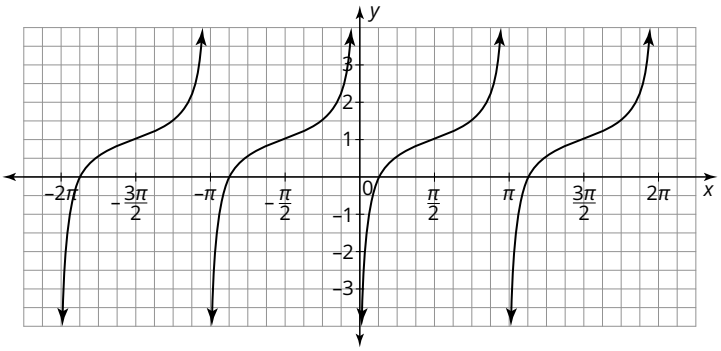


7. The function $f(x) = \tan x$ has been horizontally stretched by a factor of 4 and shifted down 3 units to create the function $m(x)$. Write the function $m(x)$.

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Stretch

1. Consider the graph of a trigonometric function $g(x)$.



Write the function $g(x)$, a transformation of the function $f(x) = \tan x$.

2. Determine the values of θ in radians that would make each equation true for $0 \leq \theta \leq 2\pi$.

a. $\cos\theta = 1$ b. $\cos\theta = 0$ c. $\cos\theta = \frac{\sqrt{3}}{2}$ d. $\cos\theta = -\frac{1}{2}$ e. $\cos(\theta) + 1 = 0$

Review

1. Determine θ and $\cos\theta$ when $\sin\theta = -\frac{\sqrt{2}}{2}$ and $\cos\theta$ is negative. Restrict values for θ such that $0 \leq \theta \leq 2\pi$.
2. Determine $\sin\left(\frac{15\pi}{4}\right)$.
3. Priscilla and Theo both bought farms the same year, and each dedicated one acre of the land for growing strawberries. The first year of operation, Priscilla's strawberry field yielded 22,000 pounds and Theo's field yielded 19,500 pounds. Since that first year, Priscilla's yield of strawberries has decreased by 1.5% each year while Theo's yield of strawberries has increased by 1.0% each year.
   a. Whose farm yielded more strawberries in the 7th year of production? Round decimals to the nearest hundredth.
   b. Which of the 2 farms had the biggest yield over the first 7 years? Round decimals to the nearest hundredth.
4. Use long division to determine whether $x + 2$ is a factor of $2x^4 + 5x^3 + 5x^2 + 10x + 8$. Show your work.

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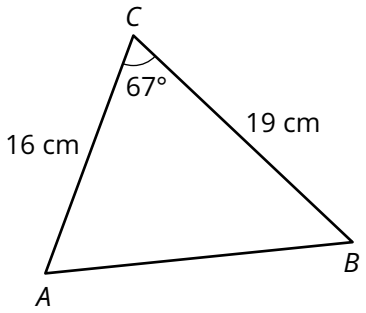
Skills Practice

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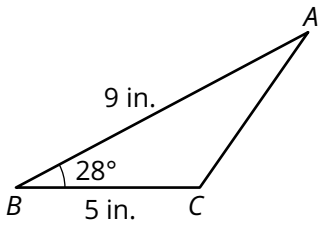
I. Law of Sines and Law of Cosines

A. Determine the area of each triangle. Round your answers to the nearest tenth.

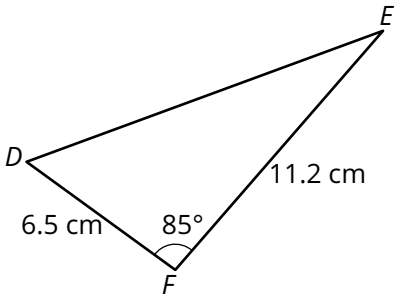
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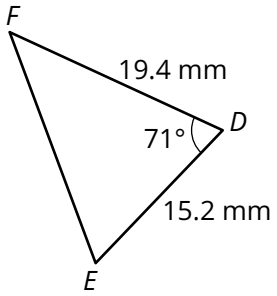
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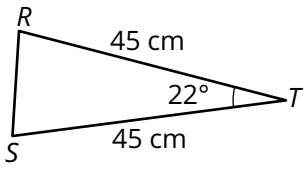
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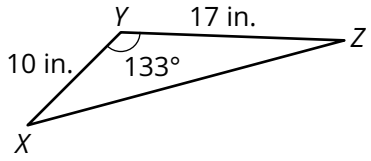
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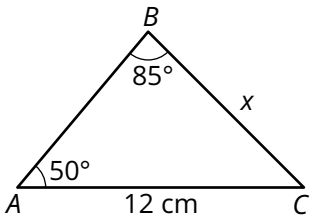


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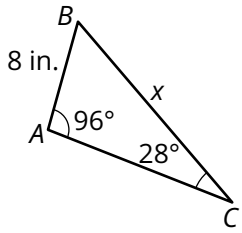
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B. Determine the unknown side length *x* by using the Law of Sines. Round your answers to the nearest tenth.

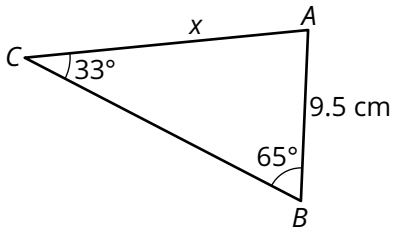
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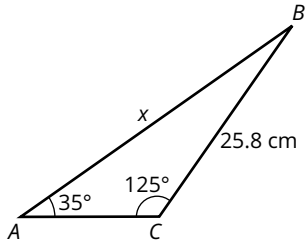
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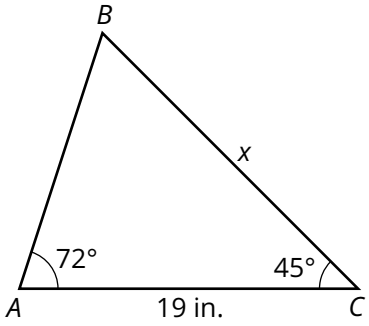
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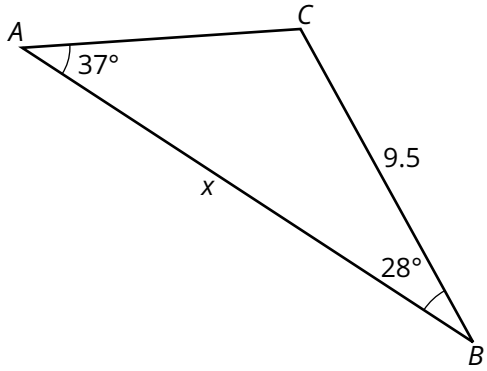
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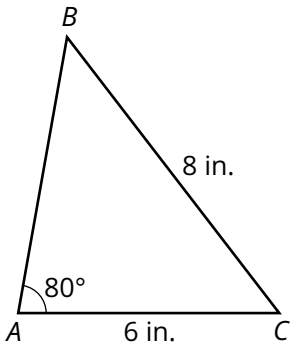
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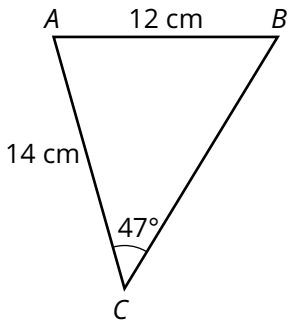
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C. Determine m∠*B* by using the Law of Sines. Round your answers to the nearest tenth.

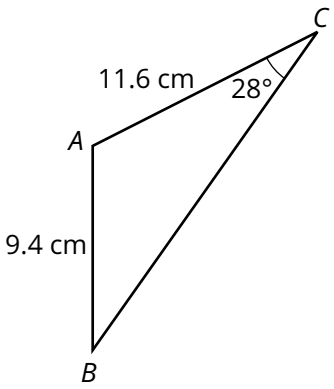
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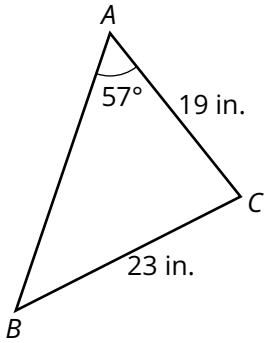
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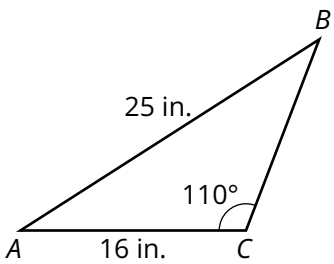
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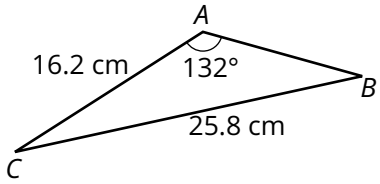
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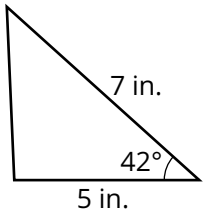


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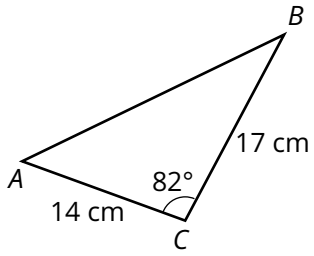
Name _____ Date _____

D. Determine the unknown side length by using the Law of Cosines. Round your answers to the nearest tenth.

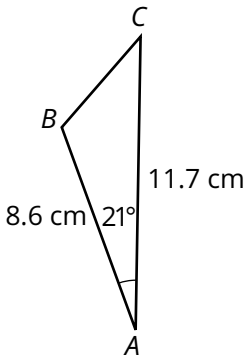
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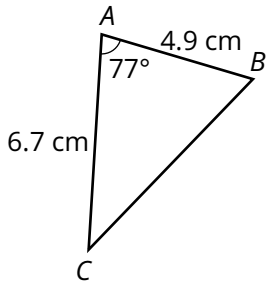
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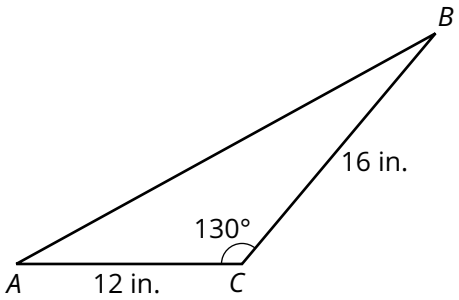
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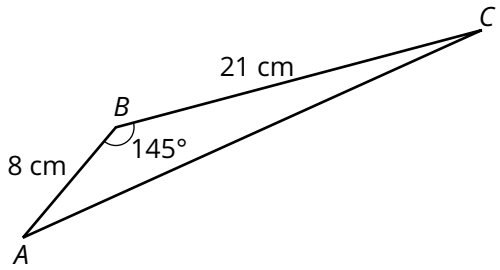
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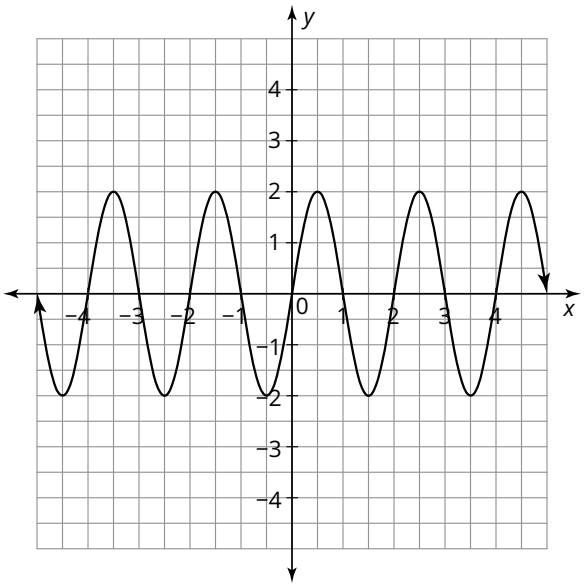


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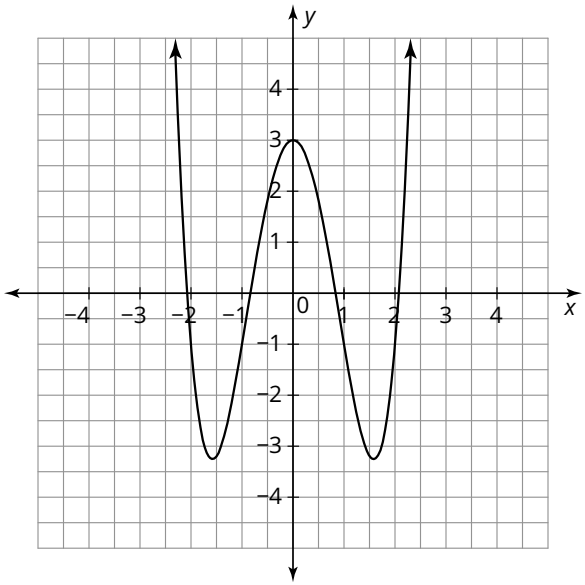
II. Characteristics of Periodic Functions

A. Determine whether each graph represents a periodic function over the interval shown. If so, identify the period *p*.

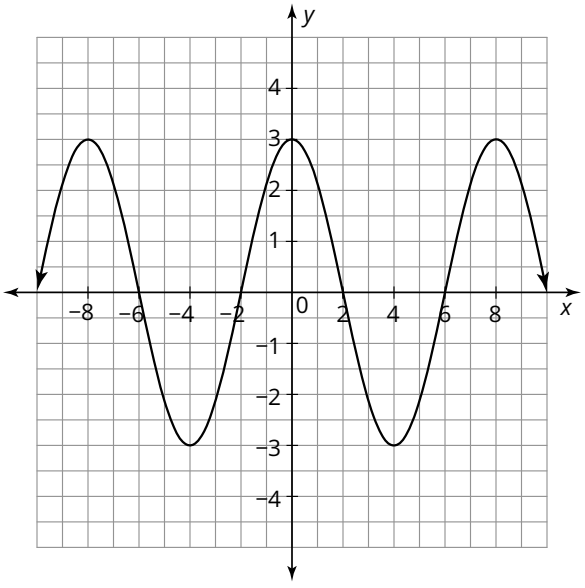
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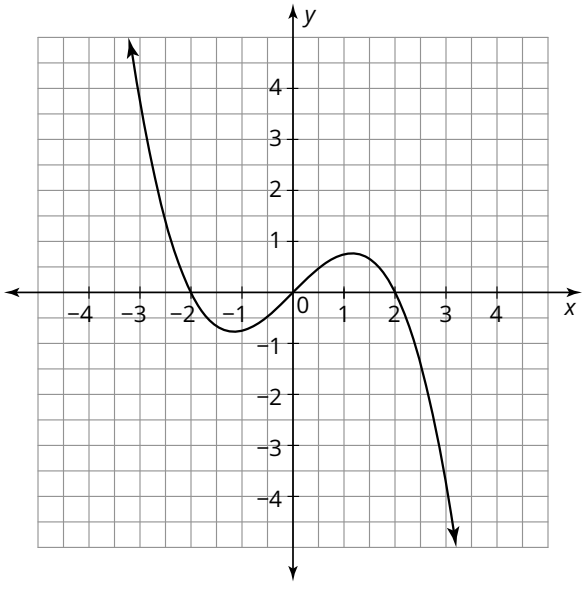
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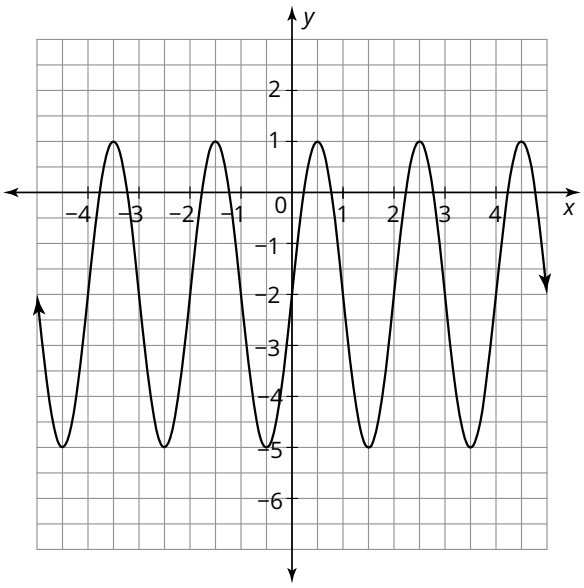
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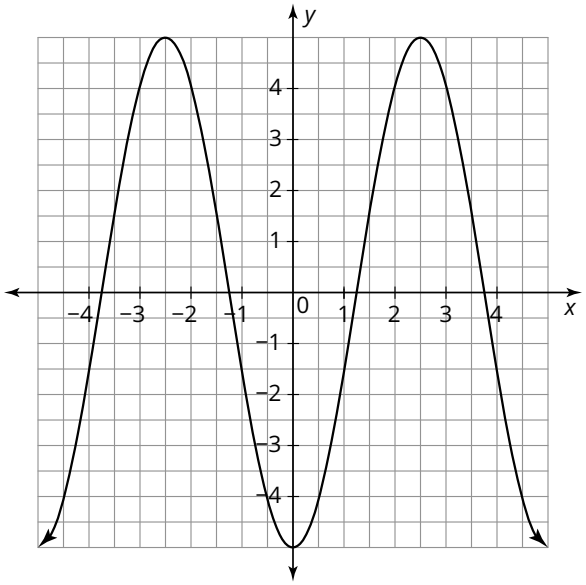
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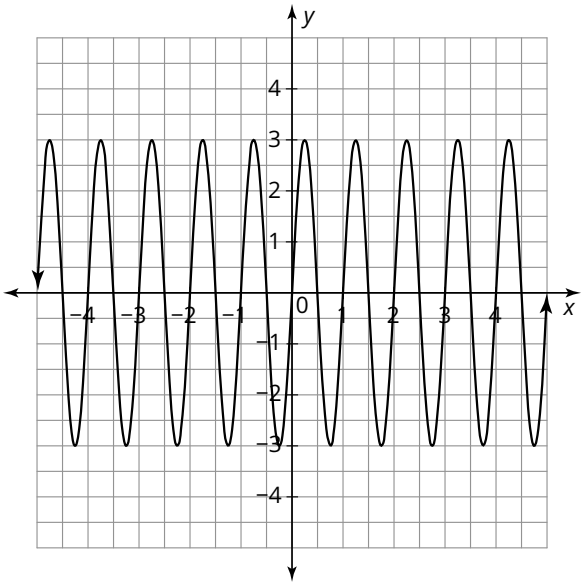


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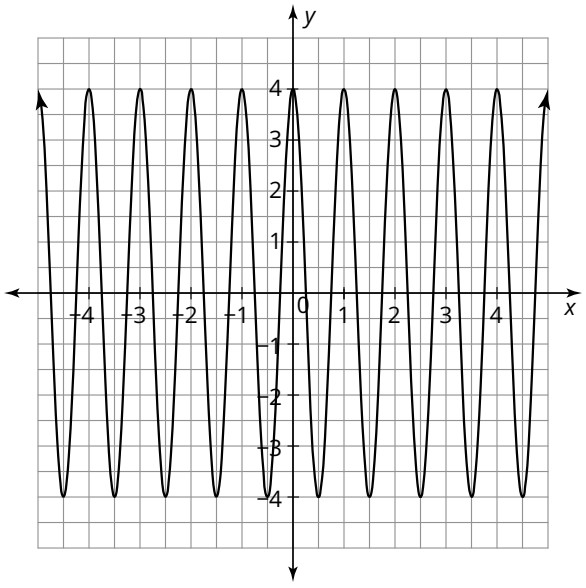


B. Determine the midline and amplitude of each graph.

1.

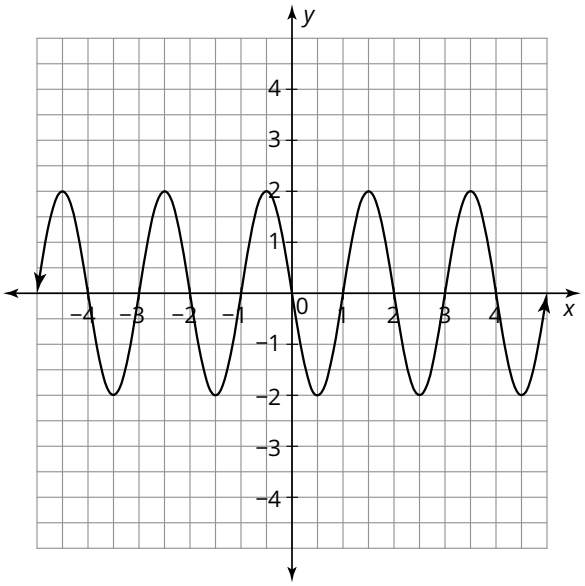


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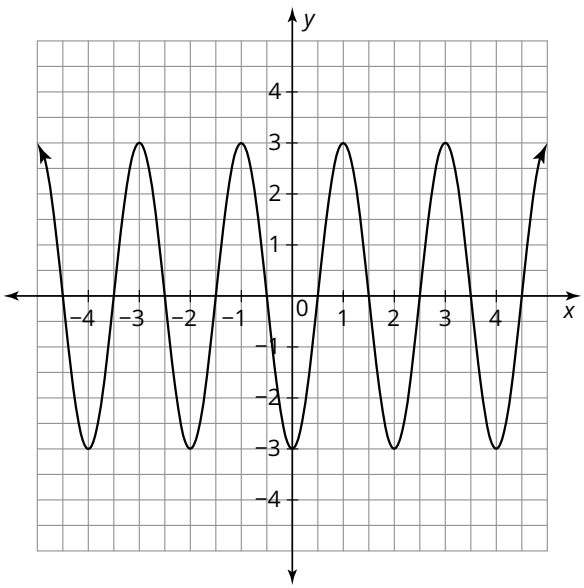


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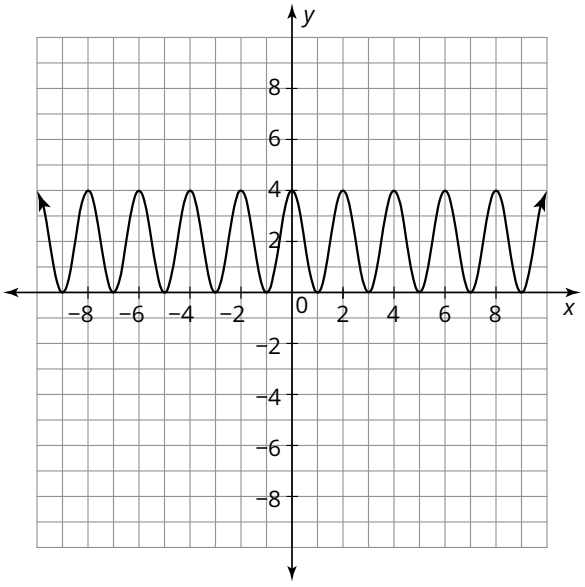
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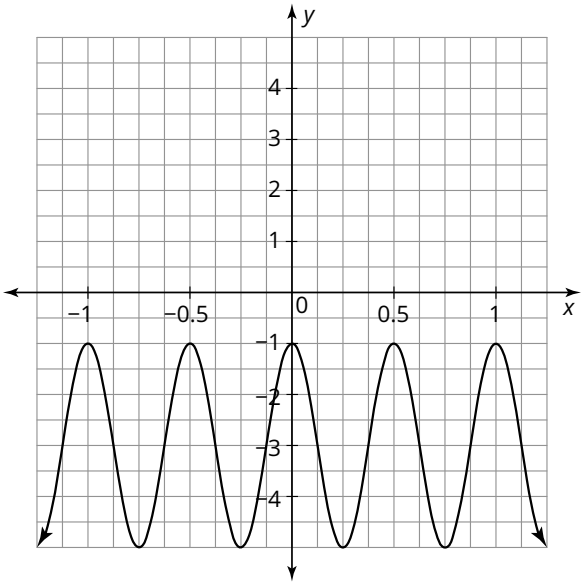
4.



5.



6.



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III. Using Radian Measures

A. Calculate the arc length and the radian measure of each angle in a circle with the given dimensions.

1. $\theta = 30°$; radius = 3 units

2. $\theta = 270°$; radius = 2 units

3. $\theta = 45°$; radius = 5 units

4. $\theta = 100°$; radius = 6 units

5. $\theta = 135°$; radius = 4 units

6. $\theta = 180°$; diameter = 10 units

7. $\theta = 90°$; diameter = 12 units

8. $\theta = 15°$; diameter = 15 units

9. $\theta = 60°$; diameter = 8 units

10. $\theta = 300°$; diameter = 3 units

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B. Estimate the degree measure of each central angle given in radians in a unit circle. Explain your reasoning.

1. 4 radians

2. 2 radians

3. 5 radians

4. 6 radians

5. 1 radian

6. 2.5 radians

7. 3.25 radians

8. 5.1 radians

9. 1.57 radians

10. 6.28 radians

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C. Convert each radian measure to degrees. Round each answer to the nearest hundredth.

1. 5 radians

2. 3 radians

3. 6 radians

4. 2 radians

5. 4 radians

6. 1.9 radians

7. 5.8 radians

8. 2.3 radians

9. 4.75 radians

10. 3.4 radians

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D. Convert each degree measure to radians. Write each answer as a simplified ratio in terms of π.

1. 121°

2. 85°

3. 204°

4. 66°

5. 18°

6. 196°

7. 320°

8. 256°

9. 102°

10. 305°

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IV. Sine and Cosine Functions and their Transformations

A. Use the unit circle to determine each value.

1. $\sin\left(\frac{\pi}{2}\right)$

2. $\sin\left(\frac{5\pi}{6}\right)$

3. $\sin(2\pi)$

4. $\sin\left(\frac{5\pi}{4}\right)$

5. $\cos\left(\frac{\pi}{4}\right)$

6. $\cos\left(\frac{2\pi}{3}\right)$

7. $\cos\left(\frac{3\pi}{2}\right)$

8. $\cos\left(\frac{7\pi}{6}\right)$

B. Evaluate the sine and cosine of the supplement of the given measure.

1. $\theta = \frac{5\pi}{6}$

2. $\theta = \frac{\pi}{4}$

3. $\theta = \frac{2\pi}{3}$

4. $\theta = \frac{3\pi}{4}$

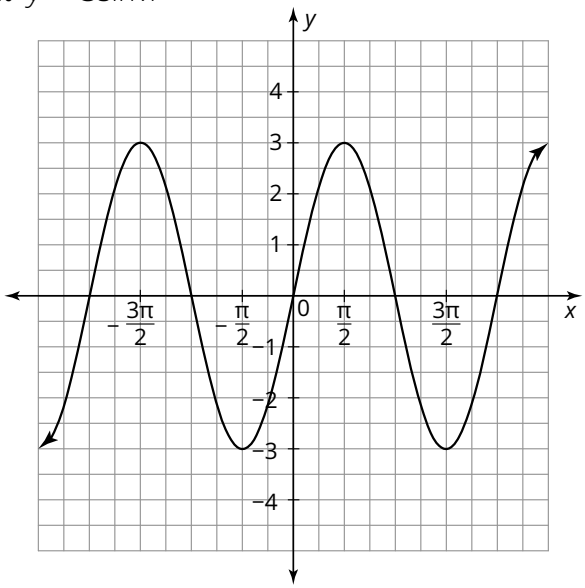
5. $\theta = \frac{\pi}{2}$

6. $\theta = \frac{\pi}{6}$

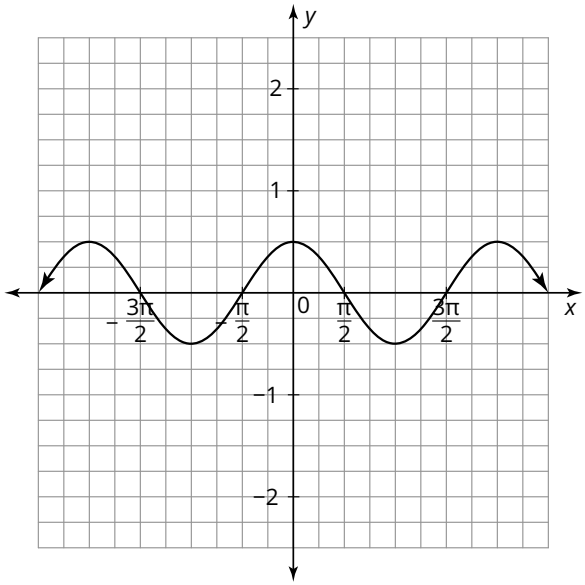
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C. Determine the amplitude of each graph.

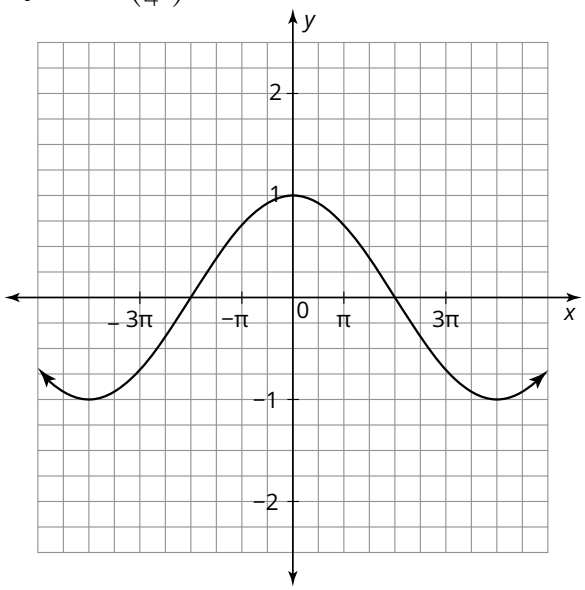
1. $y = 3\sin x$



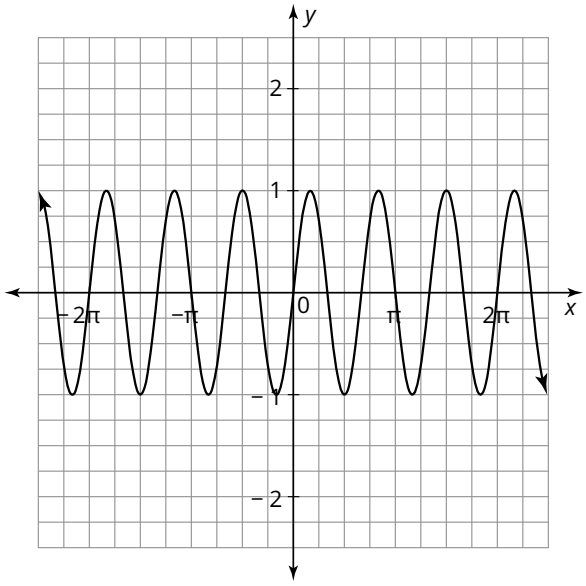
2. $y = \frac{1}{2}\cos x$



3. $y = \cos\left(\frac{1}{4}x\right)$



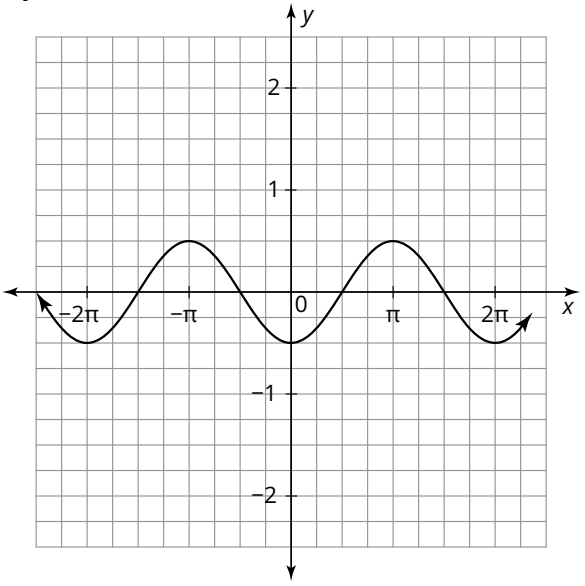
4. $y = \sin(3x)$



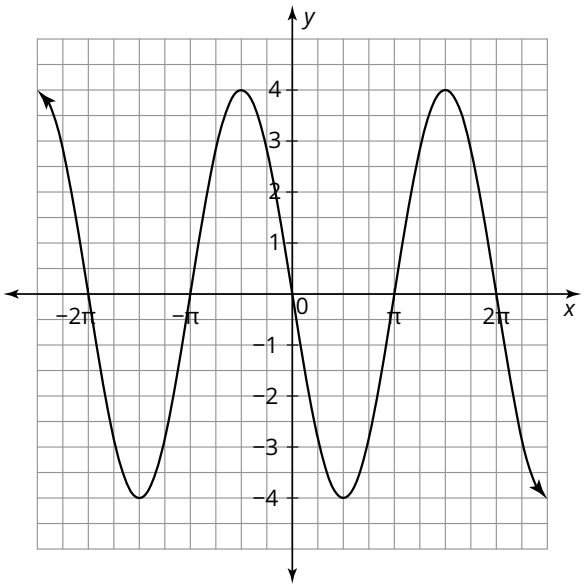
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5. $y = -0.5\cos x$

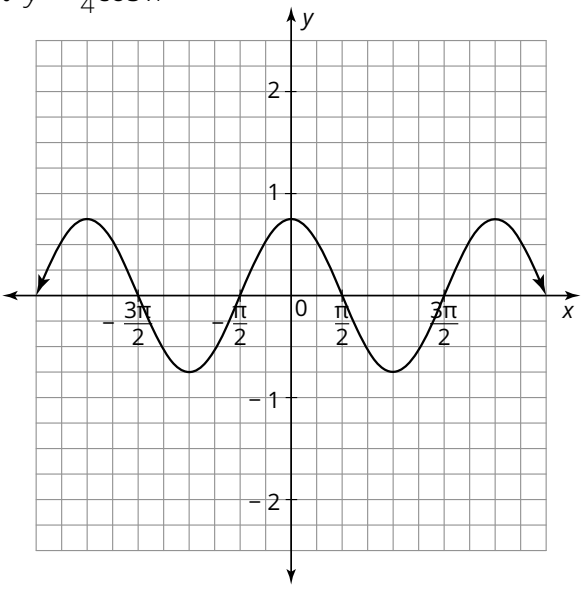


6. $y = -4\sin x$

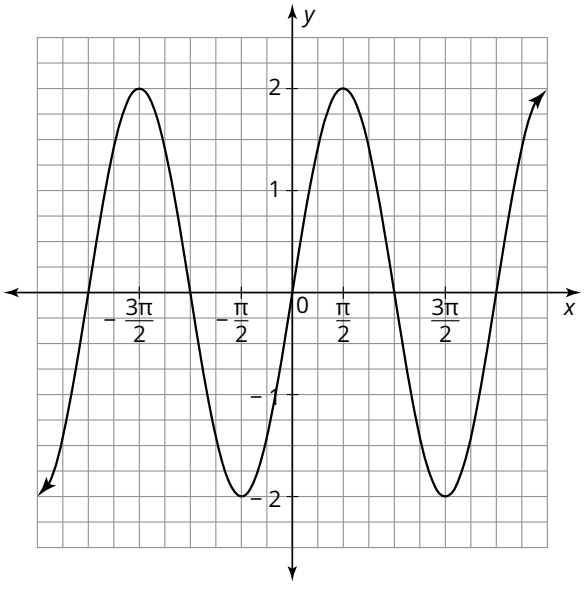


D. Determine the period and frequency of each graph.

1. $y = \frac{3}{4}\cos x$

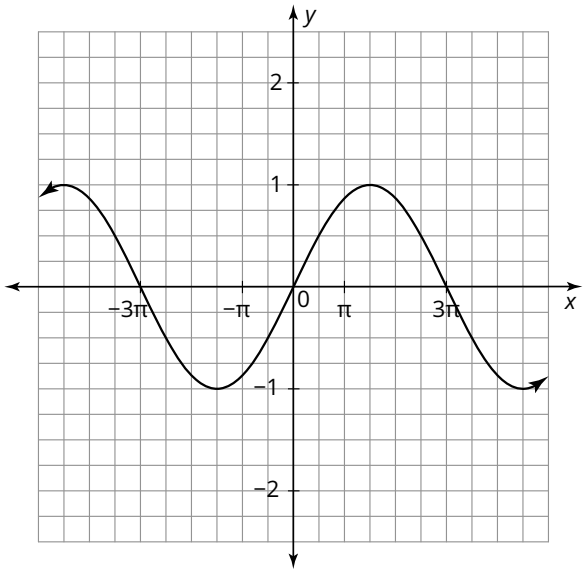


2. $y = 2\sin x$

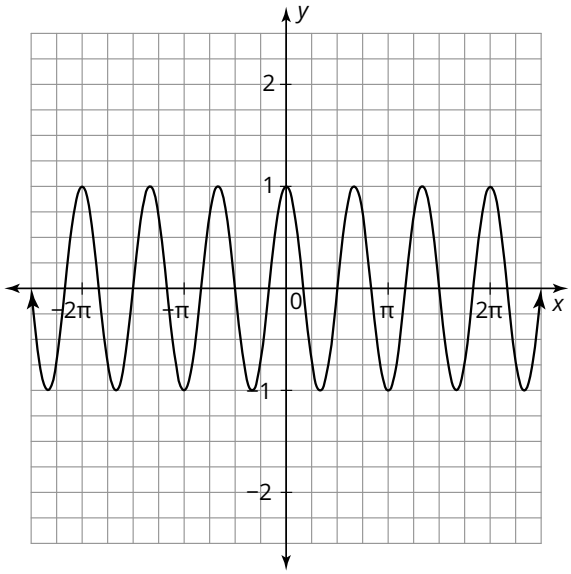


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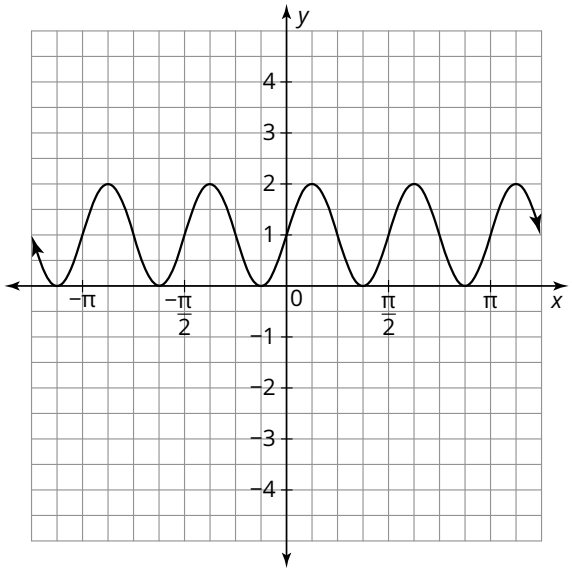
3. $y = \sin\left(\frac{1}{3}x\right)$



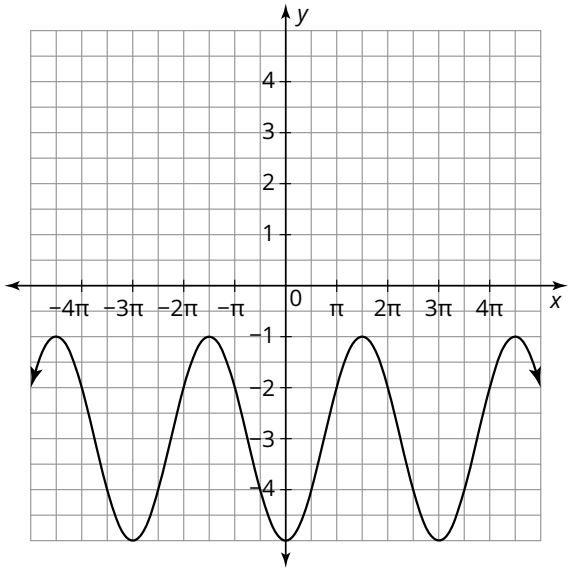
4. $y = \cos(3x)$



5. $y = \sin(4x) + 1$



6. $y = -2\cos\left(\frac{2}{3}x\right) - 3$



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V. Tangent Function

A. Calculate the tangent of each angle given the cosine and sine of the angle.

1. $\sin\theta = \frac{3}{5}, \cos\theta = \frac{4}{5}$

2. $\sin\theta = \frac{7}{25}, \cos\theta = \frac{24}{25}$

3. $\sin\theta = \frac{8}{17}, \cos\theta = \frac{15}{17}$

4. $\sin\theta = \frac{12}{13}, \cos\theta = \frac{5}{13}$

5. $\sin\theta = \frac{40}{41}, \cos\theta = \frac{9}{41}$

6. $\sin\theta = \frac{20}{29}, \cos\theta = \frac{21}{29}$

7. $\sin\theta = \frac{2\sqrt{5}}{5}, \cos\theta = \frac{\sqrt{5}}{5}$

8. $\sin\theta = \frac{2\sqrt{13}}{13}, \cos\theta = \frac{3\sqrt{13}}{13}$

B. Evaluate each tangent function by using the relationship between the tangent function and the sine and cosine functions.

1. $\tan\left(\frac{\pi}{2}\right)$

2. $\tan(\pi)$

3. $\tan\left(\frac{5\pi}{4}\right)$

4. $\tan\left(\frac{2\pi}{3}\right)$

5. $\tan(0)$

6. $\tan\left(\frac{3\pi}{2}\right)$

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7. $\tan\left(\frac{\pi}{3}\right)$

8. $\tan\left(\frac{4\pi}{3}\right)$

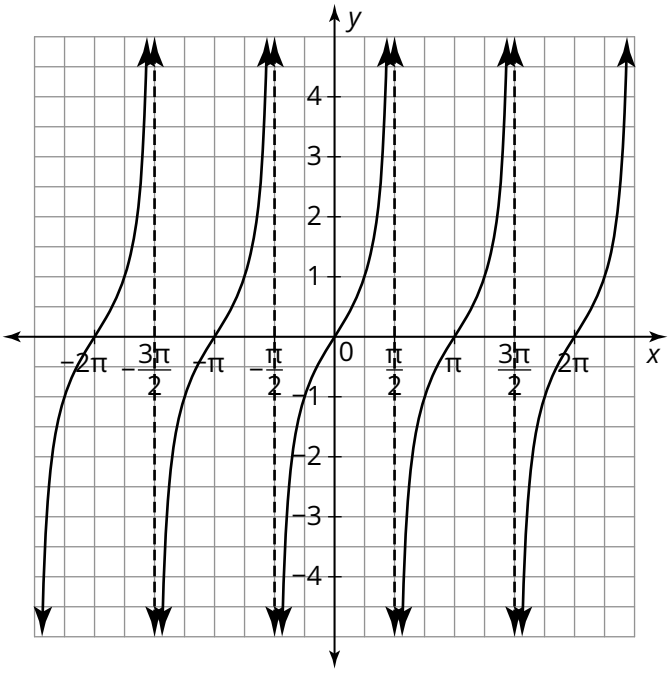
9. $\tan\left(\frac{7\pi}{6}\right)$

10. $\tan\left(\frac{\pi}{6}\right)$

11. $\tan\left(\frac{3\pi}{4}\right)$

12. $\tan\left(\frac{5\pi}{6}\right)$

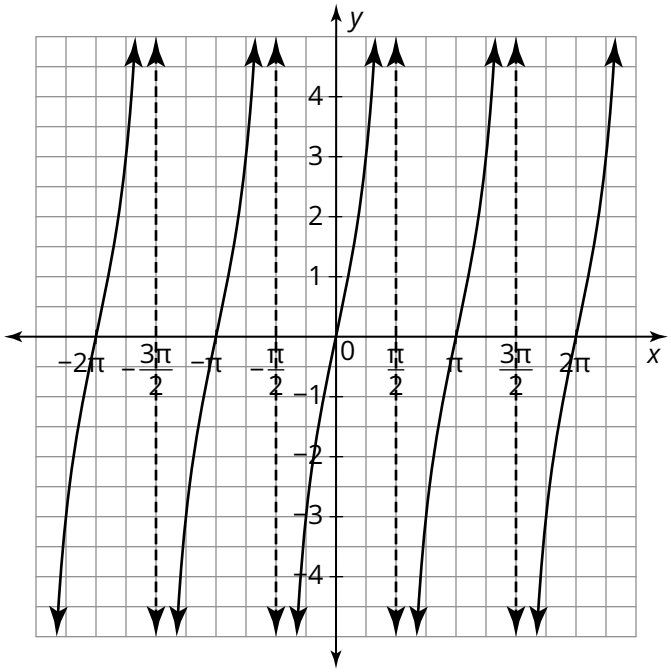
C. Compare the graph of each transformation to the graph of tan *x* shown below. Then, answer the question and explain how you determined your answer.



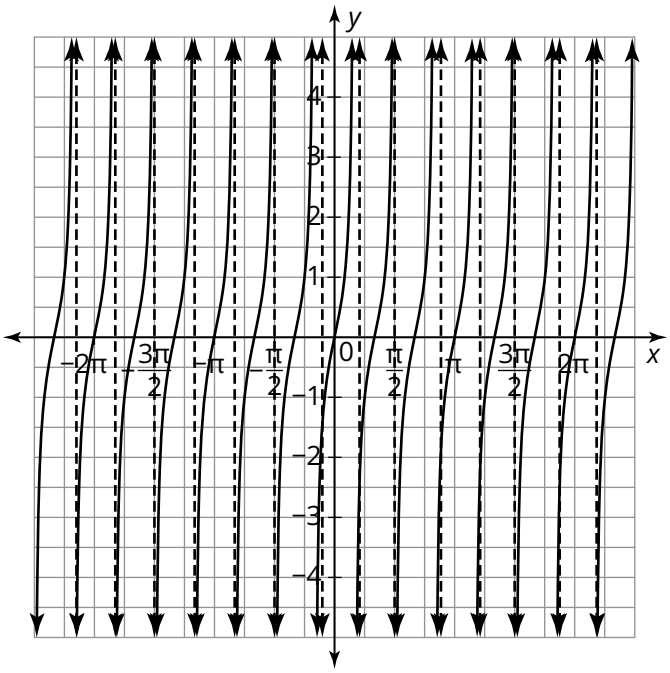
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1. Does the graph below represent the function $y = \tan(3x)$ or $y = 3\tan x$?

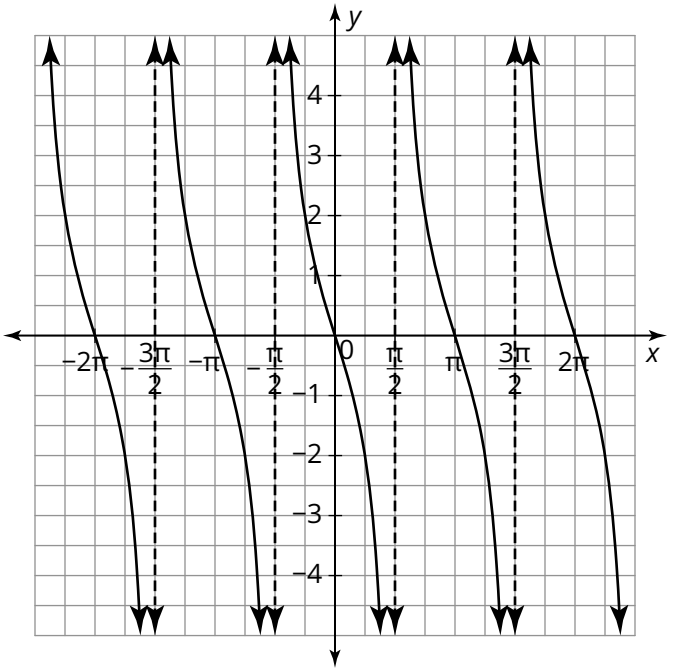


2. Does the graph below represent the function $y = \tan(3x)$ or $y = \tan\left(\frac{1}{3}x\right)$?

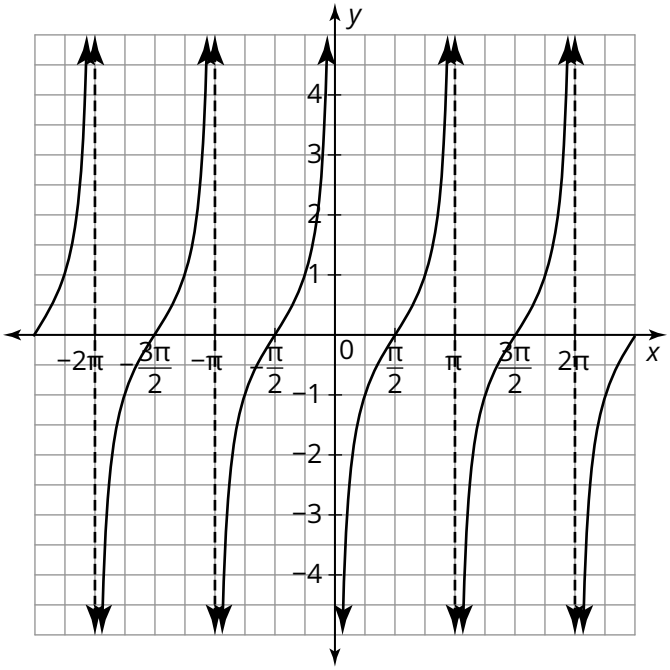


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3. Does the graph below represent the function $y = -2\tan x$ or $y = -\tan x$?



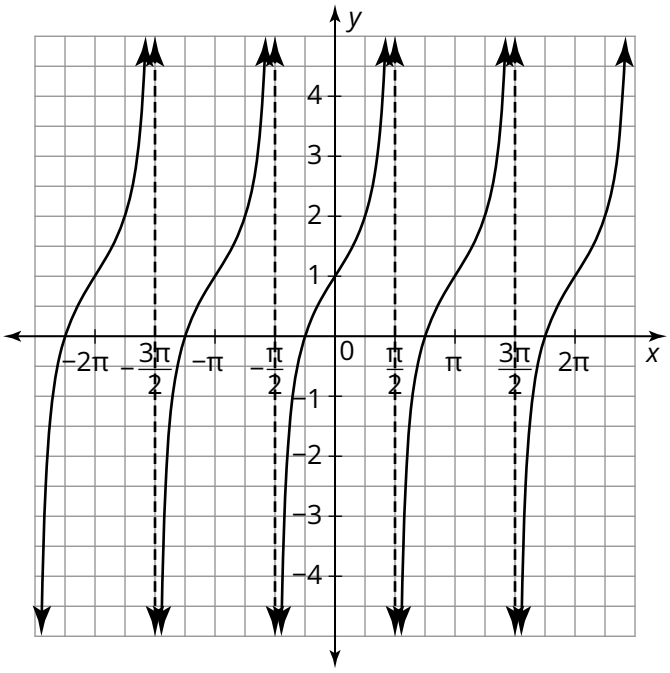
4. Does the graph below represent the function $y = \tan\left(x - \frac{1}{2}\right)$ or $y = \tan\left(x - \frac{\pi}{2}\right)$?



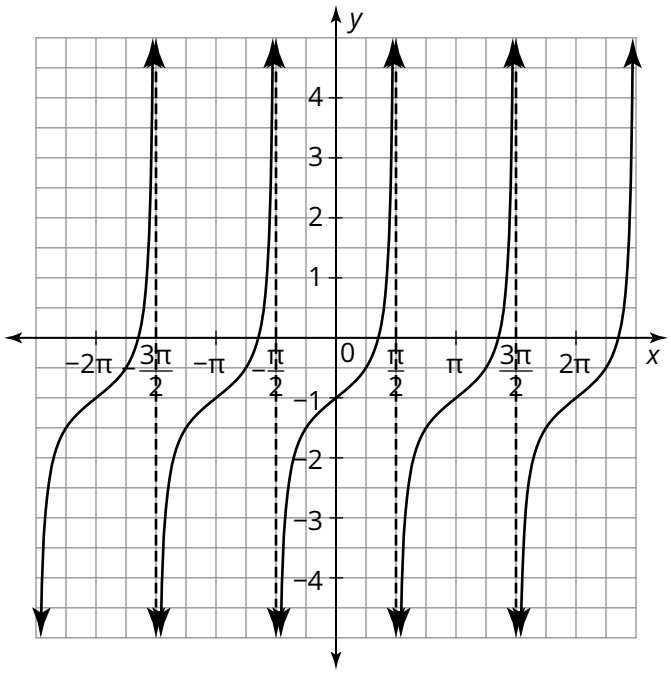
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5. Does the graph below represent the function $y = \tan x - 1$ or $y = \tan x + 1$?



6. Does the graph below represent the function $y = 2\tan x - 1$ or $y = \frac{1}{2}\tan x - 1$?



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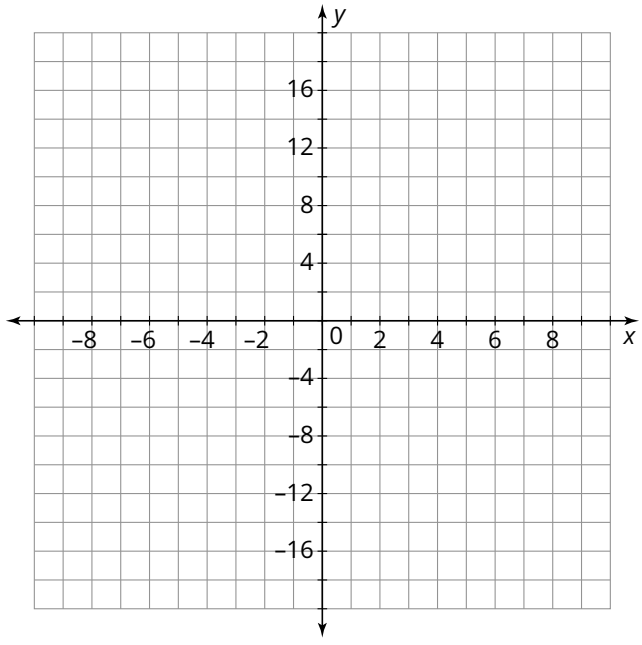
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Chasing Theta

Solving Trigonometric Equations

Warm Up

Graph the function $f(x) = 2x^2 + 5x - 12$ and determine the zeros.



Learning Goals

- Write and solve trigonometric equations.
- Use periodicity identities to identify multiple solutions to trigonometric equations.
- Solve trigonometric equations using inverse trigonometric functions.
- Solve second-degree trigonometric equations.

Key Terms

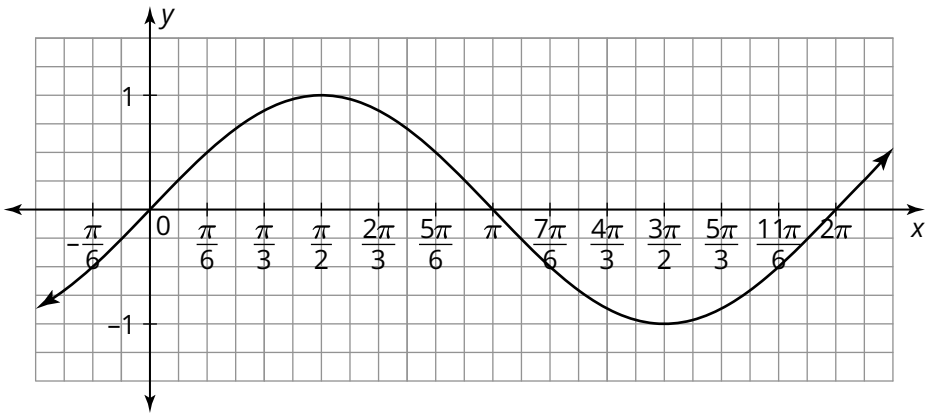
- trigonometric equation
- inverse sine ($\sin^{-1}$)
- inverse cosine ($\cos^{-1}$)
- inverse tangent ($\tan^{-1}$)

You have explored trigonometric functions, which take an angle measure as input and output a linear measure. How can you solve a trigonometric equation for the angle measure?

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Sine, Sine, Everywhere a Sine

The graph shows the function $f(x) = \sin x$.



1. Draw a horizontal line to approximate the solutions to the equation $\sin x = \frac{1}{2}$. What are the solutions?

2. List the solution(s) of the equation $\sin x = \frac{1}{2}$, given each of the domain restrictions.

a. $0 \leq x \leq \frac{\pi}{2}$

b. $0 \leq x \leq 4\pi$

c. $-\pi \leq x \leq 0$

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ACTIVITY
1.1

Solving Trigonometric Equations

A **trigonometric equation** is an equation in which the unknown is associated with a trigonometric function. The number of solutions of a trigonometric equation can vary depending on how the domain of the function is restricted.

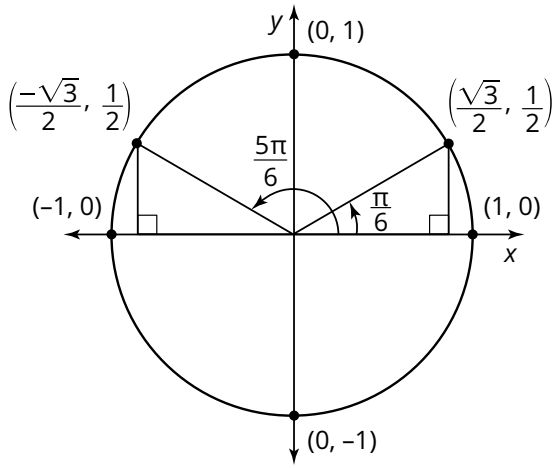
You can solve trigonometric equations using what you already know.

Worked Example

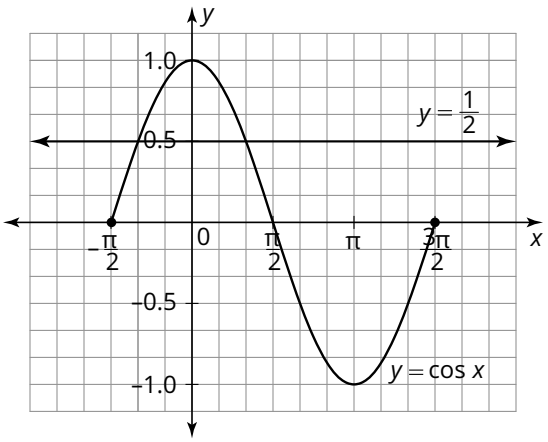
Consider the equation $\sin x = \frac{1}{2}$.

On the unit circle, you can see that $\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$ and $\sin\left(\frac{5\pi}{6}\right) = \frac{1}{2}$.
So, $x = \frac{\pi}{6}$ or $\frac{5\pi}{6}$.

When the domain is restricted to $0 \leq x \leq 2\pi$, these are the only 2 solutions to the equation. When there are no domain restrictions, the equation has an infinite number of solutions.



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You can also use what you know about the graphs of trigonometric functions to solve trigonometric equations.

Let's consider the equation $\cos x = \frac{1}{2}$.

The equations $y = \cos x$ and $y = \frac{1}{2}$ are graphed on the coordinate plane.

1. Study the graph of $y = \cos x$.

a. Over what domain is the function graphed?

b. Write the solutions to the equation $\cos x = \frac{1}{2}$, given the domain restrictions. Then, plot and label the solutions on the coordinate plane.

Think about:

How can you use reference angles on the unit circle?

2. Write the solution(s) to each equation, given the same domain restrictions in Question 1.

a. $\cos x = 1$

b. $\cos x = 0$

c. $\cos x = -\frac{1}{2}$

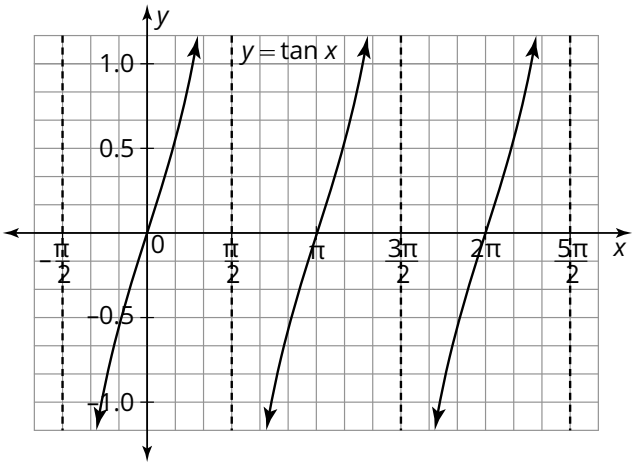
d. $\cos x = -1$

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3. Use the graph of $y = \tan x$ over the domain $-\frac{\pi}{2} \leq x \leq \frac{5\pi}{2}$ to solve each equation.

a. $\tan x = 0$

b. $\tan x$ = undefined



You can use what you know about the periods of trigonometric functions to solve trigonometric equations. The periodicity identities you have learned are shown. Adding or subtracting integer multiples of the period for each function ($2\pi n$ or πn) generates solutions to trigonometric equations.

Periodicity Identities	
Sine	$\sin(x + 2\pi n) = \sin x$
Cosine	$\cos(x + 2\pi n) = \cos x$
Tangent	$\tan(x + \pi n) = \tan x$

4. Use a periodicity identity to list 4 solutions to each equation.

a. $\cos x = \frac{\sqrt{2}}{2}$

b. $\tan x = \sqrt{3}$

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ACTIVITY
1.2 Using Inverse Trigonometric Functions to Solve Equations

When a trigonometric equation involves transformations on the basic function, solving the equation requires the same techniques you have used to solve other equations.

Worked Example

Solve $\sqrt{3} \tan x + 5 = 4$ over the domain $0 \leq x \leq \pi$.

$\sqrt{3} \tan x + 5 = 4$	Subtract 5 from both sides.
$\sqrt{3} \tan x = -1$	Divide both sides by $\sqrt{3}$.
$\tan x = \frac{-1}{\sqrt{3}}$	Rewrite the radical expression by rationalizing the denominator.
$= \frac{-\sqrt{3}}{3}$	
$x = \frac{5\pi}{6}$	Identify the reference angle with a value of $\frac{-\sqrt{3}}{3}$.

1. **Identify the solution set of the equation in the worked example over the domain of all real numbers. Show your work.**

2. **Explain why Fletcher is incorrect.**

Fletcher

If $\tan x = \frac{-\sqrt{3}}{3}$ and $\tan(x) = \frac{\sin x}{\cos x}$, then I know that $\sin x = -\sqrt{3}$ and $\cos x = 3$.

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3. **Solve the equation $2 \sin x + \sqrt{3} = 0$ over the domain $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$.**

You can use the inverse of each of the trigonometric functions to determine solutions to equations. The **inverse sine ($\sin^{-1}$), inverse cosine ($\cos^{-1}$),** and **inverse tangent ($\tan^{-1}$)** functions are used to determine solutions to sine, cosine, and tangent equations, respectively. If you do not recognize the reference angle for the given value of the function, you can use technology.

4. **Sofia and Tyhir each used a graphing calculator to solve the equation $\sin x = \frac{1}{2}$. Explain the differences in their answers.**

Sofia

$\sin^{-1}\left(\frac{1}{2}\right) = x$

$x = 0.5235987756$

Tyhir

$\sin^{-1}\left(\frac{1}{2}\right) = x$

$x = 30$

Remember:

From a previous worked example, you know that $\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$.

5. **Solve each equation over the domain of all real numbers.**

   a. $-5 + 2\sqrt{3} \cos x = -8$

   b. $5 \sin x + 9 = 3$

   c. $6 \tan x - 4 = -19$

   d. $5 - 8 \cos x = 3$

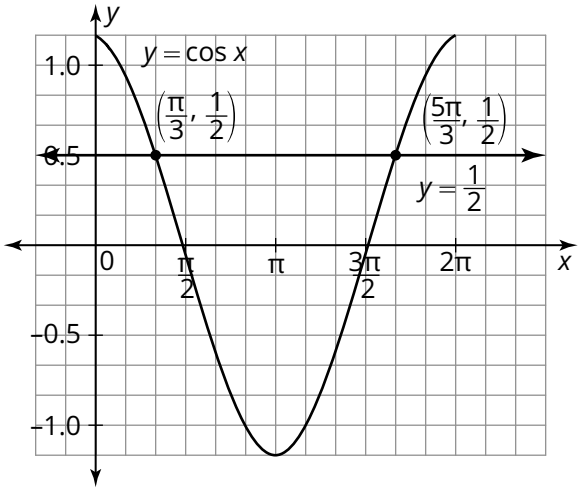
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1.3 Using the *B*-Value to Solve Equations

When the *B*-value is changed from a basic trigonometric function, you must take the change in period into account when determining solutions.

Let's consider the equation $\cos x = \frac{1}{2}$ over the domain $0 \le x \le 2\pi$.

The equations $y = \cos x$ and $y = \frac{1}{2}$ are graphed on the coordinate plane.



The solutions for $\cos x = \frac{1}{2}$ over the domain $0 \le x \le 2\pi$ are $x = \frac{\pi}{3}$ or $\frac{5\pi}{3}$.

The solutions for $\cos x = \frac{1}{2}$ over the domain for all real numbers are $x = \frac{\pi}{3} + 2\pi n$ or $\frac{5\pi}{3} + 2\pi n$.

1. Now, let's consider the equation $\cos(2x) = \frac{1}{2}$ over the domain $0 \le x \le 2\pi$.

a. Determine the period of this function.

b. The period of $y = \cos(2x)$ is different than $y = \cos x$. How does your answer to part (a) affect the number of possible solutions for $\cos(2x) = \frac{1}{2}$ over the domain $0 \le x \le 2\pi$?

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You can use what you know about reference angles to determine solutions for x.

Worked Example

Solve $\cos(2x) = \frac{1}{2}$.
You know that $\cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$.
So, to begin, let $\frac{\pi}{3} = 2x$ and solve for x.

$$2x = \frac{\pi}{3}$$
$$x = \frac{\pi}{6}$$

Because the period of $\cos(2x)$ is π, you know that two of the solutions are $x = \frac{\pi}{6}$ or $\frac{7\pi}{6}$ for $0 \leq x \leq 2\pi$.

c. Determine the remaining solutions for $\cos(2x) = \frac{1}{2}$ over the domain $0 \leq x \leq 2\pi$ given $\cos\left(\frac{5\pi}{3}\right) = \frac{1}{2}$.

d. Write the solution for $\cos(2x) = \frac{1}{2}$ over the domain for all real numbers.

2. Solve the equation $2\sin(4x) + 1 = -1$ over the set of real numbers.

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ACTIVITY
1.4 Powers of Trigonometric Functions

If an equation that can be written in the form $ax^2 + bx + c = 0$ has x replaced with a trigonometric function, the result is a trigonometric equation in quadratic form. These equations can be solved as you would solve other quadratic equations, by factoring or by using the Quadratic Formula.

Note that $(\sin x)^2$ is usually written as $\sin^2 x$.

Worked Example

You can solve $2\sin^2 x + 5\sin x = 3$ over the domain of all real numbers.

Start with a substitution. This equation involves the sine function, so let $z = \sin x$.

$2z^2 + 5z = 3$	
$2z^2 + 5z - 3 = 0$	Write the equation in general form.
$(2z - 1)(z + 3) = 0$	Factor the quadratic expression.
$2z - 1 = 0$ or $z + 3 = 0$	Set each factor equal to 0.
$z = \frac{1}{2}$ or $z = -3$	Solve each equation.
$\sin x = \frac{1}{2}$ or $\sin x = \cancel{-3}$	Replace z with the sine function.
$x = \frac{\pi}{6}, \frac{5\pi}{6} \ldots + 2\pi n$	Determine the angle measure using $\sin^{-1}$.

1. Explain why $\sin x = -3$ is crossed off in the worked example.

2. Solve $4\sin^2 x - 1 = 0$ over the domain of all real numbers.

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3. Solve each equation over the domain of all real numbers.

a. $2\cos^2 x + \cos x = 1$

b. $2\tan^2 z + 3\tan z - 1 = 0$

c. $6\sin^2 z - 16\sin z - 33 = 0$

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NOTES

TALK the TALK

Problem Solved

1. **Solve $2 \sin x + \sqrt{2} = 0$ over the domain $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$.**

2. **Solve $\cos^2 x + 2 \cos x - 5 = -2$ over the domain of all real numbers.**

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Assignment

Write

Describe when you would use an inverse sine, inverse cosine, or inverse tangent function.

Remember

The inverse of each of the trigonometric functions—inverse sine ($\sin^{-1}$), inverse cosine ($\cos^{-1}$), and inverse tangent ($\tan^{-1}$)—along with a calculator can be used to determine solutions to equations.

Practice

1. Use a periodicity identity to list 3 solutions for each equation.
   a. $\sin x = -\frac{\sqrt{2}}{2}$
   b. $\cos x = \frac{\sqrt{3}}{2}$
   c. $\tan x = \frac{\sqrt{3}}{3}$
2. Solve each equation over the domain of all real numbers.
   a. $4 + 2 \sin x = 5$
   b. $8 \cos x + 2 = -1$
   c. $5 \tan x - 3 = -11$
   d. $14 - 3 \sin x = 19$
   e. $2 \sin (3x) + 4 = 5$
   f. $4 \cos^2 x - 3 = 0$

Stretch

The average person's blood pressure can be modeled by the periodic function $P(t) = 20 \sin (160\pi t) + 100$, where t represents the time in minutes, and $P(t)$ represents the blood pressure at time t. Determine the amplitude, maximum and minimum values, period, and frequency of the function.

Review

1. Given $\cos \theta = -\frac{5}{13}$ in Quadrant III, use the Pythagorean identity to determine $\sin \theta$.
2. Given $\cos \theta = \frac{2}{9}$ in Quadrant IV, determine $\sin \theta$ and $\tan \theta$.
3. Solve each equation. Round your answer to the thousandths.
   a. $10^{(x+1)} = 7$
   b. $8^{-2a} - 5 = 55$

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2

Wascally Wabbits

Modeling with Periodic Functions

Warm Up

Describe the transformation performed on the graph of the basic function $f(x) = \sin x$ to produce the graph of $g(x)$.

1. $g(x) = \sin\left(\frac{1}{3}x\right)$

2. $g(x) = \sin x - 4$

3. $g(x) = \sin\left(x + \frac{\pi}{6}\right)$

4. $g(x) = -2 \sin x$

Learning Goals

- Model real-world situations with periodic functions.
- Interpret key characteristics of periodic functions in terms of problem situations.

You have explored trigonometric functions and solved trigonometric equations. How can you model real-life situations using trigonometric functions?

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Rabbits, Rabbits Everywhere!

The rabbit population in a national park rises and falls throughout the year. The population is at its approximate minimum of 6000 rabbits in December. As the weather gets warmer and food becomes more available, the population grows to its approximate maximum of 16,000 rabbits in June.

1. **Which trigonometric function best models this situation? Justify your answer.**

2. **Sketch a graph of the function.**

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ACTIVITY
2.1

Modeling Population Change



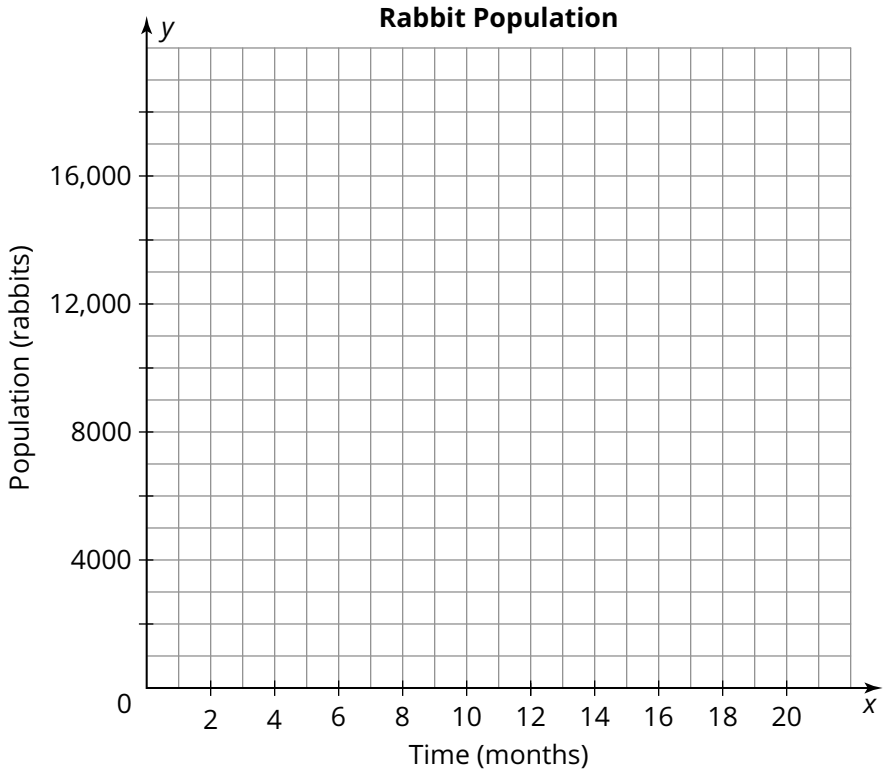
The function to describe the rabbit population is $f(x) = 5000 \sin\left(\frac{\pi}{6}x - \frac{\pi}{2}\right) + 11{,}000$, where x is the time in months and $f(x)$ is the rabbit population.

1. **Complete the table to show the rabbit population through one year.**

Month	Time (month)	Rabbit Population (rabbits)
December		
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

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2. **Graph the function representing the rabbit population.**



3. **How has the function been translated vertically from the basic sine function?**

4. **Determine each characteristic of the function.**

   a. **Amplitude**

   b. **Period**

   c. **Phase shift**

5. **How is the vertical translation related to the algebraic function? What does it represent in terms of this problem situation?**

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6. **How is the amplitude related to the algebraic function? What does it represent in terms of this problem situation?**

7. **How is the period related to the algebraic function? What does it represent in terms of this problem situation?**

8. **How is the phase shift related to the algebraic function? What does it represent in terms of this problem situation?**

9. **If the rabbit population cycle occurred over six months instead of one year, how would the graph and equation change?**

10. **If the rabbit population had a minimum of 4000 and a maximum of 20,000, how would the graph and equation change?**

11. **Describe the time(s) in months when the rabbit population is equal to 12,000. Show your work.**

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ACTIVITY
2.2 Modeling Patterns of Daylight

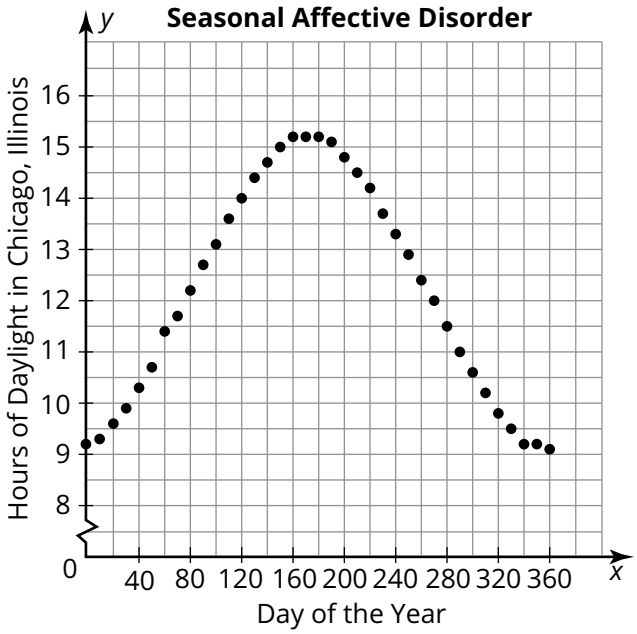
Patterns of daylight are related to seasonal affective disorder (SAD). The amount of daylight varies in a periodic manner and can be modeled by a sine function. The table shows the number of approximate daylight hours in Chicago, Illinois, which has latitude of 42° N.

Date	Day	Daylight Hours
Dec. 31	0	9.2
Jan. 10	10	9.3
Jan. 20	20	9.6
Jan. 30	30	9.9
Feb. 9	40	10.3
Feb. 19	50	10.7
Mar. 1	60	11.4
Mar. 11	70	11.7
Mar. 21	80	12.2
Mar. 31	90	12.7
Apr. 10	100	13.1
Apr. 20	110	13.6
Apr. 30	120	14.0
May 10	130	14.4
May 20	140	14.7
May 30	150	15.0
June 9	160	15.2
June 19	170	15.2
June 29	180	15.2

Date	Day	Daylight Hours
July 9	190	15.1
July 19	200	14.8
July 29	210	14.5
Aug. 8	220	14.2
Aug. 18	230	13.7
Aug. 28	240	13.3
Sept. 7	250	12.9
Sept. 17	260	12.4
Sept. 27	270	12.0
Oct. 7	280	11.5
Oct. 17	290	11.0
Oct. 27	300	10.6
Nov. 6	310	10.2
Nov. 16	320	9.8
Nov. 26	330	9.5
Dec. 6	340	9.2
Dec. 16	350	9.2
Dec. 26	360	9.1

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The graph shown models the data in the table.



1. **Determine each characteristic.**

   a. **Minimum and maximum values**

   b. **Amplitude**

   c. **Period**

   d. **Phase shift**

   e. **Vertical shift**

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2. **To model this situation with a sine function in transformation function form, you need to determine the *A*-, *B*-, *C*-, and *D*-values.**

   a. **Determine the value of *A*. What does it represent in terms of this situation?**

   b. **Determine the value of *B*. Explain your reasoning.**

   c. **Determine the value of *C*.**

   d. **Determine the value of *D*. What does it represent in terms of this situation?**

   e. **Write an algebraic function to model the data for the number of daylight hours in Chicago, Illinois.**

3. **Use technology to perform a sinusoidal regression for this data and write the regression equation. How does it compare to your equation?**

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4. **Use the regression equation to describe times of the year when there are exactly 12 hours of daylight. Show your work.**

5. **Seasonal affective disorder appears to vary according to latitude. The farther a location is from the equator, the more prevalent cases of SAD become. Why might this happen?**

6. **Anchorage, Alaska, is located at a latitude of 61° N. This is considerably farther north than Chicago. If you created a graph to model the daylight hours in Anchorage, how do you think it would compare to the graph for daylight hours in Chicago? In what ways would it be the same? In what ways would it be different?**

7. **In locations like Chicago and Anchorage, SAD is most likely to occur around the month of January. In locations in the southern hemisphere, like Santiago, Chile (latitude 33.5° S), SAD occurs around the month of July. Why does this happen?**

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NOTES

TALK the TALK

Twansforming Twig Functions

1. **Write a sine function to represent the data shown. Explain your reasoning.**

x	*y*
0	200
1	170
2	110
3	80
4	110
5	170
6	200

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Assignment

Write

Describe the types of situations that can be modeled using trigonometric functions.

Remember

The key characteristics of periodic functions, including period, amplitude, midline, and phase shift, are used to model components of real-world situations.

Practice

1. The height of a roller coaster can be modeled by the function $f(x) = 20\cos\left(\frac{\pi}{60}x\right) + 30$, where x represents the horizontal distance from the start of the ride in meters, and $f(x)$ represents the vertical height of the ride in meters.
   a. Determine the amplitude of the function. What does it represent in terms of this problem situation?
   b. Determine the period of the function. What does it represent in terms of this problem situation?
   c. Determine the vertical shift of the function. What does it represent in terms of this problem situation?
2. The table shows the average monthly high temperature for a town in Tennessee. This data can be modeled with a sine function.

Month	1	2	3	4	5	6	7	8	9	10	11	12
Average High Temperature (°F)	50	53	60	71	80	87	90	89	84	73	59	50

a. Plot the points from the table using the number of the month for your independent variable and the average high temperature for your dependent variable.
b. Determine the amplitude, period, and vertical shift of the function that could be used to model this data. Explain your reasoning.
c. Use technology to perform a sinusoidal regression for the data. Write the regression equation. Is this model a good fit for the data? Explain your reasoning.

Stretch

1. The data in the tables show the fraction of the Moon illuminated at midnight each day in the month of February, 2018. This data can be modeled with a sine function.

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fraction of Moon Illuminated	0.99	0.96	0.90	0.83	0.74	0.64	0.55	0.45	0.35	0.27	0.19	0.12	0.07	0.03

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Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Fraction of Moon Illuminated	0	0	0.02	0.05	0.11	0.18	0.27	0.38	0.49	0.6	0.71	0.81	0.89	0.95

a. Plot the points from the table using the number of the day for the independent variable and the fraction of the Moon illuminated for the dependent variable.

b. Determine the amplitude and period of the function that could be used to model this data. Explain your reasoning.

c. Use technology to perform a sinusoidal regression for the data. Write the regression equation. Is this model a good fit for the data? Explain your reasoning.

Review

1. Use a periodicity identity to list three solutions for the equation $\cos x = -\frac{1}{2}$.

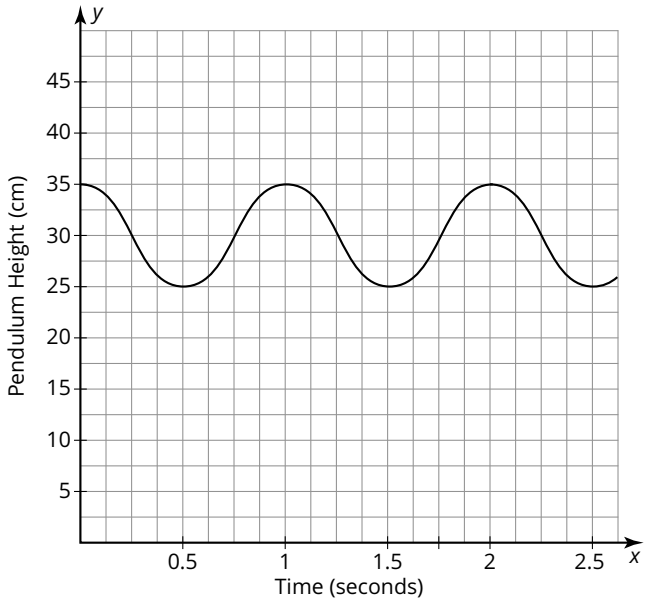
2. Solve the equation over the domain of all real numbers: $5 + 4\cos\theta = 3$.

3. A pendulum clock swings back and forth. At rest, the pendulum is 25 cm above the base. At the highest point of the swing, the pendulum is 35 cm above the base. It takes the pendulum 2 seconds to swing back and forth. The graph shows the height of the pendulum above the base as a function of seconds. Assume the pendulum is released from its highest point.

   a. Determine the amplitude of the function.

   b. Determine the period of the function.

   c. Determine the height of the pendulum at 3.75 seconds.



4. Solve each equation. Round your answers to the thousandths, if necessary.

   a. $\left(\frac{2}{3}\right)^{x} = 5^{3-x}$

   b. $2\log_5 x = 3\log_5 2$

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3

The Wheel Deal

Modeling Motion with a Trigonometric Function

Warm Up

Describe the transformation of the graph of each function from the basic function $f(\theta) = \sin \theta$.

1. $f(\theta) = 3.5 \sin \theta$

2. $f(\theta) = \sin(\theta + \pi)$

3. $f(\theta) = -\sin \theta + \frac{1}{2}$

Learning Goals

- Interpret characteristics of a graph of a trigonometric function in terms of a problem situation.
- Construct a trigonometric function to model a problem situation.

You have used the unit circle to explore trigonometric functions. You have also explored how the values of the transformed function form affect the shape of the graph of a periodic function. How can you use what you know to build a trigonometric function to model circular motion in real-world problems?

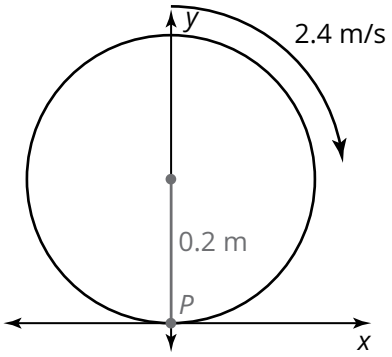
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Big Wheel Keeps on Turning

Suppose a wheel with a radius of 0.2 meter rolls clockwise on a street at a rate of 2.4 m/s.

You can build a trigonometric function to model the height, *h*, from the street of a point, *P*, on the wheel as a function of time, *t*, in seconds. As the wheel rolls, the position of point *P* will move along the circle.

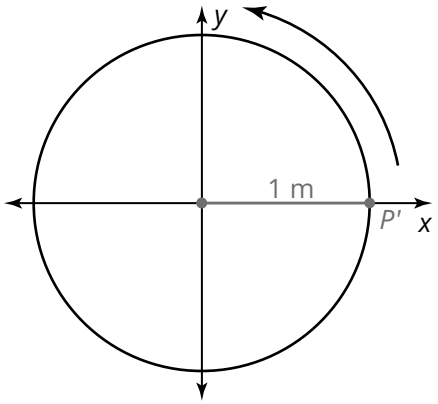
Figure 1



In order to build this trigonometric function, let's first think about point *P* from Figure 1 in standard position on a unit circle as point *P′* in Figure 2, moving counterclockwise.

- Point *P′* is located where a terminal ray in standard position intersects the circle at 0 radians.
- The point is moving counterclockwise instead of clockwise.
- The wheel is rotating in place and has a radius of 1 meter.
- The *x*-axis represents the ground.

Figure 2



1. Which trigonometric function models the height, *h*, of point *P′* for each angle measure, *θ*, in radians?

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ACTIVITY
3.1

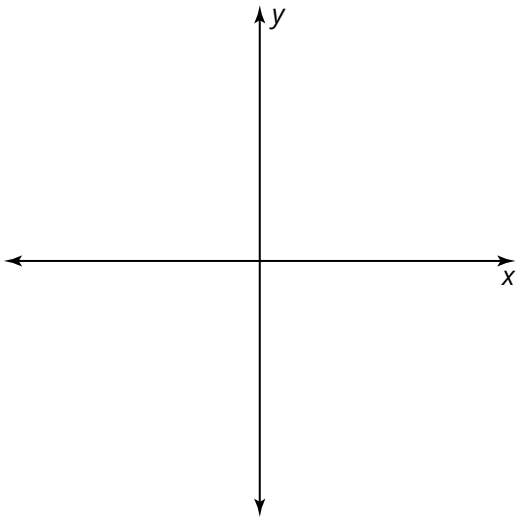
Modeling Motion with a Trigonometric Function

Let's consider each piece of information in the original problem situation from the Getting Started and how you can use transformations to build an equation to model Figure 1.

1. **Use the given information to sketch each figure and write each corresponding equation. Describe the transformation.**

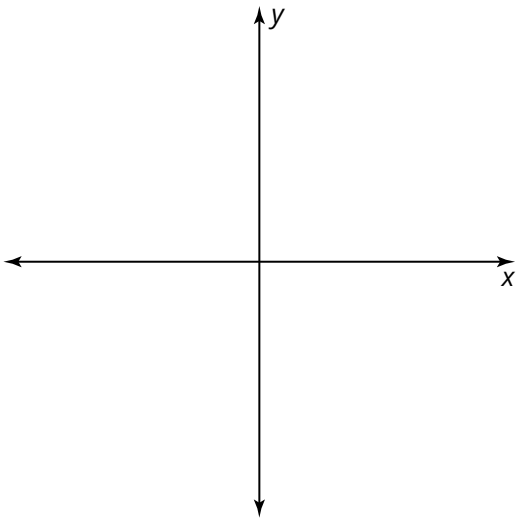
   a. **To sketch Figure 3, consider Figure 2 but the radius is 0.2 meter. Label point *P′* on your graph.**

Figure 3



   b. **To sketch Figure 4, consider Figure 3 but the wheel rests on the ground. Label point *P′* on your graph.**

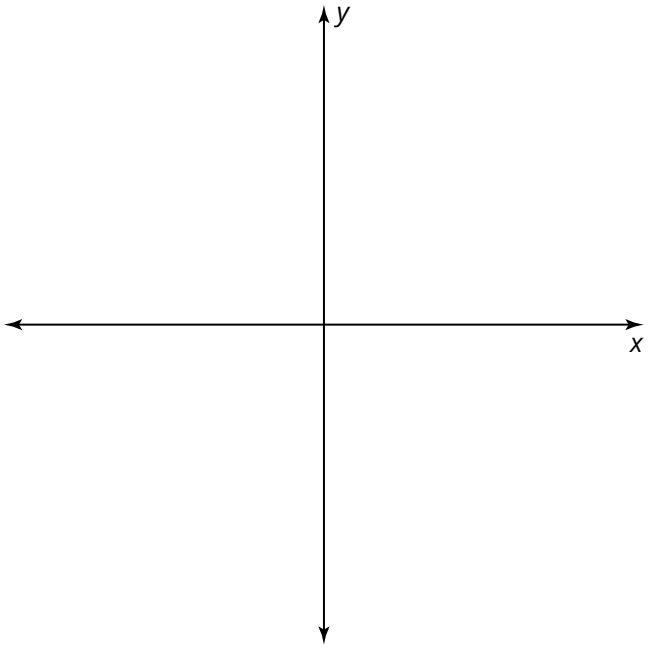
Figure 4



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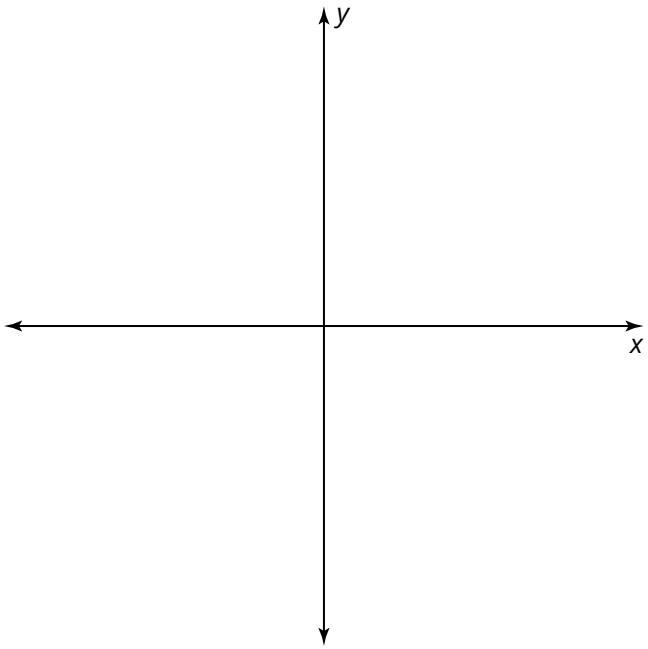
c. To sketch Figure 5, consider Figure 4 but translate point *P′* to the original starting position, point *P*, in Figure 1. Label point *P* on your graph.

Figure 5



d. To sketch Figure 6, consider Figure 5 but the wheel turns clockwise. Label point *P* on your graph.

Figure 6



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You have just written an equation that models the height of point *P* on the wheel with a radius of 0.2 meter in terms of θ.

Now let's consider the relationship between time and θ to write an equation for the height of point *P* on the wheel in terms of time.

2. Write an equation for the height of point *P* on the wheel in terms of time *t*.

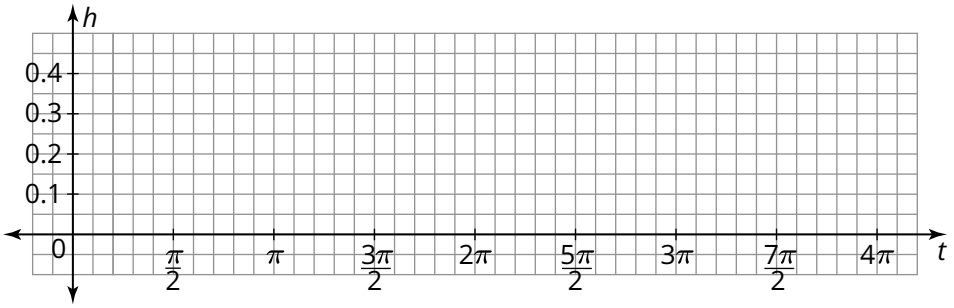
a. Determine the relationship between time, *t*, and θ.

Think about:

Use the relationship for distance in terms of rate and time to write distance as a function of θ.

b. Write the final equation in terms of time *t*.

3. Sketch a graph of your function from Question 2. Label the axes.



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4. **Determine the height of the point at 1 second.**

5. **Rewrite your function as a cosine function. Explain your reasoning.**

6. **What are the advantages of rewriting your function as a cosine function?**

7. **At what time(s) is the height of the point at 0.2 meter?**

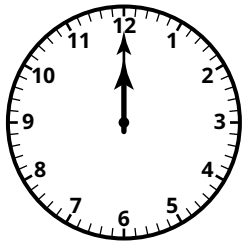
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NOTES

TALK the TALK

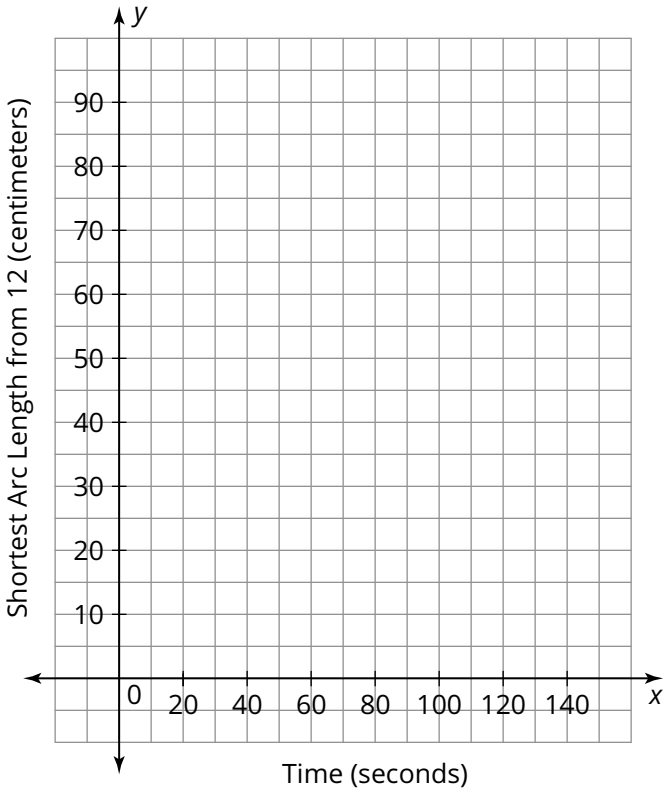
Time Stops for No One!

Consider the second hand on the face of a clock. The length of the second hand and radius of the clock face are each 30 centimeters. Suppose the second hand begins its movement at exactly 12:00 midnight.



1. **Complete the table to describe the time in seconds and the shortest arc length between the tip of the second hand and its starting position at 12:00, in centimeters. For each complete revolution, suppose that the distance resets to 0. Then create a graph.**

Time (seconds)	Shortest Arc Length from 12 (centimeters)
0	
10	
20	
30	
40	
50	
60	0
70	
80	
90	
100	
110	
120	



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NOTES

2. **What is the amplitude of this function?**

3. **What is the vertical shift of this function? Why is a vertical shift necessary?**

4. **Consider the relationship between time and θ.**

   a. **Write a proportion with ratios for length and angle measure. Solve for d.**

   b. **Use the Distance Formula to express θ in terms of time.**

5. **Choose the trigonometric function that best models this situation.**

$f(x) = -30\pi \cos\left(\frac{\pi}{30}x\right) + 30\pi$

$f(x) = -30\pi \cos\left(\frac{\pi}{6}x\right) + 15\pi$

$f(x) = -15\pi \cos\left(\frac{\pi}{30}x\right) + 15\pi$

$f(x) = -15\pi \cos\left(\frac{\pi}{6}x\right) + 15\pi$

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Assignment

Write

Describe how you can model the motion of points on a circle by using transformations of a trigonometric function.

Remember

Transformations of periodic functions can be used to map function behavior to the behavior of periodic phenomena, such as amplitude, period, frequency, phase shift, and midline.

Practice

1. Angela rode the Ferris wheel at Navy Pier in Chicago. The Ferris wheel has a diameter of 140 feet. She was curious about how long it would take her to get from the lowest point to the highest point of the ride. She began timing her ride while she was at the bottom of the wheel and noticed that it took her 3 minutes and 45 seconds to get to the top. At the highest point, Angela was 150 feet off the ground. The vertical height, h, of a person riding the Ferris Wheel can be modeled as a trigonometric function of time, t, in seconds. The Ferris wheel moves in a clockwise direction.
   a. Determine Angela's vertical height when she is at the lowest point of the ride.
   b. Determine the amount of time it takes for Angela to complete one revolution on the Ferris wheel. Write your answer in seconds.
   c. Sketch a graph of Angela's height in feet on the Ferris wheel as a function of time in seconds.
   d. Determine the amplitude of the function. Explain your reasoning.
   e. Calculate the period and value of B of the function. Explain your reasoning.
   f. Determine the values of C and D of the function if a cosine function is used to model the problem situation. Explain how you determined your answers.
   g. Write a cosine function to model Angela's height on the Ferris wheel as a function of time.
   h. Explain how Angela could write a sine function to model the height of the Ferris wheel as a function of time.

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Stretch

The hour hand of a large clock on a wall of a train station measures 18 inches in length. At noon, the tip of the hour hand is 40 inches from the ceiling. Let y equal the distance from the tip of the hour hand to the ceiling x hours after noon. Determine a trigonometric equation that best models the motion of the hour hand and sketch the graph.

Review

1. The tide at a pier can be modeled by the equation $h(t) = 2\cos\left(\frac{\pi}{6}t\right) + 7$, where t represents the number of hours past noon and $h(t)$ represents the height of the tide in feet.
   a. Determine the amplitude of the function. What does it represent in terms of this problem situation?
   b. Determine the period of the function. What does it represent in terms of this problem situation?
   c. Determine the vertical shift of the function. What does it represent in terms of this problem situation?
2. A satellite in a medium Earth orbit completes one orbit every 12 hours. The satellite follows a circular path with its center at the center of the earth. The satellite is at an altitude of 12,552 miles. The radius of the earth is 3959 miles.
   a. Determine the angle of rotation, in radians, that corresponds to a 5-hour time period.
   b. Determine the distance traveled by the satellite in a 5-hour time period.
3. Multiply the rational expressions.
   a. $\frac{x^2 + 6x + 9}{x - 3} \cdot \frac{x^2 + 3x - 18}{x^2 - 9}$
   b. $\frac{x^3 - 8}{x^4 - 9x^2} \cdot \frac{x^5 - 6x^4 + 9x^3}{x^2 - 4x + 4}$

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4

Springs Eternal

The Damping Function

Warm Up

Solve for x.

1. $8^x = 262{,}144$
2. $\left(\frac{3}{5}\right)^x = \frac{81}{625}$
3. $0.9^x = 0.5$

Learning Goals

- Choose a trigonometric function to model a periodic phenomenon.
- Determine the graphical attributes (amplitude, midline, frequency) of a periodic function from a description of a problem situation.
- Build a function that is a combination of a trigonometric function and an exponential function.

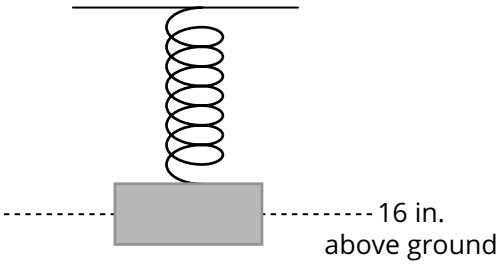
Key Term

- damping function

You know how to model a real-world situation that displays periodic tendencies with a trigonometric function. You also know how to model a situation that increases or decreases at a constant ratio using an exponential function. How can you combine these two types of functions to model a real-world situation that is both periodic and decreasing?

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Bouncing Up and Down

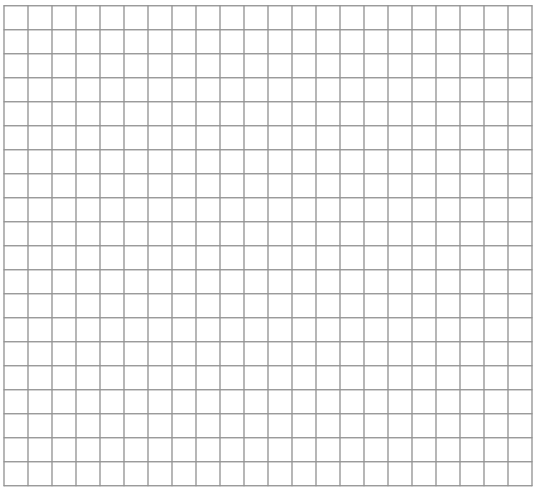


An object suspended from a spring is pulled 5 inches below its resting position and released, causing the object to bounce up and down once every second. At rest, the object's height above the ground is 16 inches.

Suppose that the object bounces up 5 inches above its resting height and then back down to 5 inches below its resting height without stopping on every bounce. Let's build a periodic function to model the bouncing of the object on the spring over time.

1. **Determine the independent and dependent quantities for this situation.**

2. **Sketch and label the graph of the function to model the bouncing object over time $h(t)$, given what you know about the height of the object. Represent at least two bounces of the object on the graph.**



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ACTIVITY
4.1

Using a Graph to Write a Periodic Function



Consider the problem situation from the Getting Started and the graph you created.

1. **Use your graph to determine each characteristic of the periodic function that will model this situation. Explain your reasoning.**

   a. **Determine the equation of the midline of the graph.**

   b. **Determine the minimum, maximum, and amplitude of the function.**



What characteristics of the graphed function correspond to the *A*-, *B*-, *C*-, and *D*-values of the transformed function?

2. **Does your sketch model a sine curve or a cosine curve? Explain your reasoning.**

3. **Write the values of *A, C,* and *D* for the function *h*(*t*). Explain how you determined each value.**

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Remember:

The period of a sine or cosine function is $\frac{2\pi}{|B|}$.

4. **Determine the period of the function $h(t)$. Then write the B-value of the function. Show your work.**

5. **Write the equation for the function $h(t)$ to represent the height of the object over time.**

Think about:

What are the cosine values on the unit circle?

6. **Explain why the sign of the B-value in this function can be either positive or negative.**

7. **Solve an equation to determine when the object on the spring is at its minimum height. Show your work.**

Ask yourself:

Do your solutions represent every time the object is at the midline?

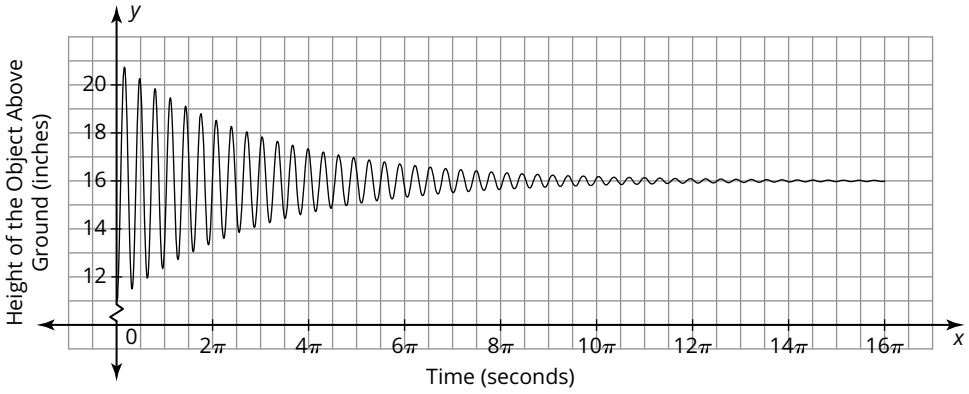
8. **Solve an equation to determine when the object on the spring is at a height of 16 inches. Show your work.**

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ACTIVITY
4.2 Damping Functions

An object connected to a string and bouncing up and down the same amount forever is not realistic. Starting from when the object is released, the energy produced will eventually fade away. The object will bounce closer and closer to the midline until it once again comes to rest.

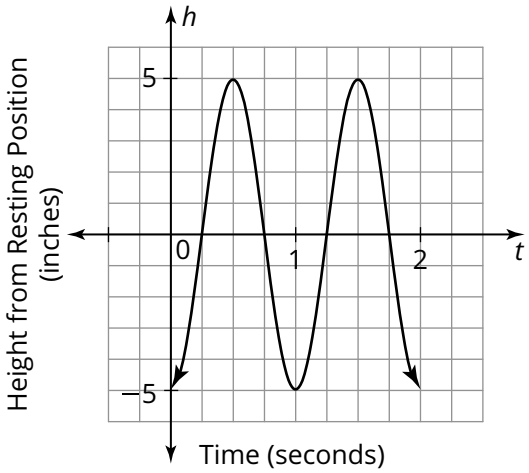
Let's consider the same situation from the Getting Started. A more realistic model of the object's motion is shown.



Recall the function that models the situation from the Getting Started is $h(t) = -5\cos(2\pi t) + 16$.

1. **How do you think you can adjust the function $h(t)$ to create the shape of the graph shown? What is changing in each period of this function?**

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A graph of the function $k(t) = h(t) - 16$ is shown. This is the function relative to its resting position. Suppose that the distance the object bounces from its resting position decreases at a rate of 10% each second.

2. At $t = 0$, the object is at -5 inches from its resting position.

a. Determine the object's new height at $t = 1$ second and $t = 2$ seconds.

b. Write an equation to describe the object's new height, n, over time, t. Explain your reasoning.

c. Does your equation correctly describe the object's new height at $t = \frac{1}{2}$ second? At $t = 1\frac{1}{2}$ seconds? If not, what equation would be correct?

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3. **Explain why Kent is correct.**

Kent



The equation $b(t) = |A| \cdot 0.9^t$ describes the change in the object's height over time, because $|A|$ represents the amplitude of the function.

4. **Write the complete function that represents the height of the object on the spring over time.**

5. **After how many seconds is the maximum height of the object on the spring equal to 18 inches? Explain how you determined your solution.**

The function that you multiply to the periodic function to decrease its amplitude over time is called a **damping function**. A damping function can be linear, quadratic, exponential, and on and on!

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6. Write a function $g(t)$ to model the height of an object connected to a spring with decreased amplitude over time given the conditions:

- **At rest, the object's height is 10 inches above the ground.**
- **The object bounces up and down once every 2 seconds.**
- **At $t = 0$, the object's height is 14 inches.**
- **The distance the object bounces from its resting position decreases at a rate of 15% each second.**

7. How would the exponent of the A-value in the function you wrote in Question 6 change if the rate of decrease for the amplitude is per bounce and not per second? Explain your reasoning.

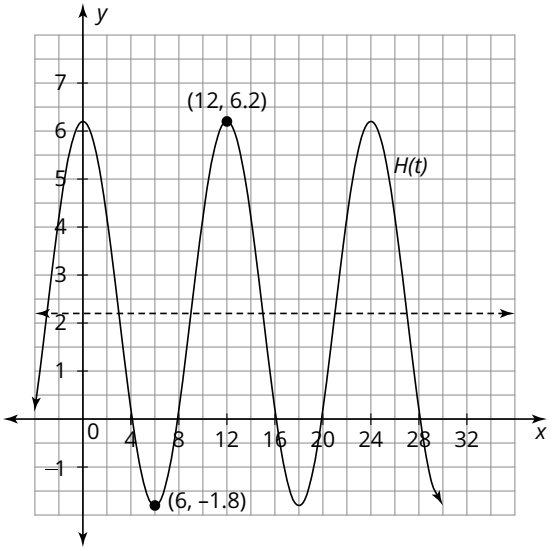
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NOTES

TALK the TALK

The Turning of the Tides

A trigonometric function can be used to model the changes in high and low tides at particular locations. The gravitational force of both the Moon and Sun affect the height of the tide. The graphed function models the high and low tides, where $H(t)$ represents the height of the tide in feet over time.



1. **What is the amplitude of the function? Explain how you can use the graph to determine this value.**

2. **What is the vertical shift of the function? How is it determined?**

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NOTES

3. **Choose the trigonometric function that models this situation.**

   $H(t) = 4\cos\left(\frac{\pi}{6}(t + 3)\right) + 2.2$

   $H(t) = 4\sin\left(\frac{\pi}{6}(t + 3)\right) + 2.2$

   $H(t) = 4\cos(12(t + 3)) + 2.2$

   $H(t) = 4\sin(12(t + 3)) + 2.2$

Interpret the different characteristics of the periodic function with respect to this problem situation.

4. **What is the phase shift? How is it related to the problem situation?**

5. **What is the period of the function? How is it related to the problem situation?**

6. **What is the high tide at midnight?**

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Assignment

Write

Describe a real-world example of a damping function.

Remember

A trigonometric function and an exponential function can be combined to model a periodic function whose amplitude decreases over time. The function that is multiplied to the periodic function is called a damping function.

Practice

1. Jordan is swinging on a rope swing that swings over a creek. When he jumps on the swing, he is 20 feet away from the center of the creek. He then swings out to 20 feet past the center of the creek to the other side. As he swings, he pumps his legs to keep his swinging motion constant. Amelia times Jordan as he swings. Jordan's distance in feet from the center of the creek, d, can be modeled with a trigonometric function of the time he swings, t, in seconds. It takes Jordan 2 seconds to swing from one side of the creek to the other.
   a. Sketch the graph of a function that could be used to model this problem situation.
   b. Write the equation of the cosine function, $d(t)$, that can be used to model the distance Jordan is from the center of the creek as a function of time.
   c. Use the equation from part (b) to determine Jordan's distance from the center of the creek at 9.5 seconds. Round your answer to the nearest foot.
   d. Use the equation from part (b) to determine when Jordan is 6 feet from the center of the creek. Round your answer to the nearest tenth of a second.
2. Amelia is swinging on a rope swing over a creek. When she jumps on the swing, she is 20 feet away from the center of the creek. She then swings out past the center of the creek toward the other side. She decides that she will not pump her legs to keep the swing moving and will just let it swing until it stops. Jordan times Amelia as she swings. Suppose Amelia's distance on each side of the creek decreases at a rate of 20% on each swing. It takes her 2 seconds to swing toward the other side of the creek on her first swing.
   a. Determine the distance Amelia swings past the center of the creek on her first trip over the creek on her initial swing.
   b. Determine the distance Amelia swings past the center of the creek on her second trip over the creek.
   c. Write an equation to represent Amelia's distance, d, in terms of the time, t, after each trip across the creek. Hint: It takes 2 seconds for Amelia to swing from one side of the creek to the other.
   d. Let the function $d(t) = -20\cos\left(\frac{\pi}{2}t\right)$ represent Amelia's distance from the center of the creek if she was swinging at a constant rate back and forth. Use this function to write a new function that represents Amelia's actual distance from the center of the creek given that her distance decreases by 20% each time she swings back over the creek.
   e. Determine Amelia's distance from the center of the creek after 10 seconds. Round your answer to the nearest foot.

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Stretch

1. Lian is swinging on a rope swing over a creek. As she swings, she pumps her legs to keep her swinging motion constant. The table shows her distances from the center of the creek from the moment she jumps on the swing until 8 seconds have passed.

Time (seconds)	0	1	2	3	4	5	6	7	8
Distance (feet)	−15	0	15	0	−15	0	15	0	−15

   a. Sketch the graph of a function that could be used to model this problem situation.
   b. Write the equation of the cosine function, $d(t)$, that can be used to model the distance Lian is from the center of the creek as a function of time.

When Lian is at the spot where she first jumped on the swing, she decides to stop pumping her legs and just let it swing until it stops. The table shows her distances from the center of the creek from the moment she stops pumping her legs until 8 seconds have passed.

Time (seconds)	0	1	2	3	4	5	6	7	8
Distance (feet)	−15	0	11.25	0	−8.4375	0	6.328125	0	−4.74609375

   c. Sketch the graph of a function that could be used to model this problem situation.
   d. Write an equation to represent Lian's distance, d, in terms of the time, t, after each trip across the creek.
   e. Use your function from part (b) to write a new function to represent Lian's actual distance from the center of the creek in terms of the time, t.

Review

1. A person is riding a Ferris wheel. The graph shows the person's height from the ground in feet as a function of time in seconds. The time starts when the rider boards the ride.
   a. Determine the amplitude of the function. Explain your reasoning.
   b. Calculate the period and value of B of the function. Explain your reasoning.
   c. Determine the values of C and D of the function if a cosine function is used to model the problem situation. Explain how you determined your answers.
   d. Write a trigonometric function to model the height of the rider from the ground as a function of time.
2. Add the rational expressions.
   a. $\frac{6}{x-1} + \frac{x}{4}$
   b. $\frac{3}{x-1} + \frac{4}{x+2}$

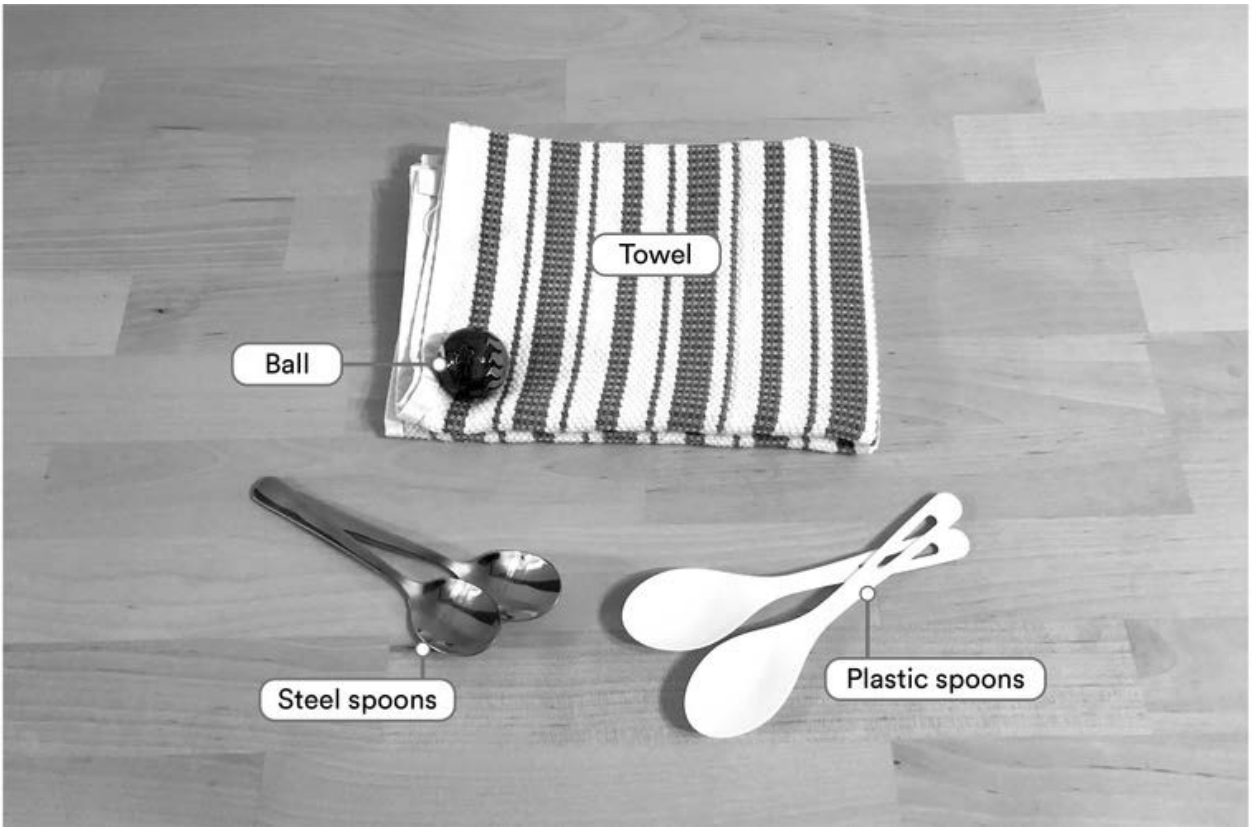
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Physics

Experiment: What do you hear underwater?

By Scientific American/Science Buddies on 03.28.20
Word Count **606**
Level **MAX**



Use these items to learn more about how hearing sounds changes when you go underwater. Newsela staff

Have you ever listened to noises underwater? Sound travels differently in the water than it does in the air. To learn more, try making your own underwater noises — and listening carefully.

Materials

Bathtub or swimming pool (a very large bucket can work, too)

Water

Two stainless steel utensils (for example, spoons or tongs)

Two plastic utensils

Small ball

Towel

Adult helper

An area that can get wet (if not performing the activity at a pool)

Floor cloth to cleanup spills (if not performing the activity at a pool)

Other materials to make underwater sounds (optional)

Access to a swimming pool (optional)

Internet access (optional)

Preparation

Fill the bathtub with lukewarm water — or head to the pool — and bring your helper and other materials.

Procedure

1. Ask your helper to click one stainless steel utensil against another. Listen. How would you describe the sound? In a moment, your helper will click one utensil against the other underwater. Do you think you will hear the same sound?
2. Ask your helper to click one utensil against the other underwater. Listen. Does the sound appear to be louder or softer? Is what you hear different in other ways, too?
3. Submerge one ear in the water. Ask your helper to click one utensil against the other underwater. Listen. How would you describe this sound?
4. Ask your helper to click one utensil against the other underwater soon after you submerge your head. Take a deep breath, close your eyes and submerge your head completely or as much as you feel comfortable doing. Listen while you hold your breath underwater. (Come up for air when you need to.) Does the sound appear to be louder or softer? Does it appear to be different in other ways?
5. Repeat this sequence but have your helper use two plastic utensils banging against each other instead.
6. Repeat the sequence again, but this time listen to a small ball being dropped into the water. Does the sound of a ball falling into the water change when you listen above or below water? Does your perception of this sound change? Why would this happen?
7. Switch roles. Have your helper listen while you make the sounds.
8. Discuss the findings you gathered. Do patterns appear? Can you conclude something about how humans perceive sounds when submerged in water?

Extra: Test with more types of sounds: soft as well as loud sounds, high- as well as low-pitched sounds. Can you find more patterns?

Extra: To investigate what picks up the sound wave when you are submerged, use your fingers to close your ears or use earbuds when submerging your head. How does the sound change when you close off your ear canal underwater? Does the same happen when you close off your ear canal when you are above water? If not, why would this be different?

Extra: Go to the swimming pool and listen to the sound of someone jumping into the water. Compare your perception of the sound when you are submerged with when your head is above the water. How does your perception change? Close your eyes. Can you tell where the person jumped into the water when submerged? Can you tell when you have your head above the water?

Extra: Research ocean sounds and how sounds caused by human activity impact aquatic animals.

Observations And Results

When you submerged only your ear, the sound probably appeared muffled. When you submerged your head, the sound probably sounded fuller. If you tried to detect where the sound came from when submerged, you probably had a hard time.

What do you hear underwater?

By Sabine de Brabandere, Scientific American on 01.12.20
Word Count **1,173**
Level **MAX**



Sound travels differently though water than it does through air. It travels faster and farther in water because there are more particles for the sound waves to bump into. Photo: Rahul/Pexels

Have you ever listened to noises underwater? Sound travels differently in the water than it does in the air. To learn more, try making your own underwater noises — and listening carefully.

Background

Sound is a wave created by vibrations. These vibrations create areas of more and less densely packed particles. So sound needs a medium to travel, such as air, water — or even solids.

Sound waves travel faster in denser substances because neighboring particles will more easily bump into one another. Take water, for example. There are about 800 times more particles in a bottle of water than there are in the same bottle filled with air. Thus, sound waves travel much faster in water than they do in air. In freshwater at room temperature, for example, sound travels about 4.3 times faster than it does in air at the same temperature.

Sound traveling through air soon becomes less loud as you get farther from the source. This is because the waves' energy quickly gets lost along the way. Sound keeps its energy longer when

traveling through water because the particles can carry the sound waves better. In the ocean, for example, the sound of a humpback whale can travel thousands of miles!

Underwater sound waves reaching us at a faster pace and keeping their intensity longer seem like they should make us perceive those sounds as louder when we are also underwater. The human ear, however, evolved to hear sound in the air and is not as useful when submerged in water. Our head itself is full of tissues that contain water and can transmit sound waves when we are underwater. When this happens, the vibrations bypass the eardrum, the part of the ear that evolved to pick up sound waves in the air.

Sound also interacts with boundaries between two different mediums, such as the surface of water. This boundary between water and air, for example, reflects almost all sounds back into the water. How will all these dynamics influence how we perceive underwater sounds? Try the activity to find out!

Key Concepts

Physics Sound Waves Biology

Materials

Bathtub or swimming pool (a very large bucket can work, too)

Water

Two stainless steel utensils (for example, spoons or tongs)

Two plastic utensils

Small ball

Towel

Adult helper

An area that can get wet (if not performing the activity at a pool)

Floor cloth to cleanup spills (if not performing the activity at a pool)

Other materials to make underwater sounds (optional)

Access to a swimming pool (optional)

Internet access (optional)

Preparation

Fill the bathtub with lukewarm water — or head to the pool — and bring your helper and other materials.

Procedure

1. Ask your helper to click one stainless steel utensil against another. Listen. *How would you describe the sound?*

In a moment, your helper will click one utensil against the other underwater. *Do you think you will hear the same sound?*

2. Ask your helper to click one utensil against the other underwater. Listen. *Does the sound appear to be louder or softer? Is what you hear different in other ways, too?*

3. Submerge one ear in the water. Ask your helper to click one utensil against the other underwater. Listen. *How would you describe this sound?*

4. Ask your helper to click one utensil against the other underwater soon after you submerge your head. Take a deep breath, close your eyes and submerge your head completely or as much as you feel comfortable doing. Listen while you hold your breath underwater (come up for air when you need to). *Does the sound appear to be louder or softer? Does it appear to be different in other ways?*

5. Repeat this sequence but have your helper use two plastic utensils banging against each other instead.

6. Repeat the sequence again, but this time listen to a small ball being dropped into the water. *Does the sound of a ball falling into the water change when you listen above or below water? Does your perception of this sound change? Why would this happen?*

7. Switch roles. Have your helper listen while you make the sounds.

8. Discuss the findings you gathered. *Do patterns appear? Can you conclude something about how humans perceive sounds when submerged in water?*

Extra: Test with more types of sounds: soft as well as loud sounds, high- as well as low-pitched sounds. *Can you find more patterns?*

Extra: To investigate what picks up the sound wave when you are submerged, use your fingers to close your ears or use earbuds when submerging your head. *How does the sound change when you close off your ear canal underwater? Does the same happen when you close off your ear canal when you are above water? If not, why would this be different?*

Extra: Go to the swimming pool and listen to the sound of someone jumping into the water. Compare your perception of the sound when you are submerged with when your head is above the water. *How does your perception change?* Close your eyes. *Can you tell where the person jumped into the water when submerged? Can you tell when you have your head above the water?*

Extra: Research ocean sounds and how sounds caused by human activity impact aquatic animals.

Observations And Results

Was the sound softer when it was created underwater and you listened above the water? Did it sound muffled when you had only your ear submerged? Was it fuller when you had your head submerged?

Sound travels faster in water compared with air because water particles are packed in more densely. Thus, the energy the sound waves carry is transported faster. This should make the sound appear louder. You probably perceived it as softer when you were not submerged, however,

because the water surface is almost like a mirror for the sound you created. The sound most likely almost completely reflected back into the water as soon as it reached the surface.

When you submerged only your ear, the sound probably still appeared muffled. This happens because the human ear is not good at picking up sound in water; after all, it evolved to pick up sound in air.

When you submerged your head, the sound probably sounded fuller. That is because our head contains a lot of water, which allows the tissue to pick up underwater sound — without relying on the eardrum. It also explains why closing your ear canal makes almost no difference in the sound you pick up while you are underwater.

If you tried to detect where the sound came from when submerged, you probably had a hard time. Our brain uses the difference in loudness and timing of the sound detected by each ear as a clue to infer where the sound came from. Because sound travels faster underwater and because you pick up sound with your entire head when you are submerged, your brain loses the cues that normally help you determine where the sound is coming from.

Quiz

1 Which section from the article BEST explains why you can benefit from trying the experiment in different ways?

(A) "Background"

(B) "Materials"

(C) "Procedure"

(D) "Observations And Results"

2 Read the paragraph from the section "Background."

> *Sound traveling through air soon becomes less loud as you get farther from the source. This is because the waves' energy quickly gets lost along the way. Sound keeps its energy longer when traveling through water because the particles can carry the sound waves better. In the ocean, for example, the sound of a humpback whale can travel thousands of miles!*

Which conclusion is BEST supported by this paragraph?

(A) Sounds heard underwater always seem louder to the human ear than sounds heard above the water.

(B) Sounds travel faster underwater because the cooler temperatures help them move easily.

(C) You should research ocean sounds and the way that human activities affect aquatic animals.

(D) You might be able to hear sounds underwater that would be too far away to hear through the air.

3 According to the article, why do underwater sounds seem fuller when a person's head is fully submerged?

(A) The ear canal is closed so the brain can pick up additional cues and determine where the sound is coming from.

(B) The tissues in a human head contain water that allows them to pick up vibrations without relying on the eardrum.

(C) The human ear evolved to use differences in loudness and timing as a clue about where sound came from.

(D) The surface of the water acts like a mirror that allows sound waves in water to be transported faster than in the air.

4 Which of the following MOST influences the speed of sound waves?

(A) the density of the medium they travel through

(B) the use of earbuds when submerging your head

(C) the boundaries between two different mediums

(D) the volume of the source of the sound waves

How dolphins communicate with whistles and clicks

By Jack Myers, Highlights on 03.08.20
Word Count **891**
Level **MAX**



Image 1. Dolphins use sound to communicate. Two kinds of sounds — whistles and clicks — are a big part of dolphin life. In fact, dolphins are so good at using these sounds that many studies have been designed to find out how dolphins use them. Photo: Howard Hall/Photophile
Howard Hall/Photophile

In the seawater world of the dolphin, sound is the very best way to communicate or to learn about its surroundings: obstacles or prey or predators.

Scientists have studied two kinds of sounds that are a big part of dolphin life. One kind is a whistle, usually a few seconds long and in many different patterns. Among its many whistles, each dolphin has a special pattern, like a signature, that it uses to tell others where it is.

A very different dolphin sound is the click. That's a sharp burst less than one-thousandth of second long. It is mostly ultrasonic (with a pitch too high for human ears) and use for sonar. By making that loud click and listening to the echoes, a dolphin can find out a lot about what's out there. That works especially well in water, where sound travels about five times faster than it does through air.

An echo may contain a lot of information. The direction of the echo tells the direction of an object that reflected the sound. The time delay tells about the distance the click traveled plus the distance

This article is available at 5 reading levels at https://newsela.com.

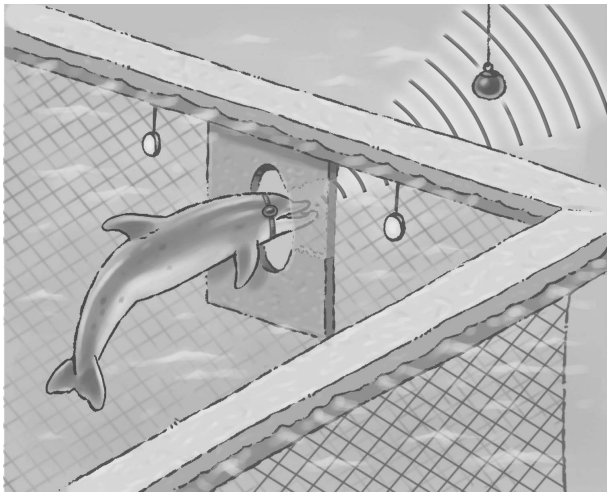
for the echo to travel back. And the details of the echo may tell about what kind of object reflected it.

Dolphins are so good at using their sonar that lots of studies have been designed to find out how they do it.

A Sonar Game

As in most studies of animal abilities, scientists first teach the animal a game that it can play over and over. For dolphins, the game usually is designed to tell about how they use sonar. The dolphin floats in a playpen especially designed for the game.

The best way to understand the game is to imagine that you are playing it yourself. You be the dolphin, and I'll be the trainer helping with the game.



You are blindfolded by rubber eyecups so that you can tell what's around you only through your ears. You have been trained to start in a special position with your head in a hoop, as shown in the diagram. A game trial starts when I pull a string and lower a sound-blocking screen out of the way. That's your cue to start making clicks and listening to their echoes.

Directing The Target

Today's target is a four-inch steel ball, but sometimes it may be much smaller. It may be hung at some measured distance in front of you. (In the diagram it is about 20 feet away). My job is to control the target. It is suspended by fishing line so I can pull it up out of the way. The target is either there or not there. Your job is to use your sonar to tell which.

If you hear an echo from the target, you swim up and push the right paddle to say, "It's there." If you can't hear any echo telling about the target, you swim up and push the left paddle to say, "No, it's not there."

If your choice was correct, I press a buzzer that tells you to come up for a snack. (For a dolphin, that's a tasty fish.) If you have made the wrong choice, there is no buzzer and no reward. You just swim back to the hoop and get ready for the next trial.

At first the game seems too easy. You can always hear echoes when the steel ball is there, and you never make a mistake when the target is not there.

The game gets harder as I move the target father away and the echoes become weaker. Then you will begin making mistakes.

I move the steel ball way out to 230 feet – about three-fourths the length of a football field. At that distance, you can detect it only nine times in every 10 trials. Now, every extra small distance makes the echoes harder to hear. At 240 feet, you are correct in your echo detection only about 5 times in every 10 trials.

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Our game was taken from a book by Dr. Whitlow Au. He played the game for real with a dolphin named Sven in Kaneohe Bay, Hawaii. The diagram I used was taken from one of his experiments. From the results of the game, you can see that a dolphin can easily find a table-tennis ball in a big, Olympic-size swimming pool.

Dr. Au has gone on to do a whole book full of experiments on dolphin sonar. He trained dolphins to listen to echoes from a standard target and then tell when some other target was used instead. He has used targets of different shapes and different materials.

He is still searching for the dolphin's secret: How does a dolphin use echoes to learn if an object is round or flat, rough or smooth, and hard or soft?

Dr. Au has said, "The dolphin's ability to discriminate and recognize features of targets with its sonar is a characteristic that man-made sonar systems do not possess." By studying dolphins he hopes to make man-made sonar as good as theirs.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which sentence from the article would be MOST important to include in a summary of the article?

(A) Among its many whistles, each dolphin has a special pattern, like a signature, that it uses to tell others where it is.

(B) By making that loud click and listening to the echoes, a dolphin can find out a lot about what's out there.

(C) You have been trained to start in a special position with your head in a hoop, as shown in the diagram.

(D) He played the game for real with a dolphin named Sven in Kaneohe Bay, Hawaii.

2 Which statement is a central idea of the article?

(A) Dolphins can easily find a small table-tennis ball that is floating in an Olympic-size swimming pool.

(B) Dolphins that do well at practicing their sonar or jumping through a hoop are given fish as a reward.

(C) Scientists create games to help them learn more about what makes dolphins so good at using sonar.

(D) Scientists believe the best way to teach dolphins or other animals is by training them to play games.

3 How does the author build understanding of dolphin sonar studies?

(A) by providing a description of steps that asks the reader to imagine being a dolphin

(B) by listing the various reasons why dolphins would need to use sonar underwater

(C) by comparing and contrasting the traits of dolphin sonar with man-made sonar

(D) by describing differences between the whistles and clicks dolphins use to communicate

4 Read the following selection from the section "Mysteries Of Sonar."

He is still searching for the dolphin's secret: How does a dolphin use echoes to learn if an object is round or flat, rough or smooth, and hard or soft?

Dr. Au has said, "The dolphin's ability to discriminate and recognize features of targets with its sonar is a characteristic that man-made sonar systems do not possess."

Why did the author include this idea?

(A) to suggest that scientists' studies have done little to advance their understanding of dolphin sonar

(B) to emphasize the unique traits of dolphin sonar that scientists are still working to fully understand

(C) to introduce the specific differences in the types of targets that are used to understand dolphin sonar

(D) to demonstrate that scientists trying to understand sonar often find dolphins difficult to work with

This article is available at 5 reading levels at https://newsela.com.

Everyday Mysteries: What is static electricity?

By Library of Congress on 01.13.17
Word Count **405**
Level **MAX**



Ryan Solymar of San Jose Street Elementary School in Los Angeles, California, got to experience the wonders of static electricity as he and his hair became part of an experiment. Photo by David Bohrer/Los Angeles Times via Getty Images

Question: How does static electricity work?

Answer: An imbalance between negative and positive charges in objects.

Have you ever walked across the room to pet your dog, but got a shock instead? Perhaps you took your hat off on a dry winter's day and had a "hair raising" experience! Or, maybe you have made a balloon stick on the wall after rubbing it against your clothes?

Why do these things happen? Is it magic? No, it's not magic; it's static electricity!

Before understanding static electricity, we first need to understand the basics of atoms and magnetism.

All physical objects are made up of atoms. Inside an atom are protons, electrons and neutrons. The protons are positively charged, the electrons are negatively charged and the neutrons are neutral.

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Therefore, all things are made up of charges. Opposite charges attract each other (negative to positive). Like charges repel each other (positive to positive or negative to negative). Most of the time positive and negative charges are balanced in an object, which makes that object neutral.

Static electricity is the result of an imbalance between negative and positive charges in an object. These charges can build up on the surface of an object until they find a way to be released or discharged. One way to discharge them is through a circuit.

The rubbing of certain materials against one another can transfer negative charges, or electrons. For example, if you rub your shoe on the carpet, your body collects extra electrons. The electrons cling to your body until they can be released. As you reach and touch your furry friend, you get a shock. Don't worry, it is only the surplus electrons being released from you to your unsuspecting pet.

And what about that "hair raising" experience? As you remove your hat, electrons are transferred from hat to hair, creating that interesting hairdo! Remember, objects with the same charge repel each other. Because they have the same charge, your hair will stand on end. Your hairs are simply trying to get as far away from each other as possible!

When you rub a balloon against your clothes and it sticks to the wall, you are adding a surplus of electrons (negative charges) to the surface of the balloon. The wall is now more positively charged than the balloon. As the two come in contact, the balloon will stick because of the rule that opposites attract (positive to negative).

This article is available at 5 reading levels at https://newsela.com.

What causes lightning and thunder?

By NASA.gov on 11.22.16
Word Count **642**
Level **MAX**



TOP: Lightning strikes near a rainbow over Lake Mead National Recreation Area July 1, 2015 in Lake Mead, Nevada. The storm brought very little rain to the lake, which was at a historic low. BOTTOM: Ice crystals and water droplets bump together and move apart to create a cloud with two charges. NASA.

Zap! You just touched a metal doorknob after shuffling your rubber-soled feet across the carpet. Yipes! You've been struck by lightning! Well, not really, but it's the same idea.

Your rubber-soled shoes picked up stray electrons from the carpet. Those electrons built up on your shoes, giving them a static charge. (Static means not moving.) Static charges are always "looking" for the first opportunity to "escape," or discharge. Your contact with a metal doorknob — or car handle or anything that conducts electricity — presents that opportunity, and the excess electrons jump at the chance.

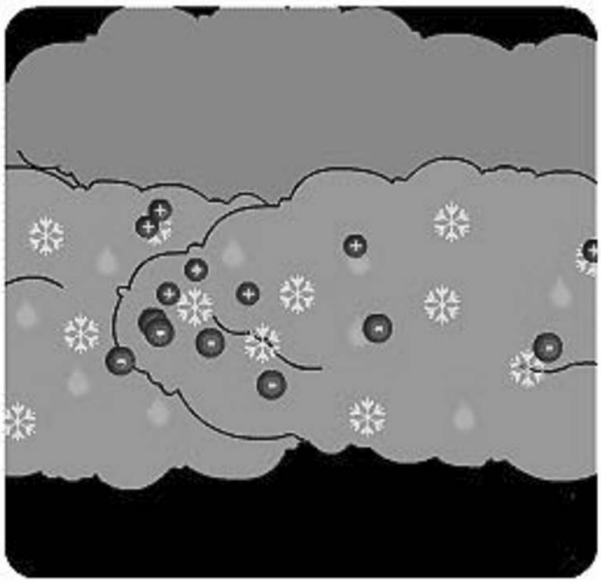
What Causes Lightning?

So, do thunderclouds have rubber shoes? Not exactly, but there is a lot of shuffling going on inside the cloud.

Lightning begins as static charges in a rain cloud. Winds inside the cloud are very turbulent. Water droplets in the bottom part of the cloud are caught in the updrafts and lifted to great heights where

This article is available at 5 reading levels at https://newsela.com.

the much colder atmosphere freezes them. Meanwhile, downdrafts in the cloud push ice and hail down from the top of the cloud. Where the ice going down meets the water coming up, electrons are stripped off.



It's a little more complicated than that, but what results is a cloud with a negatively charged bottom and a positively charged top. These electrical fields become incredibly strong, with the atmosphere acting as an insulator between them in the cloud.

When the strength of the charge overpowers the insulating properties of the atmosphere, Z-Z-Z-ZAP! Lightning happens.

How Does The Lightning "Know" Where To Discharge — Or Strike?

The electric field "looks" for a doorknob. Sort of. It looks for the closest and easiest path to release its charge. Often lightning occurs between clouds or inside a cloud.

But the lightning we usually care about most is the lightning that goes from clouds to ground — because that's us!

As the storm moves over the ground, the strong negative charge in the cloud attracts positive charges in the ground. These positive charges move up into the tallest objects like trees, telephone poles and houses. A "stepped leader" of negative charge descends from the cloud, seeking out a path toward the ground. Although this phase of a lightning strike is too rapid for human eyes, it's possible to see it in a slow-motion video.

As the negative charge gets close to the ground, a positive charge, called a streamer, reaches up to meet the negative charge. The channels connect, and we see the lightning stroke. We might see several strokes using the same path, giving the lightning bolt a flickering appearance, before the electrical discharge is complete.

What Causes Thunder?

In a fraction of a second, lightning heats the air around it to incredible temperatures — as hot as 54,000 degrees Fahrenheit. That's five times hotter than the surface of the Sun!

The heated air expands explosively, creating a shockwave as the surrounding air is rapidly compressed. The air then contracts rapidly as it cools. This creates an initial CRACK sound, followed by rumbles as the column of air continues to vibrate.

If we are watching the sky, we see the lightning before we hear the thunder. That is because light travels much faster than sound waves. We can estimate the distance of the lightning by counting how many seconds it takes until we hear the thunder. It takes approximately five seconds for the sound to travel one mile. If the thunder follows the lightning almost instantly, you know the lightning is too close for comfort!

What Does Lightning Look Like From Space?

This article is available at 5 reading levels at https://newsela.com.

Lightning is an important part of weather forecasting. The new GOES-R Geostationary Lightning Mapper instrument will detect lightning activity over nearly the whole Western Hemisphere. This complete picture of lightning at any given time will improve "now-casting" of dangerous thunderstorms, tornadoes, hail and flash floods.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which sequence of events would lead to a person being shocked by a doorknob?

1. *electrons in the carpet*
2. *electricity into the hand*
3. *flow of electrons*
4. *static charge of electrons*

(A) 1, 4, 3 then 2

(B) 1, 3, 4 then 2

(C) 4, 1, 3 then 2

(D) 4, 3, 1 then 2

2 Which statement would be MOST important to include in an objective and accurate summary of the article?

(A) The turbulent winds inside a rain cloud are partially responsible for creating the conditions that result in lightning.

(B) The natural process that produces lightning includes a crucial period of time in which a cloud experiences more positive charges than negative charges.

(C) Lightning rarely occurs between clouds because positive and negative charges within the clouds neutralize each other.

(D) Lightning strikes have the potential to cause horrific damage because they create temperatures that are many times hotter than the surface of the sun.

3 Which factors contribute to making lightning?

(A) charged electrons in the top and bottom of a cloud

(B) positive charges in the top and bottom of a cloud

(C) frozen droplets and electrons in the top of a cloud

(D) frozen droplets and electrons in the bottom of a cloud

4 Which statement accurately describes the relationship between the article's CENTRAL ideas?

(A) Lightning begins as static charges in a rain cloud; through movement, these charges transform into negative and positive charges.

(B) Clouds look to release electrical energy in the easiest way they can; they usually discharge that energy directly to the ground.

(C) Negative charges from clouds descend directly to the ground where they overpower positive charges; this confrontation of charges produces lightning.

(D) Lightning results from the connection made between negative charges and positive charges; thunder is a reaction to lightning.

5 If lightning hit the flat ground with no tall objects anywhere near, what would likely happen?

(A) The lightning would electrify the ground and spread out in all directions.

(B) The lightning would weaken in the air with no streamers rising to meet it.

(C) The lightning would become more powerful with no objects to dissipate it.

(D) The lightning would hit the ground and weaken without objects to magnify it.

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6 According to the article, each of the following contributes to the production of lightning EXCEPT:

(A) ice and hail in a cloud

(B) insulating properties of the atmosphere in a cloud

(C) the rapid expansion and contraction of air in a cloud

(D) a negative charge descending from a cloud toward the ground

7 A person sees lightning, then hears thunder 2 minutes later.

How far away is the lightning?

(A) 2 miles

(B) 2.4 miles

(C) 20 miles

(D) 24 miles

8 Which sentence BEST summarizes the connection between rubber-soled shoes and lightning in the article?

(A) The author uses rubber-soled shoes as an easy way to explain how electrons change from being static charges to lightning.

(B) The author uses rubber-soled shoes as an example to describe the power that both electricity and lightning have to shock.

(C) The author uses rubber-soled shoes as an analogy to describe how lightning works.

(D) The author uses rubber-soled shoes to suggest that lightning is an everyday natural phenomenon.

This article is available at 5 reading levels at https://newsela.com.

Thunderstorms and homemade "lightning"

By M. Rae Nelson, Gale, Cengage Learning on 11.02.17
Word Count **1,585**
Level **MAX**



A thunderstorm rips through the night sky. Photo by: Gerlos/Wikimedia.

Right now, at least one area of the world is experiencing some type of powerful storm. Storms are periods of extreme bad weather that can bring powerful winds and torrential rains. Storms can rip buildings apart, toss cars through the air, cause deaths and spark forest fires. Every day there are as many as 50,000 storms occurring throughout the world. They can stretch for hundreds of miles, or remain isolated to a few hundred yards. Either way, storms can cause enormous devastation. One of the most common types of storm is the thunderstorm.

Clouds Brewing

Thunderstorms need three basic ingredients to form. The first is moisture in the air or water vapor, which forms clouds and rain. The second is a column of unstable air, which provides relatively warm, moist air on the bottom layers with cold, dry air high above it. And lastly, a thunderstorm needs some kind of force to lift the air upward.

When the moist, warm air rises it eventually meets colder air and begins to cool. That forms the beginning of a cloud. Inside a cloud, currents of air move up and down quickly. This air is filled with tiny particles of dust. Water vapor is pushed upward by the warm air. When it comes into

contact with cooler air, the water vapor condenses. Condensation is when a gas (or vapor) changes into a liquid. The condensed drops of water will then surround a dust particle. Clouds form where millions of water-dust droplets gather together. Each of the particles in a cloud has a positive and a negative electrical charge.

These small, puffy clouds grow increasingly larger as more warm air rises from the ground. If the cloud gets large enough, it may continue to rise into the ever-colder air. Strong winds can blow the top of the cloud downwind, and this gives the top of the cloud an anvil shape. This thunderstorm cloud is called a cumulonimbus cloud and it can extend upward for miles.

Shocking Sights, Loud Noises

To be called a thunderstorm there must be thunder. Thunder is caused by lightning, and lightning begins in the cumulonimbus clouds. Lightning is an intense discharge of electricity. Scientists estimate that about a hundred lightning flashes occur each second around the world. The electricity flowing within a lightning bolt is so powerful that it can kill instantly, split trees and spark fires. The average flash of lightning could turn on a 100-watt light bulb for more than three months.

As a storm advances, strong winds blow the particles of dust and water in the cloud and cause them to hit each other. Each particle contains positive and negative charges, which are attracted to each other under normal conditions, but collisions cause the positive and negative charges to separate. Positive charges tend to move toward the top of a cloud and negative charges move toward the bottom. Both types of charges hold energy. Charges that are alike repel each other and charges that are opposites pull together. When enough charges and time build up, the negative charge in the cloud reaches out toward the positive charges on the ground. The result is a burst of electricity, or a lightning bolt.

Every lightning flash produces thunder. In just a fraction of a second, a lightning flash can heat up the air to 50,000°F (28,000°C) — a temperature hotter that the surface of the sun. The burst of heat causes the air molecules around it to expand quickly away from the lightning's flash. As this hot air cools, it contracts. This quick expansion and contraction of air causes the air molecules to shake or vibrate, making sound waves that create the sound of thunder.

Thunder and lightning occur simultaneously, yet people will always see lightning before they hear thunder because light and sound travel at different speeds. Light travels at about 186,000 miles per second (299,800 kilometers per second). The speed of sound is only about 0.2 miles per second (0.3 kilometers per second). That means a person will see lightning almost instantly, but won't hear the thunder for several seconds. Knowing this allows any storm watcher to calculate the distance of the lightning strike. Count the number of seconds between the lightning and the thunder, and divide the number of seconds by 5 to calculate the miles distance; divide the number of seconds by 3 to calculate the kilometers distance.

EXPERIMENT: Separating Charges

Lightning that is produced during a storm is simply a massive electric spark, which is called static electricity. Friction causes the particles to separate into positive and negative charges. These opposite charges attract one another, and when the electric charges are separated they look for a way to get back together. In a storm, the jump of numerous negative charges reaching out toward

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the positive charges produces a bolt of lighting. A miniature version of static electricity will produce sparks and an attraction between charged objects.



In this experiment, you will explore what happens when you cause charges to separate. You will use friction to create electrical charges on a balloon, and observe how three different objects react to these charges. The three objects you will use are salt and pepper, water and another balloon.

Before you begin, make an educated guess about the outcome of this experiment based on your knowledge of lightning and charges. This educated guess, or prediction, is your hypothesis. A hypothesis should explain the topic of the experiment, the variable you will change, the variable you will measure and what you expect to happen.

What Are The Variables?

Variables are anything that might affect the results of an experiment. Here are the main variables in this experiment: the object that is charged, the degree of friction, the material that produces the friction and the distance from the balloon to the objects.

In other words, the variables in this experiment are everything that might affect the charge of the balloon. If you change more than one variable at the same time, you will not be able to tell which variable had the most effect on the action of the charged particles.

A hypothesis should be brief, specific and measurable. It must be something you can test through further investigation. Your experiment will prove or disprove whether your hypothesis is correct. Here is one possible hypothesis for this experiment: "If enough charges are separated, the balloon will attract different objects and create electricity."

In this case, the variable you will change is the separation of the negative and positive charges on the balloon. The variable you will measure is how the balloon's charges are attracted to other objects. Having a control experiment will help you isolate each variable and measure the changes in the dependent variable. Only one variable will change between the control and the experimental setup, and that is the amount of charged particles. At the end of the experiment, you will compare the charged balloon with the neutrally charged balloon.

Materials Needed

- 2 balloons
- Salt and pepper
- Access to sink
- Small plate
- Wool cloth or nylon (optional)
- Time: 30 minutes

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How To Experiment Safely

This project poses little hazard, but remember you are experimenting with electricity, however small. Do not conduct this experiment if there are any flammable vapors in the air, such as gasoline from an open container.

Step-By-Step Instructions

1. Sprinkle some salt and pepper on a plate.

2. Inflate both balloons. For the control, do not rub one balloon. Place the balloon about 1 inch (2.5 centimeters) above the salt and pepper. Then place the balloon about 1 inch (2.5 centimeters) away from a trickle of water from the faucet. Note the results.

3. Rub the second balloon briskly against a piece of wool or your hair.

4. Hold this balloon about 1 inch (2.5 centimeters) above the salt and paper. Note what you see and hear.

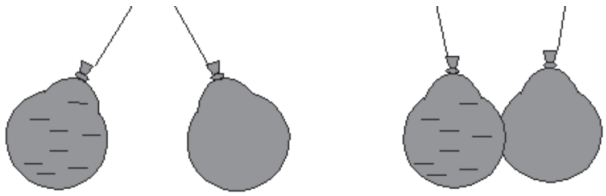
5. Hold the balloon about 1 inch (2.5 centimeters) from a trickle of water. Note the results.

6. Darken the room. Rub both balloons against a cloth or your hair, and place them together. Note what you see and hear.

7. Place your hand gently over the section of the balloon that you rubbed. Again place the two balloons together and note the results.

Summary Of Results

Create a data chart that describes the results of each trial. Compare the results to the control experiment. What did placing your hand over the balloon do to the charges in the balloon? Write a paragraph explaining your conclusions. Include how powerful bolts of lightning relate to this experiment.



Change The Variables

You can change the variables in this experiment in several ways. You can use different types of material to create friction, and determine if this produces less or more attraction. You can also create charges on different objects, such as a comb. Try creating sparks or picking up different objects.

Troubleshooter's Guide

Below is a problem that may arise during this experiment, a possible cause and a way to remedy the problem.

Problem: There was no difference between the control and the experimental balloon.

Possible cause: You may not have created enough friction, in which case not enough charges would separate. Try rubbing the balloon vigorously against your hair, and repeat the experiment.

This article is available at 5 reading levels at https://newsela.com.

Sea turtles are natural ocean navigators

By Los Angeles Times, adapted by Newsela staff on 01.28.15
Word Count **800**
Level **1040L**



A sea turtle lies on the beach in Kailua, Hawaii, on Aug. 7, 2014. AP Photo/Chris Stewart

LOS ANGELES — It is a mystery that has stumped scientists for years: How do female sea turtles navigate back to the beach where they were born when it comes time to lay their own eggs? After all, sea turtles travel across thousands of miles of open ocean each year. Yet somehow the females find their way back to the spot where they were hatched.

Keep in mind that there are no visual guideposts in the open ocean where sea turtles spend most of their lives. Yet every two to three years, sea turtles dig their nests at the same location where they once crawled out of their own eggs.

Earth's Magnetic Force

Since the 1990s, scientists have known that the turtles are somehow guided by the Earth’s geomagnetic field.

Geomagnetism is an invisible but powerful force. The Earth's core is mostly solid iron. Electrical currents stream from it, creating a strong magnetic field. The force acts like an enormous magnet buried in the planet's center. One end of the magnet, or pole — the North Pole — is in the Arctic.

This article is available at 5 reading levels at https://newsela.com.

The other end — the South Pole — is in Antarctica. When travelers use a compass to find north, they rely on geomagnetism. The metal needle of a compass is attracted to the North Pole of the Earth, just as a pin is attracted to an ordinary magnet.

Scientists knew that sea turtles use magnetism to guide themselves in general directions. What they did not know was how turtles find the exact beach where they were born.

A study published on Thursday looks at loggerhead sea turtles that bury their eggs on the Florida coast. It shows that slight changes in the Earth's magnetic field affect where the eggs are buried.

Natural Field Of Magnets

Once again, to understand how geomagnetism works, it helps to imagine that there is a giant bar magnet inside the Earth. Its two ends give off a powerful magnetic charge, which travels in a straight line through the Earth and up into the atmosphere. Because the bar shifts constantly, its angle relative to the Earth changes over time.

Also important to understand is that some objects are more magnetic than others. Everything on Earth reacts to geomagnetism in a different way, and the particular way each thing reacts is known as its magnetic signature. Imagine that you are pointing a magnet at two objects, and that one is pulled quickly toward the magnet, while the other is not. The difference in how they are attracted to the magnet is part of their magnetic signature.

However, an object's magnetic signature changes when the magnetic field shifts in strength and direction. The signature reflects how an object reacts to magnetism at a given time.

Pulled Back To The Beach

Scientist J. Roger Brothers was involved in the new sea turtle study.

He said that over thousands of years, turtles developed a way to use the shifts in the geomagnetic field and the field's strength to guide themselves. It is almost as if they have a built-in GPS system similar to what is found in cellphones or cars.

Returning turtles are not just using geomagnetism to point themselves in the right general direction, however. Somehow, the turtles are also able to sense, remember and track their birth beach's magnetic signature.

But the magnetic signature of a particular stretch of beach changes over time. The change comes in response to changes in the strength and direction of the magnetic field itself.

The Sea Turtle Knows

The scientists suspected that shifts in the geomagnetic field led to shifts in loggerhead turtle nesting sites.

In fact, that is exactly what they found. The team looked at 19 years' worth of records tracking loggerhead turtle nesting sites along Florida's Atlantic coast. They compared that information to the record of shifts in the geomagnetic field over the same period of time.

As the geomagnetic field shifted, the turtles went to different nesting sites. It proved that sea turtles can sense magnetic signatures.

This article is available at 5 reading levels at https://newsela.com.

However, there are still many more questions to be answered. For example, researchers do not know how the turtles sense the geomagnetic field, which can neither be seen nor heard.

“Most likely they have tiny magnetic particles in their brains or in their bodies that act like a compass," Brothers said. The particles may be spread throughout the animals' bodies, which would make them hard to find.

Brothers also noted that loggerhead turtles do not only rely on geomagnetic fields when looking for a place to lay their eggs.

“We don’t expect that these turtles are coming to the magnetic signature regardless of what else is going on,” he said. “If a condo is built there, they will usually decide to go nest somewhere else.”

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Select the sentence from the article that is LEAST important to be included in its summary.

(A) The signature reflects how an object reacts to magnetism at a given time.

(B) Yet somehow the females find their way back to the spot where they were hatched.

(C) Scientists knew that sea turtles use magnetism to guide themselves in general directions.

(D) It is almost as if they have a built-in GPS system similar to what is found in cellphones or cars.

2 Select the sentence from the article that BEST supports its central idea.

(A) After all, sea turtles travel across thousands of miles of open ocean each year.

(B) A study published on Thursday looks at loggerhead sea turtles that bury their eggs on the Florida coast.

(C) As the geomagnetic field shifted, the turtles went to different nesting sites. It proved that sea turtles can sense magnetic signatures.

(D) Returning turtles are not just using geomagnetism to point themselves in the right general direction, however.

3 What is the significance of the section "The Sea Turtle Knows" in the article?

(A) It provides an account of the conflicting explanations about how sea turtles navigate their way to the same beach.

(B) It shows that sea turtles also rely on factors other than the magnetic signature of a beach.

(C) It shows that the magnetic signature of a beach influences the nesting sites of sea turtles.

(D) It provides information on where magnetic particles are located in sea turtles.

4 Read the sentence from the article.

What they did not know was how turtles find the exact beach where they were born.

Why did the author include the above sentence in the article?

(A) to show that sea turtles prefer living near the beach where they were born

(B) to show that scientists disagree on how sea turtles go back to the beach where they were born

(C) to show that sea turtles have a complex magnetic sense that leads them back to the beach where they were born

(D) to show that sea turtles have an exceptional memory that helps them find their way back to the beach where they were born

This article is available at 5 reading levels at https://newsela.com.

Magnets and magnetism

By Encyclopaedia Britannica, adapted by Newsela staff on 08.21.19
Word Count **562**
Level **MAX**

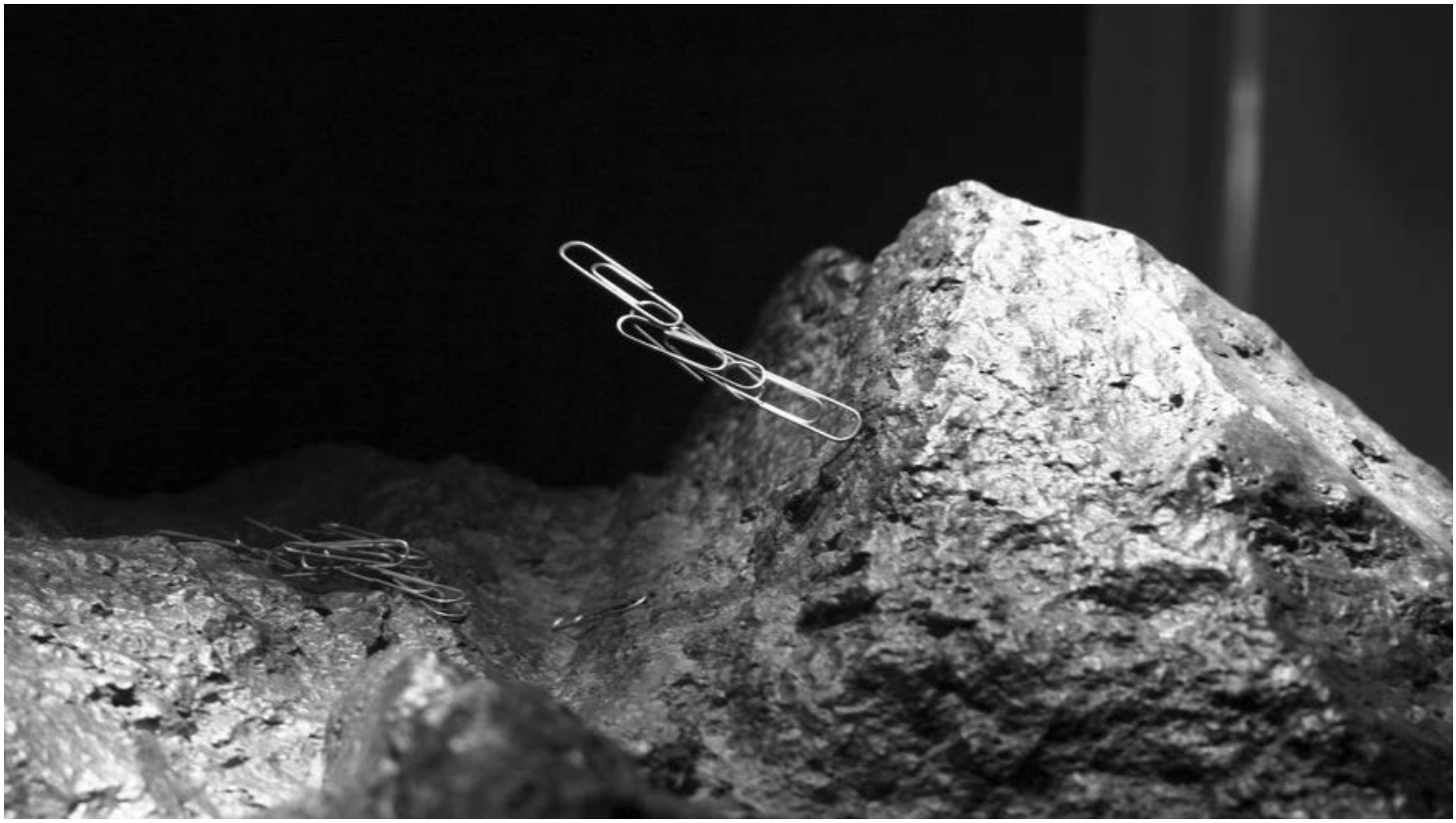


Image 1. Metal paperclips stick to a lodestone rock. Lodestone is a natural magnet. Photo by: Ryan Somma/Flickr

A magnet is a rock or a piece of metal that can pull certain types of metal toward itself. The force of magnets, called magnetism, is a basic force of nature, like electricity and gravity. Magnetism works over a distance, and this means that a magnet does not have to be touching an object to pull it.

What Causes Magnetism?

People have known for a long time that a certain type of rock, called lodestone, is a natural magnet. When scientists learned why that is, they also learned how to make other metals into magnets.

Magnetism happens when tiny particles called electrons behave in a certain way. All objects in the universe are made up of units called atoms, which, in turn, are made up of electrons and other particles (neutrons and protons). The electrons spin around the atom's nucleus, which contains the other particles. The spinning electrons form tiny magnetic forces. Sometimes many of the electrons in an object spin in the same direction. In these cases, all the tiny magnetic forces from the electrons add up to make the object one big magnet.

This article is available at 5 reading levels at https://newsela.com.

It is possible to make a magnet by taking an existing magnet and rubbing another piece of metal with it. The new piece of metal must be rubbed continuously in the same direction, and this will make the electrons in that metal start to spin in the same direction.

Electricity can also create magnets. Electricity is a flow of electrons. As electrons move through a piece of wire they have the same effect as electrons spinning around the nucleus of an atom. This is called an electromagnet.

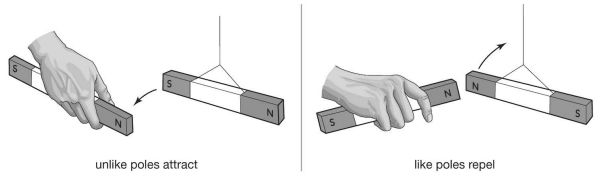
Hard And Soft Magnets

Because of the way their electrons are arranged, the metals iron, steel, nickel and cobalt make good magnets. Once these metals become magnets, they can stay magnets forever. Then they are called hard magnets. But these metals and others can also act like magnets temporarily, after they have been near a hard magnet. Then they are called soft magnets. Most other materials — for example, water, air and wood — have very weak magnetic properties.

Properties Of Magnets

Magnets strongly attract objects that contain iron, steel, nickel or cobalt. Magnets also attract or repel (push away) other hard magnets. This happens because every magnet has two opposite poles, or ends: a north pole and a south pole. North poles attract the south poles of other magnets, but they repel other north poles. Likewise, south poles attract north poles, but they repel other south poles.

The magnetic forces between the two poles of a magnet create a magnetic field. This is the area affected by the magnet. A magnetic field surrounds all magnets.



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Uses For Magnets

One of the earliest uses of magnets was in compasses, which are needle-shaped magnets that are free to turn around. The planet Earth is a giant magnet. Because the south pole of a compass is attracted to the north pole of Earth, the compass needle always points north.

Today magnets are found in many places. Magnets hold papers on refrigerator doors and they also hold the doors shut. Credit cards have a magnetic strip. Automatic doors, stereo speakers and many electric motors use electromagnets.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which sentence from the article is BEST illustrated by Image 1?

(A) Magnetism works over a distance, and this means that a magnet does not have to be touching an object to pull it.

(B) People have known for a long time that a certain type of rock, called lodestone, is a natural magnet.

(C) It is possible to make a magnet by taking an existing magnet and rubbing another piece of metal with it.

(D) Because of the way their electrons are arranged, the metals iron, steel, nickel and cobalt make good magnets.

2 What does Image 2 teach the reader about magnets?

(A) that magnets must be painted red, white and blue

(B) that magnets in compasses point north

(C) that like poles of a magnet will attract

(D) that opposite poles of a magnet will attract

3 What materials will work as magnets? How do you know?

(A) any metal

A magnet is a rock or a piece of metal that can pull certain types of metal toward itself.

(B) iron, steel, nickel and cobalt

Because of the way their electrons are arranged, the metals iron, steel, nickel and cobalt make good magnets.

(C) water, air and wood

Most other materials — for example, water, air and wood — have very weak magnetic properties.

(D) any paper

Magnets hold papers on refrigerator doors and they also hold the doors shut.

4 Read the section "What Causes Magnetism?"

Select the paragraph that explains how magnets can be created from other magnets.

(A) People have known for a long time that a certain type of rock, called lodestone, is a natural magnet. When scientists learned why that is, they also learned how to make other metals into magnets.

(B) Magnetism happens when tiny particles called electrons behave in a certain way. All objects in the universe are made up of units called atoms, which, in turn, are made up of electrons and other particles (neutrons and protons). The electrons spin around the atom's nucleus, which contains the other particles. The spinning electrons form tiny magnetic forces. Sometimes many of the electrons in an object spin in the same direction. In these cases, all the tiny magnetic forces from the electrons add up to make the object one big magnet.

(C) It is possible to make a magnet by taking an existing magnet and rubbing another piece of metal with it. The new piece of metal must be rubbed continuously in the same direction, and this will make the electrons in that metal start to spin in the same direction.

(D) Electricity can also create magnets. Electricity is a flow of electrons. As electrons move through a piece of wire they have the same effect as electrons spinning around the nucleus of an atom. This is called an electromagnet.

This article is available at 5 reading levels at https://newsela.com.

What is a compass?

By Alison Ince Rodgers, National Geographic on 01.05.20
Word Count **1,069**
Level **MAX**



A reproduction of a compass from 1607. Photo by: Virginia State Parks staff/Wikimedia.

A compass is a device that indicates direction. It is one of the most important instruments for navigation.

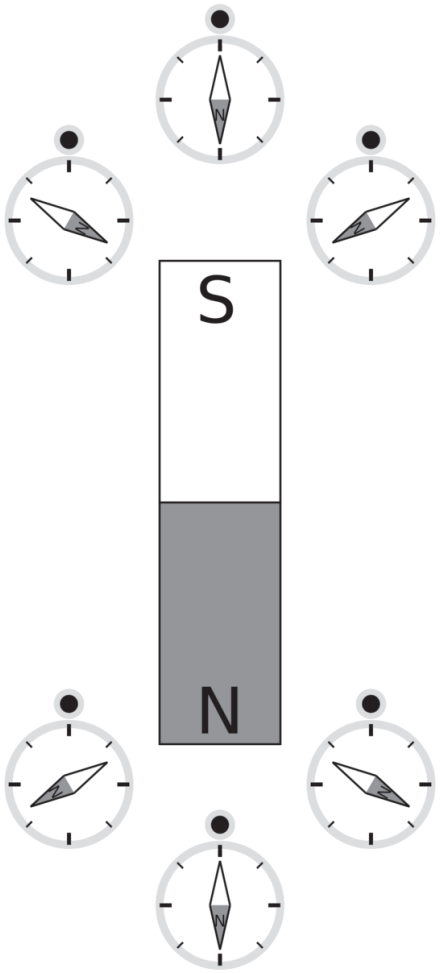
Magnetic compasses are the most well-known type of compass. They have become so popular that the term "compass" almost always refers a magnetic compass. While the design and construction of this type of compass have changed significantly over the centuries, the concept of how it works has remained the same. Magnetic compasses consist of a magnetized needle that is allowed to rotate so it lines up with the Earth's magnetic field. The ends point to what are known as magnetic north and magnetic south.

Scientists and historians don't know when the principles behind magnetic compasses were discovered. Ancient Greeks understood magnetism. As early as 2,000 years ago, Chinese scientists may have known that rubbing an iron bar (such as a needle) with a naturally occurring magnet, called a lodestone, would temporarily magnetize the needle so that it would point north and south.

Very early compasses were made of a magnetized needle attached to a piece of wood or cork that floated freely in a dish of water. As the needle would settle, the marked end would point toward

This article is available at 5 reading levels at https://newsela.com.

magnetic north.



As engineers and scientists learned more about magnetism, the compass needle was mounted and placed in the middle of a card that showed the cardinal directions — north, south, east and west. A spearhead and the letter T, which stood for the Latin name of the North Wind, Tramontana, signified north. This combination evolved into a fleur-de-lis design, which can still be seen today. All 32 points of direction were eventually added to the compass card.

Historians think China may have been the first civilization to develop a magnetic compass that could be used for navigation. Chinese scientists may have developed navigational compasses as early as the 11th or 12th century. Western Europeans soon followed at the end of the 12th century.

In their earliest use, compasses were likely used as backups for when the sun, stars or other landmarks could not be seen. Eventually, as compasses became more reliable and more explorers understood how to read them, the devices became a critical navigational tool.

Adjustments And Adaptations

By the 15th century, explorers realized that the "north" indicated by a compass was not the same as Earth's true geographic north. This discrepancy between magnetic north and true north is called variation (by mariners or pilots) or magnetic declination (by land navigators) and varies depending on location. Variation is not significant when using magnetic compasses near the equator, but closer to the North and South Poles, the difference is much greater and can lead someone many kilometers off-course. Navigators must adjust their compass readings to account for variation.

Other adaptations have been made to magnetic compasses over time, especially for their use in marine navigation. When ships evolved from being made of wood to being made of iron and steel, the magnetism of the ship affected compass readings. This difference is called deviation. Adjustments such as placing soft iron balls (called Kelvin spheres) and bar magnets (called Flinders bars) near the compass helped increase the accuracy of the readings. Deviation must also be taken into account on aircraft using compasses, due to the metal in the construction of an airplane.

Magnetic compasses come in many forms. The most basic are portable compasses for use on casual hikes. Magnetic compasses can have additional features, such as magnifiers for use with maps, a prism or a mirror that allows you to see the landscape as you follow the compass reading, or markings in Braille for the visually impaired. The most complicated compasses are complex devices on ships or planes that can calculate and adjust for motion, variation and deviation.

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Other Types Of Compasses





Some compasses do not use Earth's magnetism to indicate direction. The gyrocompass, invented in the early 20th century, uses a spinning gyroscope to follow Earth's axis of rotation to point to true north. Since magnetic north is not measured, variation is not an issue. Once the gyroscope begins spinning, motion will not disturb it. This type of compass is often used on ships and aircraft.

A solar compass uses the sun as a navigational tool. The most common method is to use a compass card and the angle of the shadow of the sun to indicate direction.

Even without a compass card, there are techniques that use the sun as a compass. One method is to make a shadow stick. A shadow stick is a stick placed upright in the ground. Pebbles placed around the stick, and a piece of string to track the shadow of the sun across the sky, help a navigator determine the directions of east and west.



Another type of solar compass is an old-fashioned analog (not digital) watch. Using the watch's hands and the position of the sun, it is possible to determine north or south. Simply hold the watch parallel to the ground (in your hand) and point the hour hand in the direction of the sun. Find the angle between the hour hand and the 12 o'clock mark. This is the north-south line. In the Southern Hemisphere, north will be the direction closer to the sun. In the Northern Hemisphere, north will be the direction further from the sun.

Receivers from the global positioning system (GPS) have begun to take the place of compasses. A GPS receiver coordinates with satellites orbiting the Earth and monitoring stations on Earth to pinpoint the receiver's location. GPS receivers can plot latitude, longitude and altitude on a map. Unless large objects block signals, readings are usually accurate to within about 15 meters (50 feet).

Despite advancements with GPS, the compass is still a valuable tool. Many airplanes and ships still use highly advanced compasses as navigational instruments. For casual observation — for

This article is available at 5 reading levels at https://newsela.com.

navigators on foot or in a small boat — a pocket compass or a basic compass mounted on a dashboard remains a practical and portable tool.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 If a person got lost, in which situation would a magnetic compass be MOST useful?

(A) lost in a car in the Arctic

(B) lost at sea in an old, tall ship

(C) lost in outer space in a space shuttle

(D) lost underground in a metal tunnel maze

2 Read the paragraph from the article.

In their earliest use, compasses were likely used as backups for when the sun, stars or other landmarks could not be seen. Eventually, as compasses became more reliable and more explorers understood how to read them, the devices became a critical navigational tool.

The word "reliable" has a positive connotation. Which phrase from the paragraph BEST emphasizes that connotation?

(A) used as backups

(B) could not be seen

(C) understood how to read

(D) critical navigational tool

3 An explorer is traveling to Iceland with a lodestone, a needle, and a marked card. The explorer gets lost.

Which is the MOST likely explanation?

(A) The needle had come loose from the card.

(B) The needle did not indicate true north or south.

(C) The needle was not magnetized by the lodestone.

(D) The needle pointed to the north, but the explorer misread it.

4 Read the paragraph from the section “Adjustments And Adaptations.”

By the 15th century, explorers realized that the “north” indicated by a compass was not the same as Earth’s true geographic north. This discrepancy between magnetic north and true north is called variation (by mariners or pilots) or magnetic declination (by land navigators) and varies depending on location. Variation is not significant when using magnetic compasses near the equator, but closer to the North and South Poles, the difference is much greater and can lead someone many kilometers off-course. Navigators must adjust their compass readings to account for variation.

Which phrase from the paragraph BEST represents what the author means by “discrepancy”?

(A) varies depending on location

(B) is not significant

(C) the difference is much greater

(D) to account for variation

This article is available at 5 reading levels at https://newsela.com.

5 If Earth's magnetism were to disappear, which compasses might still function?

1. *gyroscope compass*
2. *lodestone compass*
3. *magnetic compass*
4. *solar clock compass*

(A) 1 and 2

(B) 1 and 4

(C) 2 and 3

(D) 3 and 4

6 How do the images in the article enhance your understanding of the evolution of the compass?

(A) by showing the different types of compasses and their uses

(B) by demonstrating how different compasses indicate direction

(C) by showing examples of different compasses from various times

(D) by demonstrating how a magnetic compass indicates direction

7 Which materials would be BEST for designing an accurate compass for a blind person to use while on a train?

(A) paper maps and prisms

(B) prisms and Braille marks

(C) Braille marks and Flinders bars

(D) Flinders bars and paper maps

8 Who would find the diagram from the introduction [paragraphs 1-7] MOST helpful, and why?

(A) someone who is interested in using a magnetic compass, because this diagram illustrates how a magnetic compass shows direction

(B) someone who is interested in designing their own magnetic compass, because this diagram shows how magnetic compasses are created

(C) someone who is interested in learning about the original design of magnetic compasses, because this diagram demonstrates how the first compass worked

(D) someone who is interested in how Earth’s magnetic fields work, because this image illustrates how magnetic fields indicate direction

This article is available at 5 reading levels at https://newsela.com.

How roller coasters work

By Tom Harris and Cherise Threewitt, How Stuff Works on 05.09.19
Word Count **598**
Level **MAX**



Image 1. A roller coaster in a loop-the-loop. To get through such an impressive loop, the roller coaster's cars need a lot of energy. Photo by: Hauke-Christian Dittrich/Getty Images

If you enjoy studying physics (and who doesn't), there are few more exhilarating classrooms than roller coasters. Roller coasters are driven almost entirely by basic inertial, gravitational and centripetal forces. All these are manipulated in the service of a great ride. Amusement parks keep upping the ante. They are building faster and more complex roller coasters. Still, the fundamental principles at work remain basically the same.

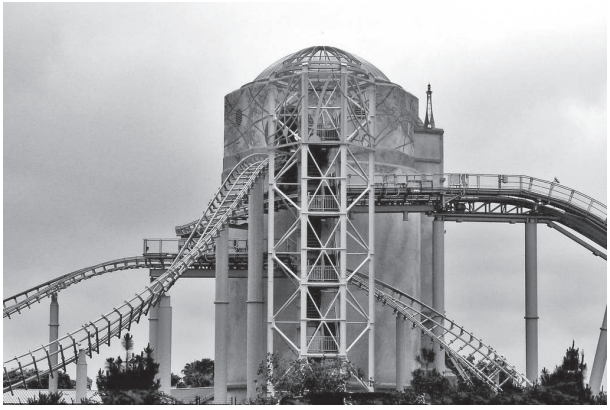
In this article, we'll examine the principles that keep coaster cars flying around on their tracks.

At first glance, a roller coaster is something like a passenger train. It consists of a series of connected cars that move on tracks. But unlike a passenger train, a roller coaster has no engine. It has no power source of its own. For most of the ride, the train is moved by gravity and momentum. To build up this momentum, the train has to get to the top of the first hill or get a powerful launch.

The purpose of the coaster's initial ascent is to build up a sort of reservoir of potential energy. The concept of potential energy is often referred to as energy of position. This concept is very simple: As the coaster gets higher in the air, gravity can pull it down a greater distance. You experience

This article is available at 5 reading levels at https://newsela.com.

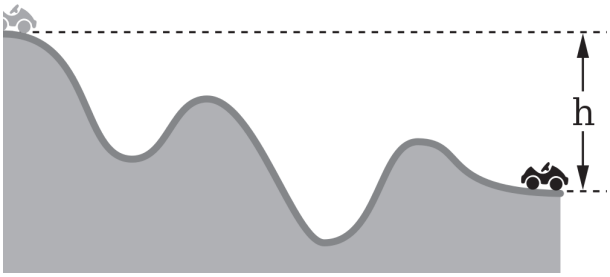
this phenomenon all the time. Think about driving your car, riding your bike or pulling your sled to the top of a big hill. The potential energy you build going up the hill can be released as kinetic energy — the energy of motion that takes you down the hill.



Once you start cruising down that first hill, gravity takes over. Then, all the built-up potential energy changes to kinetic energy. Gravity applies a constant downward force on the cars. The coaster tracks serve to channel this force — they control the way the coaster cars fall. If the tracks slope down, gravity pulls the front of the car toward the ground, so it accelerates. If the tracks tilt up, gravity applies a downward force on the back of the coaster, so it decelerates.

An object in motion tends to stay in motion. This is Newton's first law of motion. Because of this, the coaster car will maintain a forward velocity even when it is moving up the track, opposite the force of gravity. When the coaster ascends one of the smaller hills that follows the initial lift hill, its kinetic energy changes back to potential energy. In this way, the course of the track is constantly converting energy from kinetic to potential and back again.

This fluctuation in acceleration is what makes roller coasters so much fun. In most roller coasters, the hills decrease in height as the train moves along the track. This is necessary because the total energy reservoir built up in the lift hill is gradually lost to friction between the train and the track, as well as between the train and the air. When the train coasts to the end of the track, the energy reservoir is almost completely empty. At this point, the train either comes to a stop or is sent up the lift hill for another ride.



At its most basic level, this is all a roller coaster is — a machine that uses gravity and inertia to send a train along a winding track.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 At which point does the roller coaster have the most potential energy?

(A) at the bottom of a hill, before going up the hill

(B) at the beginning of the track, which is flat

(C) at the top of the hill

(D) at the end of the track, which is flat

2 Which sentence from the article BEST introduces to the reader how roller coasters work?

(A) If you enjoy studying physics (and who doesn't), there are few more exhilarating classrooms than roller coasters.

(B) Roller coasters are driven almost entirely by basic inertial, gravitational and centripetal forces.

(C) They are building faster and more complex roller coasters.

(D) In this article, we'll examine the principles that keep coaster cars flying around on their tracks.

3 At which point does the roller coaster have the most kinetic energy?

(A) at the bottom of a hill, before going up the hill

(B) at the bottom of a hill, after coming down the hill

(C) at the beginning of the track, which is flat

(D) at the end of the track, which is flat

4 What is MOST LIKELY the reason the author included a description of Newton's first law of motion?

(A) to demonstrate a problem that can interfere with the roller coaster moving smoothly on the hills

(B) to show a type of energy that forces a car that is not moving at the top to start going down

(C) to describe the reason why a roller coaster car begins to slow down as it ascends up a hill

(D) to explain why the roller coaster car keeps moving up the hill despite gravity pulling it down

5 At which point does the roller coaster have very little kinetic energy and very little potential energy?

(A) at the bottom of a hill, before going up the hill

(B) at the bottom of a hill, after coming down the hill

(C) at the top of the hill

(D) at the end of the track, which is flat

6 Read the following sentence from the article.

This is necessary because the total energy reservoir built up in the lift hill is gradually lost to friction between the train and the track, as well as between the train and the air.

Which of the following words, if it replaced the word "gradually" in the sentence above, would CHANGE the meaning of the sentence?

(A) steadily

(B) slowly

(C) abruptly

(D) progressively

This article is available at 5 reading levels at https://newsela.com.

7 What happens as s a roller coaster car moves down a hill?

(A) The car’s potential energy turns into kinetic energy.

(B) The car's momentum turns into gravity.

(C) The car’s kinetic energy turns into potential energy.

(D) The car's gravity turns into inertia.

8 Read the following selection from the article. Then, fill in the blank.

The purpose of the coaster's initial ascent is to build up a sort of reservoir of potential energy. The concept of potential energy is often referred to as energy of position.

The word "reservoir" in the selection above tells the reader that ____.

(A) the initial ascent of the coaster has used up all of the potential energy

(B) the initial ascent of the coaster is not as important as the other ascents on the ride

(C) the initial ascent of the coaster has created a supply of potential energy

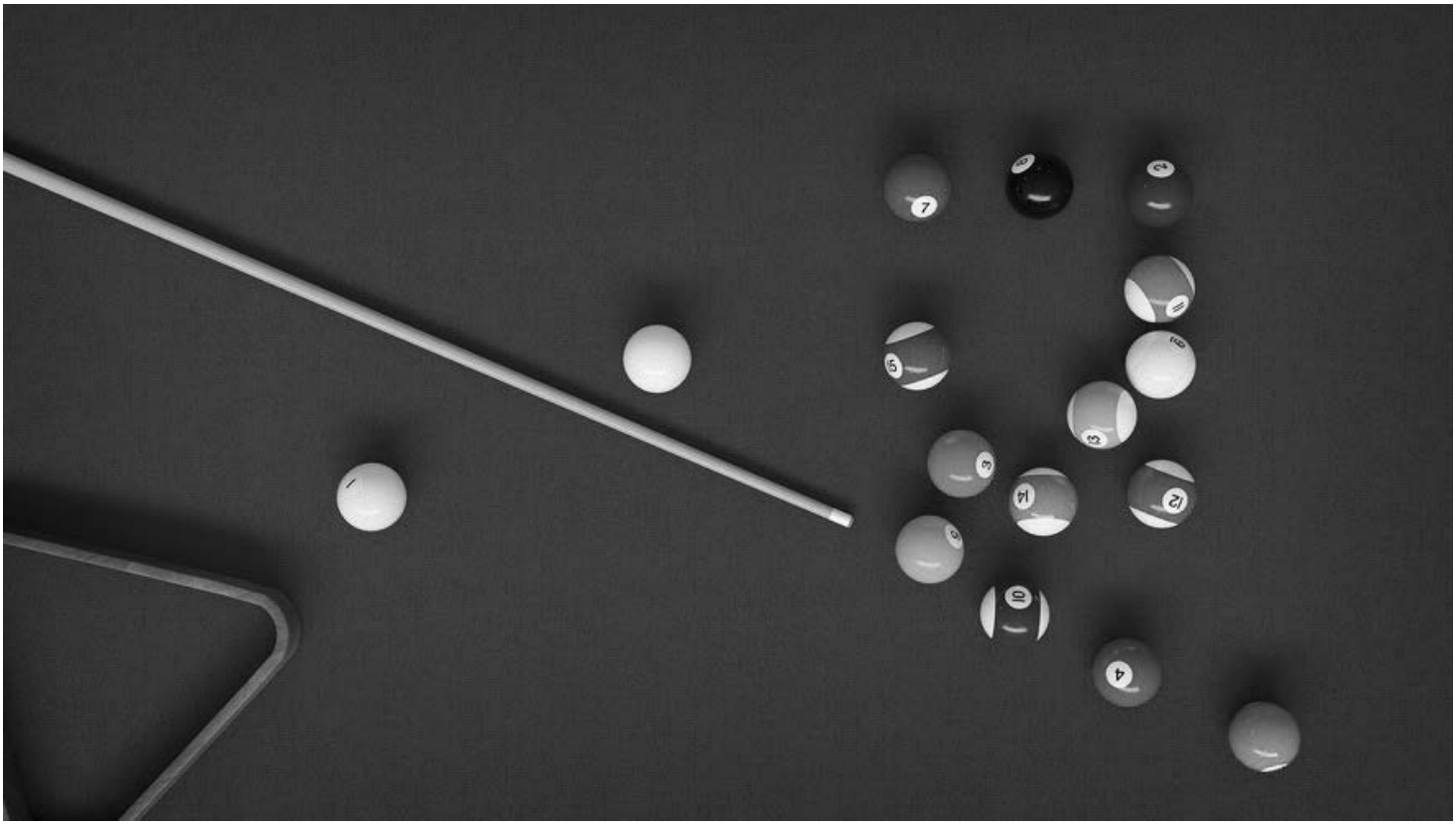
(D) the initial ascent of the coaster works best when it is near a large body of water

This article is available at 5 reading levels at https://newsela.com.

An explanation of the two types of energy: potential and kinetic

By Gale, Cengage Learning on 12.15.19

Word Count **543**
Level **MAX**



Billiards, often called pool, is a good example of how energy can be transferred between objects. When a ball is still, it has potential energy. When a ball moves, it has kinetic energy. When one ball hits another, kinetic energy is transferred to the second ball. Photo by PIRO4D/Pixabay

Energy is involved in nearly everything we do. It is defined as the ability to do work, to set an object in motion. There are several different kinds of energy. Kinetic energy is the energy an object has when it is in motion. Vibration, forward motion, turning and spinning are all examples of kinetic energy. Kinetic energy is directly proportional to the mass of an object. If two objects move at the same speed, and one has twice the mass of the other, the object with twice the mass will have twice the kinetic energy.

Potential energy is the energy an object has because of its position; it is energy waiting to be released. For example, a weight suspended above the ground has potential energy because it can be set in motion by gravity. Compressed or extended springs also have potential energy.

Thermal energy is the kinetic energy of atoms vibrating within matter. The faster the atoms move, the hotter the object becomes. Electrical energy is the kinetic energy resulting from the motion of

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electrons within any object that conducts electricity. Chemical energy is the potential energy stored in molecules. Thermal, electrical and chemical energy are all forms of kinetic or potential energy.

What Laws Control Energy?

One of the most fundamental laws of physics is that energy cannot be created or destroyed, only transformed from one form into another. For example, if a suspended weight falls, its potential energy becomes kinetic energy. When a car burns fuel, the fuel's chemical energy is transformed into thermal energy, which in turn, is transformed into kinetic energy by the engine to make the car move.

Energy can also be transferred from one object to another. Think about a game of pool. When a moving ball hits a still one, the moving ball stops or slows down, and the still one begins to move. The majority of the first ball's kinetic energy has been transferred to the second ball, while a small amount has been converted to thermal energy by the collision. If you could measure the temperature on the surface of each ball, you would find there was a slight rise in temperature at the point of contact. The total amount of energy involved — kinetic and thermal — remains the same. No energy was created or destroyed by the collision.

Who Wrote These Laws?

The person who laid the groundwork for the study of energy was English mathematician and physicist Isaac Newton (1642–1727). Newton developed the laws of motion, which describe how objects are acted upon by forces. Newton's ideas formed the basis for much of physics, in fact. He studied at Cambridge University, where he excelled in mathematics and developed the field of calculus while he was still a student. Newton later became a professor at Cambridge, where he built the first reflecting telescope and studied optics.

He published his most important work in 1687, the Principia Mathematica. This book describes Newton's three laws of motion and the law of gravitation, which are a major part of the foundation of modern science. Newton also had an interesting life. He became Master of Mint in England, where he supervised the making of money, and later became the first scientist to be knighted.

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Quiz

1 How does reducing the mass of a moving object by half (1/2) change its kinetic energy?

(A) kinetic energy will be half of what it was before

(B) kinetic energy will be double of what it was before

(C) there is no relationship between mass and kinetic energy

(D) decreasing the mass will make the object go faster, increasing its kinetic energy

2 Which piece of evidence explains the cause of Newton's effect on physics?

(A) The person who laid the groundwork for the study of energy was English mathematician and physicist Isaac Newton (1642–1727).

(B) Newton developed the laws of motion, which describe how objects are acted upon by forces.

(C) Newton later became a professor at Cambridge, where he built the first reflecting telescope and studied optics.

(D) He published his most important work in 1687, the "Principia Mathematica."

3 Why is heat or thermal energy considered a form of kinetic energy?

(A) Heat or thermal energy is a measure of particle vibration, vibration is a type of motion.

(B) Heat or thermal energy increases the speed at which an object moves from place to place.

(C) Heat or thermal energy must always be stored in great quantities for an object to move.

(D) Heat or thermal energy is a form of stored energy.

4 Read the following selection from the introduction [paragraphs 1-3].

> *Potential energy is the energy an object has because of its position; it is energy waiting to be released.*

What conclusion is BEST supported by the selection above?

(A) All still objects have potential energy.

(B) Some objects have more energy than others.

(C) Most still objects do not have potential energy.

(D) Potential energy makes objects move.

5 Which choices are examples of an energy transformation?

1. *baking a cake*
2. *a tennis racket hitting a ball*
3. *a car speeding off from a stop sign*

(A) 1 and 2

(B) 1 and 3

(C) 2 and 3

(D) 1, 2 and 3

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6 How are the sections organized to help to develop understanding?

(A) by description; to help to introduce and give examples of several types of energies

(B) by scientific questions; to help readers to understand what they should be asking themselves

(C) by cause and effect; to demonstrate how different types of energies affect each other

(D) by guiding questions; to help readers to understand major concepts in energy

7 Why is Sir Isaac Newton an important person in the field of physics?

(A) Sir Isaac Newton was the first person to calculate the shape and size of the solar system.

(B) Sir Isaac Newton developed many of the laws of physics we still use today.

(C) Sir Isaac Newton developed a mathematical formula to calculate the mass of any object.

(D) Sir Isaac Newton's laws of chemistry and biology changed the way we study science.

8 What is one reason why the author includes the information about what energies a car uses?

(A) to explain how energy makes a car move

(B) to provide an example of chemical energy

(C) to provide an example of how energy can change

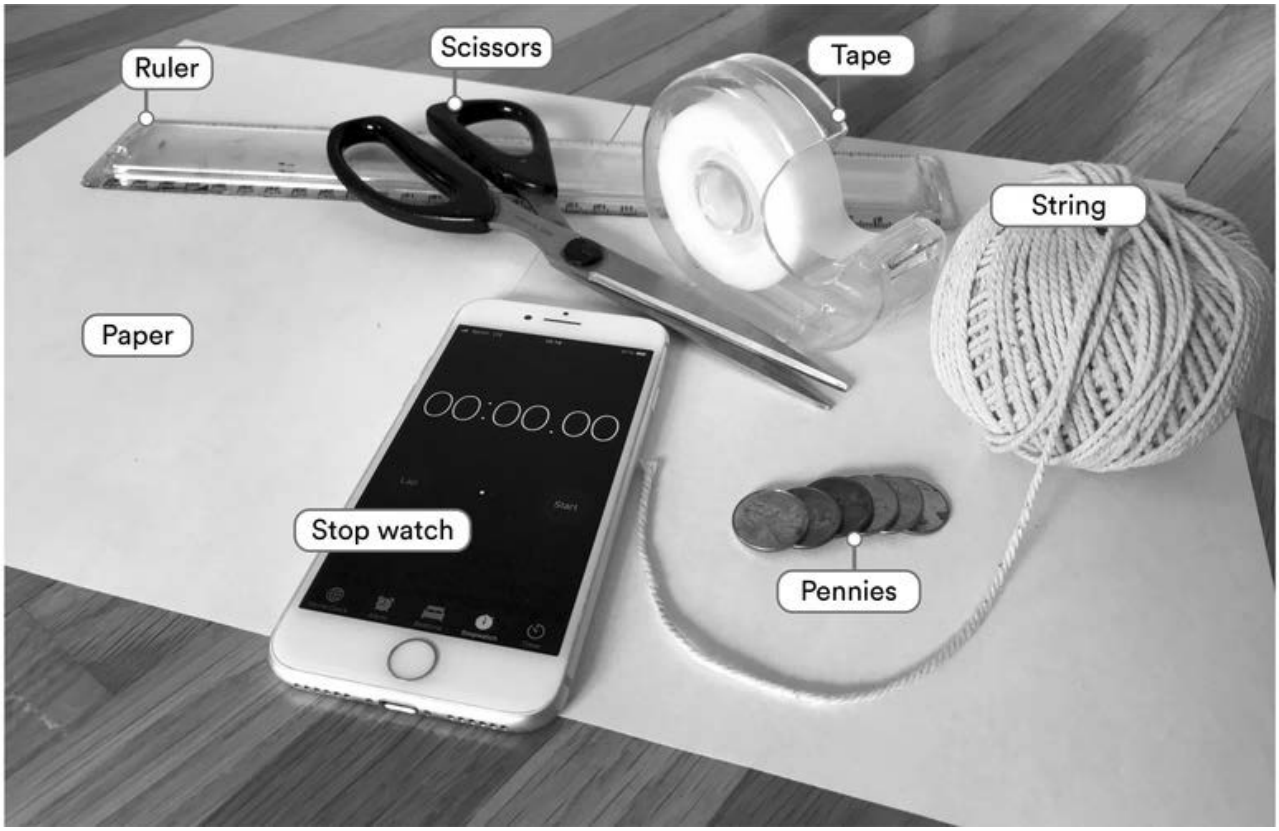
(D) to explain what thermal energy is

This article is available at 5 reading levels at https://newsela.com.

Experiment: Swinging with a pendulum

By Scientific American/Science Buddies on 03.28.20

Word Count **666**
Level **MAX**



Use these items to learn more about how the motion of a pendulum is affected by gravity. Newsela staff

The back-and-forth motion of a playground swing is an example of a pendulum.

But pendulums can do more than provide fun at recess and help tell the time. Among other scientific applications, they can show that the Earth is huge! This is because the swinging motion of a pendulum is due to the force of gravity generated by the Earth's size. Other factors, including a pendulum's length, can also affect its motion. Do this activity to learn more.

Materials

Two identical chairs

String or yarn

Ten metal washers of identical size or six pennies

Strong tape

Measuring stick

This article is available at 5 reading levels at https://newsela.com.

Scissors

Stopwatch accurate to 0.1 second

An assistant

Preparation

1. Place the two chairs back-to-back. Space them about 1 meter (about 39 inches) apart. Lay the measuring stick on the backs of the two chairs, centered on the back of each.
2. Cut one piece of string to a length of 70 centimeters (about 28 inches). Cut a second piece of string to a length of 35 centimeters (about 14 inches). Tie one end of both strings to the measuring stick, toward the middle of the stick. Space the strings about 20 to 30 centimeters (about 8 to 12 inches) apart on the measuring stick.
3. Tie five metal washers to the free end of each string. Alternatively, if you are using pennies and tape, securely tape three pennies to the free end of each string. Tip: If the measuring stick does not seem to stably sit on the backs of the chairs, you can try to tape the ends of the stick to the chairs.

Procedure

1. Pull the strings tight (by holding on to the washers or pennies at the ends) and position the strings at the same angle from the measuring stick.
2. Have an assistant ready with a stopwatch. Drop the longer pendulum and, at the same time, have the assistant start the stopwatch. Then have the assistant stop the stopwatch when the pendulum returns back to its original position. If the pendulum hit anything as it swung, such as the wall, readjust your setup and try timing the pendulum again. How long does it take the longer pendulum to swing back to its original position? This is the period of the pendulum.
3. Again, pull the strings tight and hold them at the same angle from the meter stick.
4. Have the assistant reset the stopwatch. Drop the shorter pendulum and, once more, have the assistant time the period of the pendulum. How long does it take the shorter pendulum to swing back to its original position?
5. Time the periods of the shorter and longer pendulums a few more times. Are the periods consistent for each pendulum, or do they vary a lot?
6. Is the period of the longer pendulum longer or shorter than the period of the shorter pendulum? How different are the two periods? Is this what you expected?

Extra: Instead of timing the period of the swing, you could time how long each pendulum swings before it comes to rest. What is the total time that each pendulum swings?

Extra: Instead of changing the length of the string, change the number of weights attached to the string or the initial angle of the string. Do mass or initial angle affect the period of the pendulum? Do they affect the pendulum's total time?

Observations And Results

This article is available at 5 reading levels at https://newsela.com.

Did the longer pendulum have a longer period than the shorter pendulum? Was the longer pendulum's period not quite twice as long as the shorter pendulum's period?

A pendulum that is twice as long as another pendulum does not simply have a period that is also twice as long. The exact periods of your longer and shorter pendulums might be slightly less than 1.7 seconds and 1.2 seconds, respectively, because of friction and because their lengths were less than 70 centimeters (about 28 inches) and 35 centimeters (about 14 inches) because of strings being used to tie to attachments.

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Quiz

1) Instead of timing the period of the swing, you could time how long each pendulum swings before it comes to rest. What is the total time that each pendulum swings?

2) Instead of changing the length of the string, change the number of weights attached to the string or the initial angle of the string. Do mass or initial angle affect the period of the pendulum? Do they affect the pendulum's total time?

3) Did the longer pendulum have a longer period than the shorter pendulum? Was the longer pendulum's period not quite twice as long as the shorter pendulum's period?

This article is available at 5 reading levels at https://newsela.com.

A history of rockets

By NASA.gov on 11.16.16
Word Count **2,227**
Level **MAX**



TOP: A space shuttle blasts off piggybacking on a rocket. Pixabay. Graphics courtesy of NASA.

Today's rockets are remarkable collections of human ingenuity that have their roots in the science and technology of the past. They are natural outgrowths of literally thousands of years of experimentation and research on rockets and rocket propulsion.

One of the first devices to successfully employ the principles essential to rocket flight was a wooden bird. The writings of Aulus Gellius, a Roman, tell a story of a Greek named Archytas who lived in the city of Tarentum, now a part of southern Italy. Somewhere around the year 400 B.C., Archytas mystified and amused the citizens of Tarentum by flying a pigeon made of wood. Escaping steam propelled the bird suspended on wires. The pigeon used the action-reaction principle, which was not stated as a scientific law until the 17th century.

About 300 years after the pigeon, another Greek, Hero of Alexandria, invented a similar rocket-like device called an aeolipile. It, too, used steam as a propulsive gas.

Hero mounted a sphere on top of a water kettle. A fire below the kettle turned the water into steam, and the gas traveled through pipes to the sphere. Two L-shaped tubes on opposite sides of

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the sphere allowed the gas to escape, and in doing so gave a thrust to the sphere that caused it to rotate.

Just when the first true rockets appeared is unclear. Stories of early rocket-like devices appear sporadically through the historical records of various cultures. Perhaps the first true rockets were accidents. In the first century A.D., the Chinese reportedly had a simple form of gunpowder made from saltpeter, sulfur and charcoal dust. To create explosions during religious festivals, they filled bamboo tubes with a mixture and tossed them into fires. Perhaps some of those tubes failed to explode and instead skittered out of the fires, propelled by the gases and sparks produced by the burning gunpowder.

The Chinese began experimenting with the gunpowder-filled tubes. At some point, they attached bamboo tubes to arrows and launched them with bows. Soon they discovered that these gunpowder tubes could launch themselves just by the power produced from the escaping gas. The true rocket was born.

The date reporting the first use of true rockets was in 1232. At this time, the Chinese and the Mongols were at war with each other. During the battle of Kai-Keng, the Chinese repelled the Mongol invaders by a barrage of "arrows of flying fire." These fire-arrows were a simple form of a solid-propellant rocket. A tube, capped at one end, contained gunpowder. The other end was left open and the tube was attached to a long stick. When the powder was ignited, the rapid burning of the powder produced fire, smoke and gas that escaped out the open end and produced a thrust. The stick acted as a simple guidance system that kept the rocket headed in one general direction as it flew through the air. It is not clear how effective these arrows of flying fire were as weapons of destruction, but their psychological effects on the Mongols must have been formidable.

Following the battle of Kai-Keng, the Mongols produced rockets of their own and may have been responsible for the spread of rockets to Europe. All through the 13th to the 15th centuries there were reports of many rocket experiments. In England, a monk named Roger Bacon worked on improved forms of gunpowder that greatly increased the range of rockets. In France, Jean Froissart found that more accurate flights could be achieved by launching rockets through tubes. Froissart's idea was the forerunner of the modern bazooka. Joanes de Fontana of Italy designed a surface-running, rocket-powered torpedo for setting enemy ships on fire.

By the 16th century rockets fell into a time of disuse as weapons of war, though they were still used for fireworks displays, and a German fireworks maker, Johann Schmidlap, invented the "step rocket," a multi-staged vehicle for lifting fireworks to higher altitudes. A large sky rocket (first stage) carried a smaller sky rocket (second stage). When the large rocket burned out, the smaller one continued to a higher altitude before showering the sky with glowing cinders. Schmidlap's idea is basic to all rockets today that go into outer space.

Nearly all uses of rockets up to this time were for warfare or fireworks, but there is an interesting old Chinese legend that reported the use of rockets as a means of transportation. With the help of many assistants, a lesser-known Chinese official named Wan-Hu assembled a rocket-powered flying chair. Attached to the chair were two large kites, and fixed to the kites were 47 fire-arrow rockets.

On the day of the flight, Wan-Hu sat himself on the chair and gave the command to light the rockets. Forty-seven rocket assistants, each armed with torches, rushed forward to light the fuses.

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In a moment, there was a tremendous roar accompanied by billowing clouds of smoke. When the smoke cleared, Wan-Hu and his flying chair were gone. No one knows for sure what happened to Wan-Hu, but it is probable that if the event really did take place, Wan-Hu and his chair were blown to pieces. Fire-arrows were as apt to explode as to fly.

Rocketry Becomes A Science

During the latter part of the 17th century, the scientific foundations for modern rocketry were laid by the great English scientist Sir Isaac Newton (1642-1727). Newton organized his understanding of physical motion into three scientific laws. The laws explain how rockets work and why they are able to work in the vacuum of outer space. Newton's laws soon began to have a practical impact on the design of rockets. About 1720, a Dutch professor, Willem Gravesande, built model cars propelled by jets of steam. Rocket experimenters in Germany and Russia began working with rockets with a mass of more than 45 kilograms. Some of these rockets were so powerful that their escaping exhaust flames bored deep holes in the ground even before liftoff.

During the end of the 18th century and early into the 19th, rockets experienced a brief revival as a weapon of war. The success of Indian rocket barrages against the British in 1792 and again in 1799 caught the interest of an artillery expert, Colonel William Congreve. Congreve set out to design rockets for use by the British military.

The Congreve rockets were highly successful in battle. Used by British ships to pound Fort McHenry in the War of 1812, they inspired Francis Scott Key to write "the rockets' red glare," words in his poem that later became "The Star-Spangled Banner."

Even with Congreve's work, the accuracy of rockets still had not improved much from the early days. The devastating nature of war rockets was not their accuracy or power, but their numbers. During a typical siege, thousands of them might be fired at the enemy. All over the world, rocket researchers experimented with ways to improve accuracy. An Englishman, William Hale, developed a technique called spin stabilization. In this method, the escaping exhaust gases struck small vanes at the bottom of the rocket, causing it to spin much as a bullet does in flight. Variations of the principle are still used today.

Rockets continued to be used with success in battles all over the European continent. However, in a war with Prussia, the Austrian rocket brigades met their match against newly designed artillery pieces. Breech-loading cannons with rifled barrels and exploding warheads were far more effective weapons of war than the best rockets. Once again, rockets were relegated to peacetime uses.

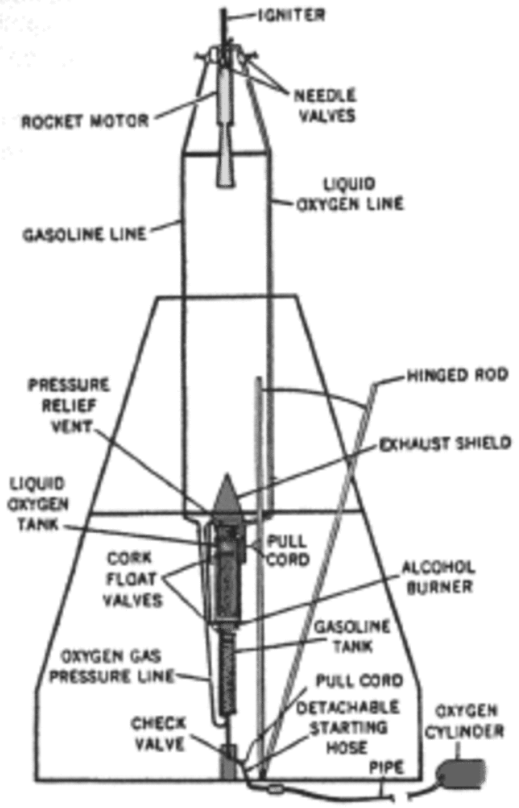
Modern Rocketry Begins

In 1898, a Russian schoolteacher, Konstantin Tsiolkovsky (1857-1935), proposed the idea of space exploration by rocket. In a report he published in 1903, Tsiolkovsky suggested the use of liquid propellants for rockets in order to achieve greater range. Tsiolkovsky stated that the speed and range of a rocket were limited only by the exhaust velocity of escaping gases. For his ideas, careful research and great vision, Tsiolkovsky has been called the father of modern astronautics. Early in the 20th century, an American, Robert H. Goddard (1882-1945), conducted practical experiments in rocketry. He had become interested in a way of achieving higher altitudes than were possible for lighter-than-air balloons. He published a pamphlet in 1919 titled "A Method of Reaching Extreme

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Altitudes." It was a mathematical analysis of what is today called the meteorological sounding rocket.

Goddard's earliest experiments were with solid-propellant rockets. In 1915, he began to try various types of solid fuels and to measure the exhaust velocities of the burning gases. While working on solid-propellant rockets, Goddard became convinced that a rocket could be propelled better by liquid fuel. No one had ever built a successful liquid-propellant rocket before. It was a much more difficult task than building solid-propellant rockets. Fuel and oxygen tanks, turbines, and combustion chambers would be needed. In spite of the difficulties, Goddard achieved the first successful flight with a liquid-propellant rocket on March 16, 1926. Fueled by liquid oxygen and gasoline, the rocket flew for only two-and- a-half seconds, climbed 12.5 meters, and landed 56 meters away in a cabbage patch. By today's standards, the flight was unimpressive, but like the first powered airplane flight by the Wright brothers in 1903, Goddard's gasoline rocket was the forerunner of a whole new era in rocket flight.



Dr. Goddard's 1926 Rocket

Goddard's experiments in liquid-propellant rockets continued for many years. His rockets became bigger and flew higher. He developed a gyroscope system for flight control and a payload compartment for scientific instruments. Parachute recovery systems were employed to return rockets and instruments safely. Goddard, for his achievements, has been called the father of modern rocketry.

A third great space pioneer, Hermann Oberth, who was born on June 25, 1894, in Hermannstadt (Transylvania) and died on December 28, 1989, in Nuremberg, Germany, published a book in 1923 about rocket travel into outer space. His writings were important. Because of them, many small rocket societies sprang up around the world. In Germany, the formation of one such society, the Verein fur Raumschiffahrt (Society for Space Travel), led to the development of the V-2 rocket, which was used against London during World War II. In 1937, German engineers and scientists, including Oberth, assembled in Peenemunde on the shores of the Baltic Sea. There the most advanced rocket of its time would be built and flown under the directorship of Wernher von Braun.

The V-2 rocket (in Germany called the A-4) was small by comparison to today's rockets. It achieved its great thrust by burning a mixture of liquid oxygen and alcohol at a rate of about 1 ton every 7 seconds. Once launched, the V-2 was a formidable weapon that could devastate whole city blocks.

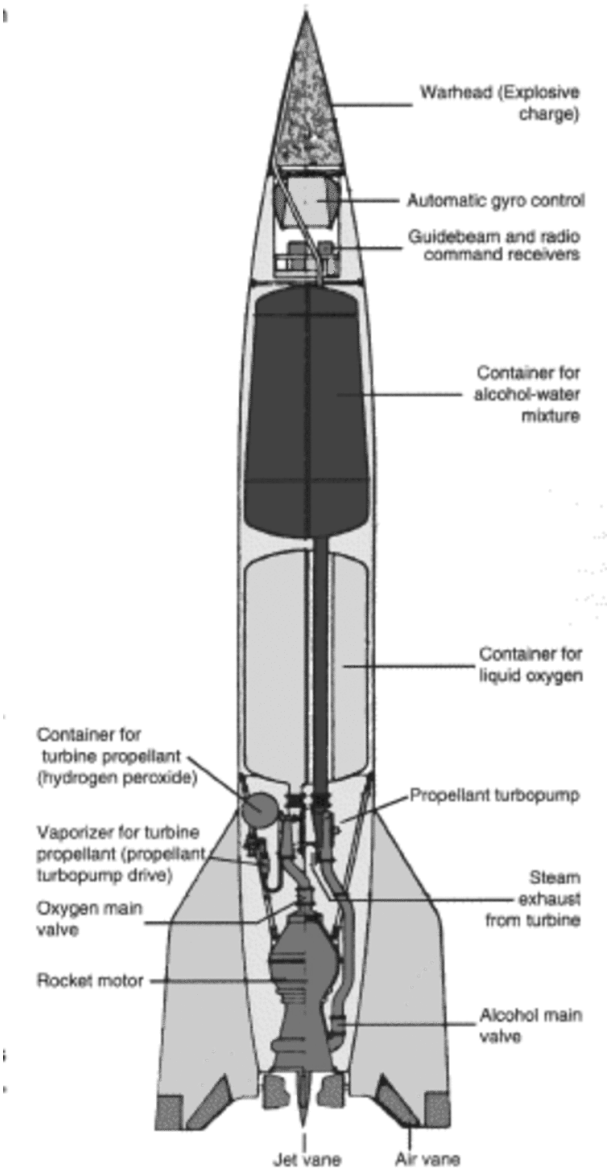
Fortunately for London and the Allied forces, the V-2 came too late in the war to change its outcome. Nevertheless, by war's end, German rocket scientists and engineers had already laid plans for advanced missiles capable of spanning the Atlantic Ocean and landing in the United

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States. These missiles would have had winged upper stages but very small payload capacities.

With the fall of Germany, many unused V-2 rockets and components were captured by the Allies. Many German rocket scientists came to the United States. Others went to the Soviet Union. The German scientists, including von Braun, were amazed at the progress Goddard had made.

Both the United States and the Soviet Union realized the potential of rocketry as a military weapon and began a variety of experimental programs. At first, the United States began a program with high-altitude atmospheric sounding rockets, one of Goddard's early ideas. Later, a variety of medium- and long-range intercontinental ballistic missiles were developed. These became the starting point of the U.S. space program. Missiles such as the Redstone, Atlas and Titan would eventually launch astronauts into space.



German V-2 (A-4) Missile

On October 4, 1957, the world was stunned by the news of an Earth-orbiting artificial satellite launched by the Soviet Union. Called Sputnik I, the satellite was the first successful entry in a race for space between the Soviet Union and United States. Less than a month later, the Soviets followed with the launch of a satellite carrying a dog named Laika on board. Laika survived in space for seven days before being put to sleep before the oxygen supply ran out. A few months after the first Sputnik, the United States followed the Soviet Union with a satellite of its own. Explorer I was launched by the U.S. Army on January 31, 1958. In October of that year, the United States formally organized its space program by creating the National Aeronautics and Space Administration (NASA). NASA became a civilian agency with the goal of peaceful exploration of space for the benefit of all humankind.

Soon, many people and machines were being launched into space. Astronauts orbited Earth and landed on the moon. Robot spacecraft traveled to the planets. Space was suddenly opened up to exploration and commercial exploitation. Satellites enabled scientists to investigate our world, forecast the weather and communicate instantaneously around the globe. As the demand for more and larger payloads increased, a wide array of powerful and versatile rockets had to be built.

Since the earliest days of discovery and experimentation, rockets have evolved from simple gunpowder devices into giant vehicles capable of traveling into outer space. Rockets have opened the universe to direct exploration by humankind.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which of the following options BEST describes the structure of the article?

(A) The article explains the diverse range of applications for modern rocketry.

(B) The article describes how the discovery of rocket technology has solved problems.

(C) The article chronologically describes advancements in rocket technology.

(D) The article presents and supports an argument in favor of continued rocket research.

2 Read the last two paragraphs of the article. Why does the author choose to conclude the article with these paragraphs?

(A) to emphasize the impact of rocket advancements

(B) to summarize the importance of ancient rockets

(C) to convince the reader to research more about rockets

(D) to predict how rockets will be used in the future

3 Who would find the diagrams MOST helpful?

(A) someone who wanted to build a rocket that can fly into space

(B) someone who wanted to understand early rocket design

(C) someone who wanted to know how each rocket part functioned

(D) someone who wanted to improve modern rocket technology

4 Which of the following topics is emphasized in the article, but not in the diagrams?

(A) the use of liquid oxygen to power rockets

(B) the design of solid-propellant rockets

(C) the burning of alcohol to help fuel rockets

(D) the placement of the motor on the rocket

This article is available at 5 reading levels at https://newsela.com.

How does gravity pull things down to Earth?

By Monica Grady, The Conversation on 01.16.20
Word Count **790**
Level **MAX**



Image 1. Everything in the universe has its own gravitational pull. When you throw an apple into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the apple is also pulling on the Earth. Image by: Westend61/Getty Images

Gravity is a force, which means that it pulls on things. But the Earth isn't the only thing which has gravity. In fact, everything in the universe, big or little, has its own pull because of gravity – even you.

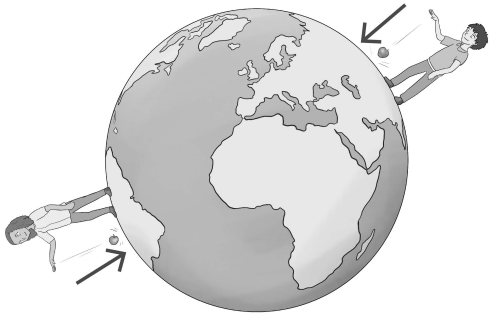
Isaac Newton was one of the first scientists to figure out the rules of how gravity behaves. The story goes, he was sitting under an apple tree when one of the fruits fell off. As he saw the apple fall down to the ground, he started to wonder why it didn't go up to the sky instead.

After lots of experiments, and some very clever thinking, he worked out that the force of gravity depends on how heavy objects are, and that the pull of gravity between objects gets smaller the farther apart they are. To see how gravity works in our universe, we're going to take a journey, with a few stops along the way.

First off, we'll go to the park and play a game of football. When you kick the football into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the football is also pulling on the Earth. The thing is, the Earth is very heavy – much heavier than

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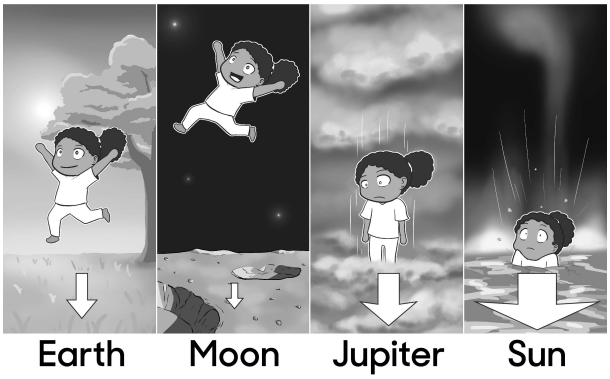
the football – so it's unaffected by the pull of the football, while the football itself is pulled back down to Earth.



Our next stop is the moon, and as we journey up into space, there's a good chance you'll see the sun. Now, the sun is much, much bigger than the Earth, which means its pull is very powerful indeed.

You might be wondering why the Earth (and all the other planets) don't just fall into the sun, the same way the football falls to Earth. The answer is that the planets are all moving, and the balance between the force of gravity and the speed of their movement (which comes from when they were first made, about 4.5 billion years ago) keeps them circling round the sun.

When we arrive on the moon, you'll see that the pull of gravity is not the same everywhere. It is related to how heavy – or how massive – an object is. If you jump on the moon, you'll be able to go much higher than you can on Earth. This is because the Earth is bigger than the moon, so the force between you and the Earth – which is what we call weight – is bigger than the force between you and the moon. On the moon, you seem to weigh less than on Earth, so you can jump higher.



Our final stop is the seaside. Sitting on the beach, you can see the sea gradually getting closer and closer to you – this is the tide coming in. After some time, the sea seems to get farther away – now, the tide is going out. But the sea is not actually moving in and out – it is moving up and down. As the sea level rises, the water gets closer to you, because the beach you are sitting on slopes upwards away from the sea. And as the sea level drops down, the water gets farther away from you.

This is also an effect of gravity, and it happens because the moon is close to the Earth. Unlike the football, the moon is heavy enough to have an effect – just a little one, because the Earth is still much heavier – but it's enough for us to notice when we watch the tides. As the water level rises, it is being pulled toward the moon, and the tide comes in. Then the tide goes out, and the water level drops, as the moon rotates around the Earth.

An interesting question is why we don't have enormous tides caused by the sun pulling on the Earth. We know that the sun is much bigger than the moon – so surely it ought to be able to pull water toward it? Actually, it does – but much less than the moon. This is because although the sun is much bigger than the moon, it is much, much farther away – and the pull of gravity gets weaker the bigger the distance between objects.

So, next time you're kicking a football around in the park, you'll know how gravity is bringing the football back down to Earth.

This article is available at 5 reading levels at https://newsela.com.

Time travel may be possible for certain tiny particles, but probably not

By Scientific American, adapted by Newsela staff on 10.14.14
Word Count **1,462**
Level **1000L**



Visitors explore an imaginary time machine, part of the Philadelphia International Festival of the Arts, at the Kimmel Center for the Performing Arts, March 28, 2013, in Philadelphia. AP Photo/Matt Rourke

On June 28, 2009, the world-famous physicist Stephen Hawking threw a party, complete with balloons, appetizers and champagne. Everyone was invited but no one showed up. Hawking had expected that, because he only sent out invitations after his party had ended. It was, he said, "a welcome reception for future time travelers." It was a joke, but it was also an experiment to prove his belief that travel into the past is impossible.

But Hawking may be wrong. Recent experiments offer some support for time travel's possibility — at least in the world of math. The new study cuts to the core of our understanding of the universe. Proving that time travel is possible would have change classical physics as well as allow for super-fast types of computing that rely on quantum physics, also called quantum mechanics.

Briefly, classical physics deals with the big things, like the Sun and Moon. Quantum mechanics tells us that the things described in classical physics are affected by things even smaller than atoms. For instance, a ray of light is actually made up of tiny packets of energy.

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Bending Space And Time

Some think time travel is possible because physics says so. It should be possible based on Einstein's theory of general relativity. His famous theory describes gravity as the bending of space and time, which are one thing called "spacetime."

To understand that, imagine you and a friend stretch a blanket out between the two of you. That blanket is "spacetime." Space and time are part of the same fabric. Then someone drops a marble onto the blanket and it sinks a bit. The marble is like a planet, or anything with mass.

The mass of planets affects and bends both space and time, with big effects for time. Events that happen at the same time for one observer could happen at different times for another.

So, what does this mean for time travel? Instead of the marble bending spacetime, imagine a powerful gravitational field. One example would be a spinning black hole. It could make spacetime bend back on itself, creating a "closed timelike curve," or CTC. People could use this loop, or tube, to travel back in time.

Subatomic Time Travel?

Hawking and many other physicists don't like the idea of CTCs. Anything traveling through one would create paradoxes. Even if you can go back in time, how can you come back to the future and have it be the same?

Think about science fiction movies. When someone travels back in time their actions change the future, and may even prevent themselves from being born. Cause and effect fall apart.

In 1991, physicist David Deutsch said he knew how to fix paradoxes caused by CTCs. He said the answer was at the tiniest quantum level. The key was fundamental particles, like quarks which are inside protons. Physicists believe fundamental particles are the smallest parts of matter. Now, they may be made of smaller parts or not, but we can't see that far. Deutsch came up with a theory to send these particles back in time.

"It's intriguing that you've got general relativity predicting these paradoxes, but then you consider them in quantum mechanical terms and the paradoxes go away," says University of Queensland physicist Tim Ralph. "It makes you wonder whether this is important in terms of formulating a theory that unifies general relativity with quantum mechanics." For years, physicists have searched for a theory to unite classical physics and quantum physics.

"The Grandfather Paradox"

Recently Ralph and his PhD student Martin Ringbauer led a team that confirmed much of Deutsch's model of CTCs. Their findings are published in Nature Communications. They investigated how Deutsch's model deals with the “grandfather paradox.” In the hypothetical scenario someone uses a CTC to travel back through time to murder her own grandfather. In turn, this prevents her own birth.

Deutsch's quantum solution to the grandfather paradox works like this:

Instead of a human taking a CTC back in time to kill her ancestor, imagine that a particle goes back in time to flip a switch on the particle-generating machine that created it. If the particle flips

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the switch, the machine shoots a particle — the particle — back into the CTC. However, if the switch isn't flipped, the machine shoots out nothing.

In this scenario it is not certain the particle will be shot out. It's just a probability. Deutsch's big idea was that particles are steady and constant at the quantum level. He insists that any particle entering one end of a CTC must come out the other end exactly the same. Therefore, a particle shot out by the machine with a probability of one half would enter the CTC and come out the other end to flip the switch with a probability of one half.

By doing so it would give itself at birth a probability of one half of going back to flip the switch. If the particle were a person, she would be born with a one-half probability of killing her grandfather. In turn, that would give her grandfather a one-half probability of escaping death at her hands. That's good enough in terms of probability to escape the paradox. This strange solution agrees with the laws of quantum physics.

Mathematical Stunt Double

Ralph and Ringbauer simulated Deutsch's model using pairs of polarized light particles (photons). They say it is mathematically the same as a photon passing through a CTC. "We encode their polarization so that the second one acts as kind of a past incarnation of the first," Ringbauer says. So instead of sending a person through a time loop, they created a stunt double of the person and ran him through a time-loop simulator. They wanted to see if the stunt double coming through a CTC exactly resembled the original person as he was in that moment in the past.

By measuring the polarization of the second photon after it interacted with the first, the team demonstrated Deutsch's theory. "Of course, we're not really sending anything back in time," Ralph says.

But the simulation, Ringbauer notes, would have remarkable effects for computing based on quantum mechanics. The quantum states of fundamental particles could be cloned. "If you can clone quantum states," he says, "you can violate the Heisenberg uncertainty principle." Heisenberg's uncertainty principle says certain pairs of things can't be measured accurately at the same time. Basically, the better you know the position of a particle, the less you know its momentum, and vice versa. "But if you clone that system, you can measure one quantity in the first and the other quantity in the second." This would allow for advances in quantum computing, such as quantum encryption.

CTCs would allow quantum mechanics to perform more powerful computing tasks than "classical or even normal quantum computers could do," says Todd Brun, a physicist at the University of Southern California. "But this experiment cannot test the Deutsch model itself." For that, an actual CTC would be necessary.

Guests From Future? Still Late

Deutsch's model isn't the only one around, however. In 2011 Seth Lloyd, a physicist at Massachusetts Institute of Technology, tested simulations of a simpler model of CTCs. It resolves the grandfather paradox using quantum teleportation and post-selection. Quantum teleportation is a bit like the teleporter in Star Trek, when Scotty beams Spock up from other planets — but that's where the similarity ends. Quantum teleportation only beams around the tiniest bits of information.

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Post-selection refers to discarding experimental runs where something you wanted to happen didn't happen.

Deutsch's theory destroys correlations, Lloyd says. "That is, a time traveler who emerges from a Deutschian CTC enters a universe that has nothing to do with the one she exited in the future." Post-selection preserves correlations, "so that the time traveler returns to the same universe that she remembers in the past."

Lloyd's model would make CTCs much less powerful for computing than Deutsch's. However, they would still be far superior to what computers could achieve in typical regions of spacetime. Typical computing stores information as 0's or 1's. Quantum computing can use 1 and 0 separately or at the same time. Lloyd's model could solve problems at the level of "finding needles in haystacks," Lloyd says. "But a computer in a Deutschian CTC could solve why haystacks exist in the first place."

Lloyd, though, admits how wild the idea of CTCs is. "I have no idea which model is really right. Probably both of them are wrong," he says. Of course, he adds, the other possibility is that Hawking is correct, "that CTCs simply don't and cannot exist." Time-travel party planners should save the champagne for themselves — no guests from the future seem likely to arrive.

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Quiz

1 Select the paragraph from the section "Subatomic Time Travel?" that describes in detail a potential paradox of time travel.

2 Which section from the article confirms that there are still philosophical issues with time travel?

(A) "Bending Space And Time"

(B) "Subatomic Time Travel?"

(C) "The Grandfather Paradox"

(D) "Mathematical Stunt Double"

3 Which of the following sentences from the introduction [paragraphs 1-3] does NOT support the central idea of the text?

(A) It was a joke, but it was also an experiment to prove his belief that travel into the past is impossible.

(B) Recent experiments offer some support for time travel's possibility — at least in the world of math.

(C) Proving that time travel is possible would have change classical physics as well as allow for super-fast types of computing that rely on quantum physics, also called quantum mechanics.

(D) Briefly, classical physics deals with the big things, like the Sun and Moon.

4 Below is a summary of the article.

Currently, there exists debate about the possibility of time travel. Certain physicists believe that quantum mechanics makes time travel a theoretical possibility.

Adding which of these details would help strengthen this summary of the article?

(A) CTCs, or "closed timelike curves" are the result of spacetime bending back on itself.

(B) Many physicists are concerned about the paradoxes inherent to time travel.

(C) Albert Einstein's theory of relativity changed physics in numerous ways.

(D) Stephen Hawking does not believe that time travel is a possibility.

This article is available at 5 reading levels at https://newsela.com.

The sun, an engine of nuclear energy

By Christopher Crockett, Big History Project on 08.22.17
Word Count **1,047**
Level **MAX**



This image shows a view of all that remains of the oldest documented example of a supernova, called RCW 86. A supernova is one of the most dramatic events in the universe. All of the elements in the universe are created in supernova explosions. Photo by: NASA

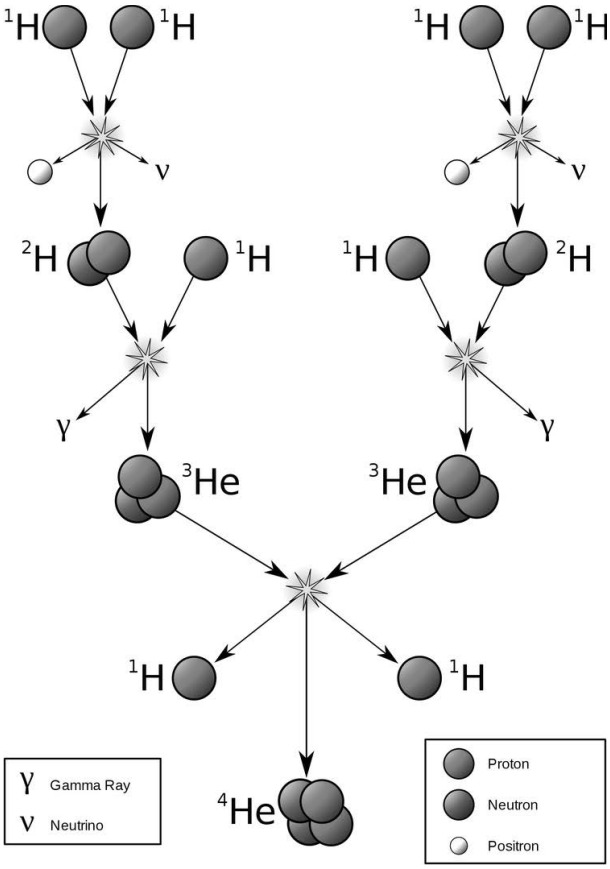
The sun generates about 400 billion billion megawatts of power and it has done so for five billion years. Nuclear fusion – combining lighter atoms to make heavier ones – is what makes it possible. What energy source is capable of this sort of power? Remarkably, the engine of the mightiest stars is not something immense, but rather something very small: tiny building blocks of atoms smashing together at high speeds. With every collision, a spark of energy is released. Nuclear fusion, the blending of atomic nuclei to form new elements, is what drives entire galaxies of stars.

The nuclei of atoms are conceptually simple. They consist of only two types of particles: protons and neutrons. The number of protons determines the type of atom; it's what distinguishes helium, carbon and sulfur. The neutrons hold the positively charged protons together. Without the neutrons, the like charges would send the protons flying apart.

Heavier atoms, like neon, can be assembled by fusing together lighter atoms, like helium. When that happens, energy is released. How much energy? If you were to fuse all the hydrogen in a gallon of water into helium, you'd have enough energy to power New York City for three days.

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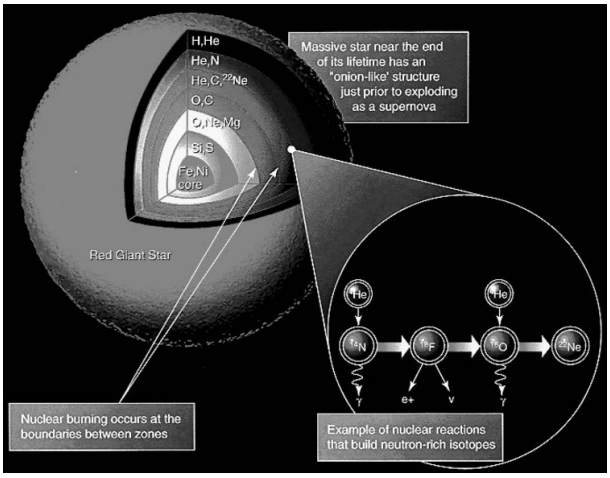
Now imagine if you had an entire star's worth of hydrogen!



The trick to getting atoms to fuse is having extremely high temperature and density. Under the pressure of a few octillion tons of gas, the sun's center is heated to about 10 million degrees Celsius. At that temperature, the bare protons of a hydrogen nucleus are moving fast enough to overcome their mutual repulsion.

Through a series of collisions, the intense pressure at the sun's core continually fuses four protons together to form helium. With every fusion, energy is released into the stellar interior. Millions of these events occurring each second produce enough energy to push back against the force of gravity and keep the star in balance for billions of years. The released gamma rays follow a tortuous path higher and higher through the star until eventually emerging from the surface, millions of years later, in the form of visible light.

But this can't continue forever. Eventually, the hydrogen is depleted as an inert core of helium builds up. For the smallest stars, this is the end of the line. The engine turns off and the star quietly fades into the darkness.



A more massive star, like our sun, has other options. As the hydrogen fuel runs out, the core contracts. The contracting core heats up and releases energy. The star balloons into a "red giant." If the core can reach a high enough temperature — approximately 100 million degrees Celsius — the helium nuclei can begin fusing. The star enters a new phase of life as helium is transformed into carbon, oxygen and neon.

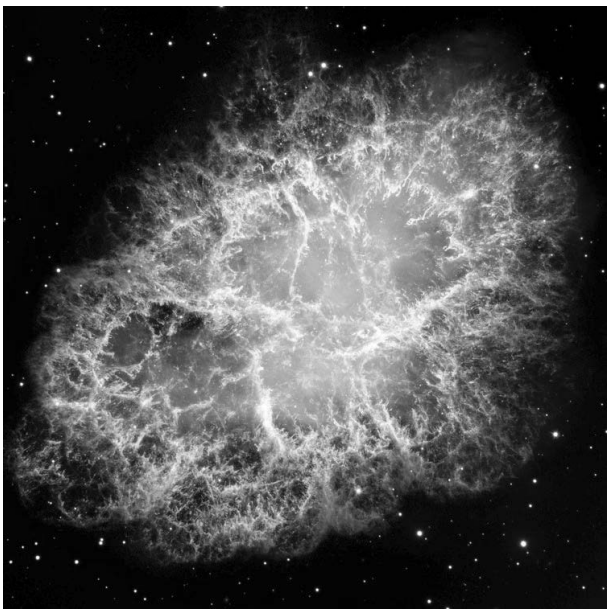
The star now enters a cycle where the nuclear fuel is depleted, the core contracts, and the star balloons. Each time, the core heating kicks off a new round of fusion.

How many times the star loops through these steps depends entirely on the mass of the star. More mass can produce more pressure and drive ever higher temperatures at the core. Most stars, like our sun, cease after producing carbon, oxygen and neon. The core becomes a white dwarf and the outer layers of the star are driven off into space.

But stars that are a couple of times more massive than the sun can keep going. After the helium is used up, the core contraction produces temperatures approaching 1 billion degrees. Now, the carbon and oxygen can start fusing to form even heavier elements: sodium, magnesium, silicon, phosphorous and sulfur. Beyond this, the most massive stars can heat their cores to several billion

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degrees. Here, a bewildering array of options is available as silicon fuses through a complex reaction chain to form metals like nickel and iron. Only a few stars get this far. It takes a star with the mass of more than eight suns to form iron.



Once a star produces a core of iron or nickel, however, there aren't any options left. At every stage along this journey, fusion has released energy into the stellar interior. To fuse with iron, on the other hand, robs energy from the star. At this point, the star has consumed all usable fuel. Without a nuclear energy source, the star collapses. All the layers of gas come crashing down to the center, which stiffens in response. An exotic neutron star is born in the core and the onrushing mass, with nowhere else to go, rebounds off the incompressible surface. Wildly out of balance, the star blows apart in a supernova — one of the most cataclysmic singular events in the universe. In the chaos of the explosion, atomic nuclei begin capturing single protons and neutrons. Here, in the fires of a supernova, the rest of the elements in the universe are created. All the gold in all the wedding bands in the world can only have come from one place: a nearby supernova that ended one star's life and most likely triggered the formation of our solar system five billion years ago.

It is a remarkable fact that the largest of stars are fueled by the smallest of things. All the light and energy in our universe is the result of atoms being built in the cores of stars. The energy released every time two particles fuse together, combined with trillions of other ongoing reactions, is enough to power a single star for billions of years. And every time a star dies, those new atoms are released into interstellar space and carried along galactic streams, seeding the next generation of stars. Everything that we are is the result of thermonuclear fusion in the heart of a star. As Carl Sagan once famously quipped, we truly are star stuff.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 The author infuses a tone of wonder and awe throughout the article.

Which selection from the article BEST reflects that tone?

(A) The sun generates about 400 billion billion megawatts of power and it has done so for five billion years. Nuclear fusion – combining lighter atoms to make heavier ones – is what makes it possible. What energy source is capable of this sort of power? Remarkably, the engine of the mightiest stars is not something immense, but rather something very small: tiny building blocks of atoms smashing together at high speeds. With every collision, a spark of energy is released. Nuclear fusion, the blending of atomic nuclei to form new elements, is what drives entire galaxies of stars.

(B) But stars that are a couple of times more massive than the sun can keep going. After the helium is used up, the core contraction produces temperatures approaching 1 billion degrees. Now, the carbon and oxygen can start fusing to form even heavier elements: sodium, magnesium, silicon, phosphorous and sulfur. Beyond this, the most massive stars can heat their cores to several billion degrees.

(C) At every stage along this journey, fusion has released energy into the stellar interior. To fuse with iron, on the other hand, robs energy from the star. At this point, the star has consumed all usable fuel. Without a nuclear energy source, the star collapses. All the layers of gas come crashing down to the center, which stiffens in response. An exotic neutron star is born in the core and the onrushing mass, with nowhere else to go, rebounds off the incompressible surface.

(D) It is a remarkable fact that the largest of stars are fueled by the smallest of things. All the light and energy in our universe is the result of atoms being built in the cores of stars. The energy released every time two particles fuse together, combined with trillions of other ongoing reactions, is enough to power a single star for billions of years. And every time a star dies, those new atoms are released into interstellar space and carried along galactic streams, seeding the next generation of stars. Everything that we are is the result of thermonuclear fusion in the heart of a star. As Carl Sagan once famously quipped, we truly are star stuff.

2 "Nuclear fusion" is central to understanding the article.

Which of the following paragraphs BEST illustrates the process of nuclear fusion for readers?

(A) Heavier atoms, like neon, can be assembled by fusing together lighter atoms, like helium. When that happens, energy is released. How much energy? If you were to fuse all the hydrogen in a gallon of water into helium, you'd have enough energy to power New York City for three days.

(B) Through a series of collisions, the intense pressure at the sun's core continually fuses four protons together to form helium. With every fusion, energy is released into the stellar interior. Millions of these events occurring each second produce enough energy to push back against the force of gravity and keep the star in balance for billions of years. The released gamma rays follow a tortuous path higher and higher through the star until eventually emerging from the surface, millions of years later, in the form of visible light.

(C) A more massive star, like our sun, has other options. As the hydrogen fuel runs out, the core contracts. The contracting core heats up and releases energy. The star balloons into a "red giant." If the core can reach a high enough temperature — approximately 100 million degrees Celsius — the helium nuclei can begin fusing. The star enters a new phase of life as helium is transformed into carbon, oxygen and neon.

(D) How many times the star loops through these steps depends entirely on the mass of the star. More mass can produce more pressure and drive ever higher temperatures at the core. Most stars, like our sun, cease after producing carbon, oxygen and neon. The core becomes a white dwarf and the outer layers of the star are driven off into space.

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3 What is the BEST way to describe this article's organizational structure? What is the MOST LIKELY reason the author chose this organizational structure?

(A) narrative description; to create a vivid image of nuclear fusion forming the stellar landscape

(B) chronology; to emphasize connections between stellar events driven by nuclear fusion

(C) compare and contrast; to show how stars of various types use nuclear fusion differently

(D) steps in a process; to explain the role of nuclear fusion in the life cycles of stars

4 How effectively does the final paragraph conclude the article for readers?

(A) It effectively concludes the article by emphasizing the significance of nuclear fusion and how it relates to readers.

(B) It effectively concludes the article by expanding the definition of nuclear fusion to help readers grasp the concept fully.

(C) It ineffectively concludes the article by introducing new ideas about nuclear fusion without providing supporting information.

(D) It ineffectively concludes the article by simply restating points about nuclear fusion discussed previously in more detail.

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Explainer: the difference between radiation and radioactivity

By Martin Boland, The Conversation on 04.05.17
Word Count **1,319**
Level **MAX**



A nuclear power plant uses the heat generated from nuclear fission t to convert water to steam, which powers generators to produce electricity. A potential danger from an accident at a nuclear power plant is exposure to radiation. Photo from Wikimedia Commons. SECOND IMAGE: The basic structure of an atom. LAST IMAGE: A chest x-ray. X-rays are a form of high-energy electromagnetic radiation. Photos from Wikimedia Commons.

Radioactivity and radiation are often used interchangeably, but they describe different (yet related) processes.

But before going into this difference, it's useful to understand what atoms are and a few concepts about how they behave.

An atom is the smallest particle that can be described as a chemical. Smaller particles aren't chemicals in the same way that wheels, windscreens, and seats aren't cars – they are parts of them, but you need a few to make the whole.

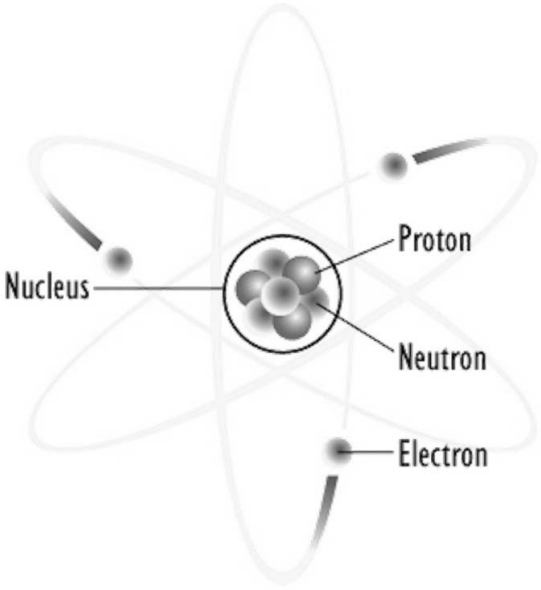
At the center of each atom is a nucleus, containing a number of protons (positively charged particles). The number of protons determines what chemical the atom is. All carbon nuclei contain

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six protons – it is what defines them as carbon nuclei. Five protons would be a boron atom, seven protons a nitrogen atom.

The nucleus also contains a number of neutrons (particle with no charge). Atoms of the same chemical can have different numbers of neutrons. Some 99 percent of carbon atoms have six neutrons, when added to the six protons this gives an atomic mass of 12.

Some carbon atoms have more or fewer neutrons – seven neutrons make carbon-13 and eight for carbon-14. The nuclei of carbon-12 and carbon-13 are stable, but carbon-14 is radioactive and is the basis of radiocarbon dating.



Atoms of the same chemical with different numbers of neutrons are known as isotopes.

Surrounding the nucleus are very small negatively charged particles called electrons. These are held in place (called orbitals) by their attraction to the positively charged nucleus. An atom contains as many electrons as protons.

Adding or removing an electron from the atom results in a charged particle, called an ion. Ions can react very differently to atoms. A chlorine atom is very reactive and dangerous; a chloride ion is part of table salt. This becomes important when talking about ionising radiation later.

What Is Radioactivity?

Radioactivity is the term given to the breaking-up (decay) or rearrangement of an atom's nucleus. Decay occurs naturally and spontaneously to unstable nuclei. This instability is usually caused by a mismatch between the number of protons and neutrons.

Radioactive decay can occur in several ways, with the more common ones being: spontaneous fission, also known as "splitting the atom" as the nucleus breaks into two parts; neutron release: a neutron is ejected from the core of the atom; alpha decay: the nucleus releases an alpha particle (a helium-4 nucleus) consisting of two neutrons and two protons; beta decay: the nucleus ejects an electron or a positron (this is not the same as an electron being removed from orbitals around the nucleus); gamma decay: the protons and neutrons within the nucleus rearrange into a more stable form, and energy is emitted as a gamma ray.

Neutron release, alpha and beta decay are all accompanied by the release of a particle. It is the particle (or the gamma ray in gamma decay) that is the "radiation" associated with radioactivity.

What Is A "Half-Life"?

Let's say we have 4,000 coins and we want to flip them all, which will take (for the sake of the argument) one minute. All of those that land heads are thrown away. By the law of averages, we should have 2,000 coins (half) remaining.

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If we then take another minute to flip all of those coins and discard the heads, we will be left with 1,000 coins. And again, taking another minute to flip the 1,000 coins, we will be left with 500 coins.

You'll notice we take the same length of time to flip all the coins, no matter how many of them there are.

In the case of radioactivity, this time is not an artificial constraint, but a fundamental property of each nucleus – that in a given time, it has a 50-50 chance of spontaneously decaying. The name given to the length of time it takes for half the atoms in a sample to decay is called the "half-life."

The half-life of an isotope is the same for all nuclei of that type (all carbon-14 nuclei have a half-life of about 5,750 years and all carbon-15 nuclei have a half life of about 2.5 seconds).

If we perform the coin flip ten times we will be left with four coins – one-thousandth of the starting number. This is important because it is considered that after ten half-lives there is a negligible amount of material remaining.

If a material has a long half-life (such as uranium-238's 4.5 billion years half-life, about the age of the Earth), it is not very radioactive. A material with a short half-life (polonium-210's 138 days) is very radioactive.

What's The Difference Between Radioactivity And Radiation?

As we have seen, radioactive decay is a property of a particular nucleus. In comparison, radiation is a possible consequence of many processes, not just radioactivity.

Radiation is the term given to a traveling particle or wave and can be split into three main types: 1. Non-ionizing radiation: essentially the low-energy parts of the electromagnetic spectrum. This includes all the light you see, radio waves (also known as microwaves, as in the oven) and infrared ("heat" radiation). Ultra violet falls into the high energy end of this category. 2. Ionizing radiation: radiation that can remove an electron from its orbital. 3. Neutrons: free neutron particles that can collide with other atoms.

Non-ionizing radiation is mostly damaging in obvious ways. Exposure to microwaves or infrared waves causes susceptible materials to heat up. Alternatively, ionizing radiation can be less obvious but, by changing an atom into a more reactive ion, can create longer-lasting damage.



Ionizing radiation falls into two main forms: 1. High-energy electromagnetic radiation, including X-ray and gamma rays; 2. Particle radiation, with alpha and beta particles.

These different forms of ionizing radiation differ in their capacity to do damage and their ability to penetrate materials.

Ionizing Electromagnetic Radiation

X-rays and gamma rays are penetrating, and ionizing radiation is essentially the same thing. (The difference

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in terminology is usually that gamma rays come from nuclear decay, while X-rays come from electron orbitals.)

These wavelengths of electromagnetic radiation contain enough energy to push an electron out of its orbit around the atom, yet again forming an ion. They are stopped by very dense materials such as lead or large amounts of earth or concrete.

Particle Radiation

Particle radiation is potentially very harmful, but it is relatively easy to block.

Alpha particles, with two neutrons and two protons, are essentially helium ions. These can strip the electrons from another atom in order to become helium atoms. Beta particles are simply free electrons that can be captured by atoms just like any other electron.

Luckily, protection from these is reasonably easy. Alpha particles are blocked by a piece of paper, and beta particles by a few millimetres of metal or an equivalent amount of plastic.

Neutrons are more penetrating and so are potentially more dangerous. They cause damage by being captured by the nucleus of an atom. This can cause the atom to break in two (fission) or undergo another decay process (known as transmutation).

In either case, the original atom (say a nitrogen atom) is changed to become a different type of atom (in this case, carbon-14). The new atom will have different chemical properties and therefore could act as a poison, or, for building materials, change their physical properties.

Neutrons are either slowed down or captured safely by materials such as graphite or compounds containing lots of hydrogen (such as tap water).

All of these forms of radioactivity and radiation are naturally occurring. They make up what is known as background radiation. The web comic xkcd gives a good visual representation of what those numbers look like.

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Quiz

1 Which sentence from the introduction [paragraphs 1-9] shows that small particle changes can have drastic effects?

(A) Atoms of the same chemical can have different numbers of neutrons.

(B) Surrounding the nucleus are very small negatively charged particles called electrons.

(C) Atoms of the same chemical with different numbers of neutrons are known as isotopes.

(D) A chlorine atom is very reactive and dangerous; a chloride ion is part of table salt.

2 Which selection from the article does NOT explain a part of the process of releasing radiation through radioactivity?

(A) Atoms of the same chemical can have different numbers of neutrons. Some 99 percent of carbon atoms have six neutrons, when added to the six protons this gives an atomic mass of 12.

(B) Decay occurs naturally and spontaneously to unstable nuclei. This instability is usually caused by a mismatch between the number of protons and neutrons.

(C) Neutron release, alpha and beta decay are all accompanied by the release of a particle. It is the particle (or the gamma ray in gamma decay) that is the “radiation” associated with radioactivity.

(D) These wavelengths of electromagnetic radiation contain enough energy to push an electron out of its orbit around the atom, yet again forming an ion.

3 Read the paragraph from the section "What Is A Half-Life?"

If we perform the coin flip ten times we will be left with four coins – one-thousandth of the starting number. This is important because it is considered that after ten half-lives there is a negligible amount of material remaining.

What does the word "negligible" convey in the sentence?

(A) the sense that the material remaining is unimportant

(B) the sense that it is hard to tell when half-lives conclude

(C) the sense that half-lives quickly break down materials

(D) the sense that the remaining materials are dangrous

4 Read the sentence from the section "Particle Radiation."

Neutrons are more penetrating and so are potentially more dangerous.

Which version of the sentence creates a more alarming tone by replacing the word "potentially"?

(A) Neutrons are more penetrating and so are POSSIBLY more dangerous.

(B) Neutrons are more penetrating and so are THEORETICALLY more dangerous.

(C) Neutrons are more penetrating and so are CONCEIVABLY more dangerous.

(D) Neutrons are more penetrating and so are UNDOUBTEDLY more dangerous.

This article is available at 5 reading levels at https://newsela.com.

The nature of dark matter

By NASA.gov on 12.02.16
Word Count **448**
Level **MAX**



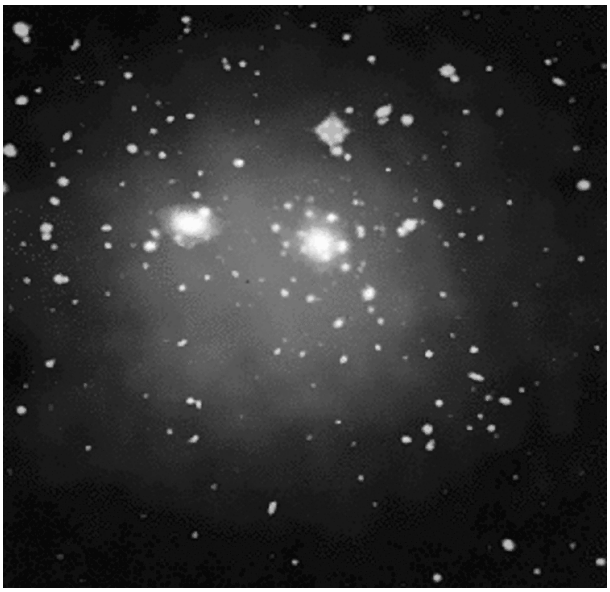
TOP: The Bullet Cluster of galaxies. Photo: NASA.

In general, astronomers learn about the universe by the electromagnetic radiation (or light) that we see from it. The light we see is in the form of radio waves, infrared, optical, ultraviolet, X-ray and gamma-ray emission. But what if there is material in the universe that does not glow? How will we ever know it is there? How can we tell how much of it there is? How do we know what it is?

Such material is called "dark matter," and astronomers now believe that most of the material in the universe is made of this stuff. It is material that does not emit sufficient light for us to directly detect it, yet there are a variety of ways that we can indirectly detect it. The most common method involves the fact that dark matter has a gravitational pull on both the light and the sources of light that we can see. From the effects of "extra" gravity that we detect, we infer how much mass must be present.

The image at right shows one way this is done. Pictured here are two superimposed images of the Coma Cluster of galaxies. The red areas are X-ray light seen by the Einstein satellite; the blue is visible light from a Palomar Sky Survey optical image (made with ground-based telescopes at Caltech). Scientists have used these observations and others to determine the amount of gravity required to hold together all the mass detected in the image. Surprisingly, there is not nearly

enough mass observed to explain the inferred gravity - somehow, there is undetected "missing mass." What could this "missing mass" be?



The kinds of materials that we experience every day are made of atoms, which are composed of protons, neutrons and electrons. We refer to this type of matter as "baryonic." Is the dark matter in the universe made of the same stuff that we are familiar with? For example, is it baryonic? Or is it something strange ... some kind of exotic new material, which we could call non-baryonic?

So far, it looks like there are both baryonic and non-baryonic types of dark matter. Some dark matter may be composed of regular matter (i.e., baryonic), but simply not give off much light. Things like brown dwarf stars would be in this category. Other non-baryonic dark matter may be tiny, sub-atomic particles that aren't a part of "normal" matter at all. If these tiny particles have mass and are numerous, they could make up a large part of the dark matter we think exists. If true, then it's possible that most of the matter in the universe is of some mysterious form that we cannot yet even identify.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the following selection from the article.

Scientists have used these observations and others to determine the amount of gravity required to hold together all the mass detected in the image. Surprisingly, there is not nearly enough mass observed to explain the inferred gravity - somehow, there is undetected "missing mass."

Which of the following conclusions can be drawn from the selection above?

(A) Due to high levels of gravity observed, scientists have inferred that the matter in the universe is shifting.

(B) Due to low mass and high levels of gravity, scientists have inferred that dark matter is denser than previously thought.

(C) Due to disproportionate amounts of mass and gravity, scientists have inferred that dark matter is present.

(D) Due to areas of "missing mass," scientists have inferred that portions of the universe have likely disappeared.

2 Which of the following aspects of the article is NOT thoroughly discussed?

(A) the methods scientists use to detect dark matter

(B) the relationship between gravity and dark matter

(C) the role that dark matter plays in the universe

(D) the possible composition of dark matter

3 Read the sentence from the article.

If true, then it's possible that most of the matter in the universe is of some mysterious form that we cannot yet even identify.

Which version of this sentence creates a more bewildered tone by replacing the word "mysterious"?

(A) If true, then it's possible that most of the matter in the universe is of some PERPLEXING form that we cannot yet even identify.

(B) If true, then it's possible that most of the matter in the universe is of some NOTEWORTHY form that we cannot yet even identify.

(C) If true, then it's possible that most of the matter in the universe is of some PECULIAR form that we cannot yet even identify.

(D) If true, then it's possible that most of the matter in the universe is of some REMARKABLE form that we cannot yet even identify.

4 Read the sentence from the article.

It is material that does not emit sufficient light for us to directly detect it, yet there are a variety of ways that we can indirectly detect it.

Which two words could BEST replace "emit" and "sufficient" without changing the meaning of the sentence?

(A) absorb; enough

(B) radiate; adequate

(C) emanate; excessive

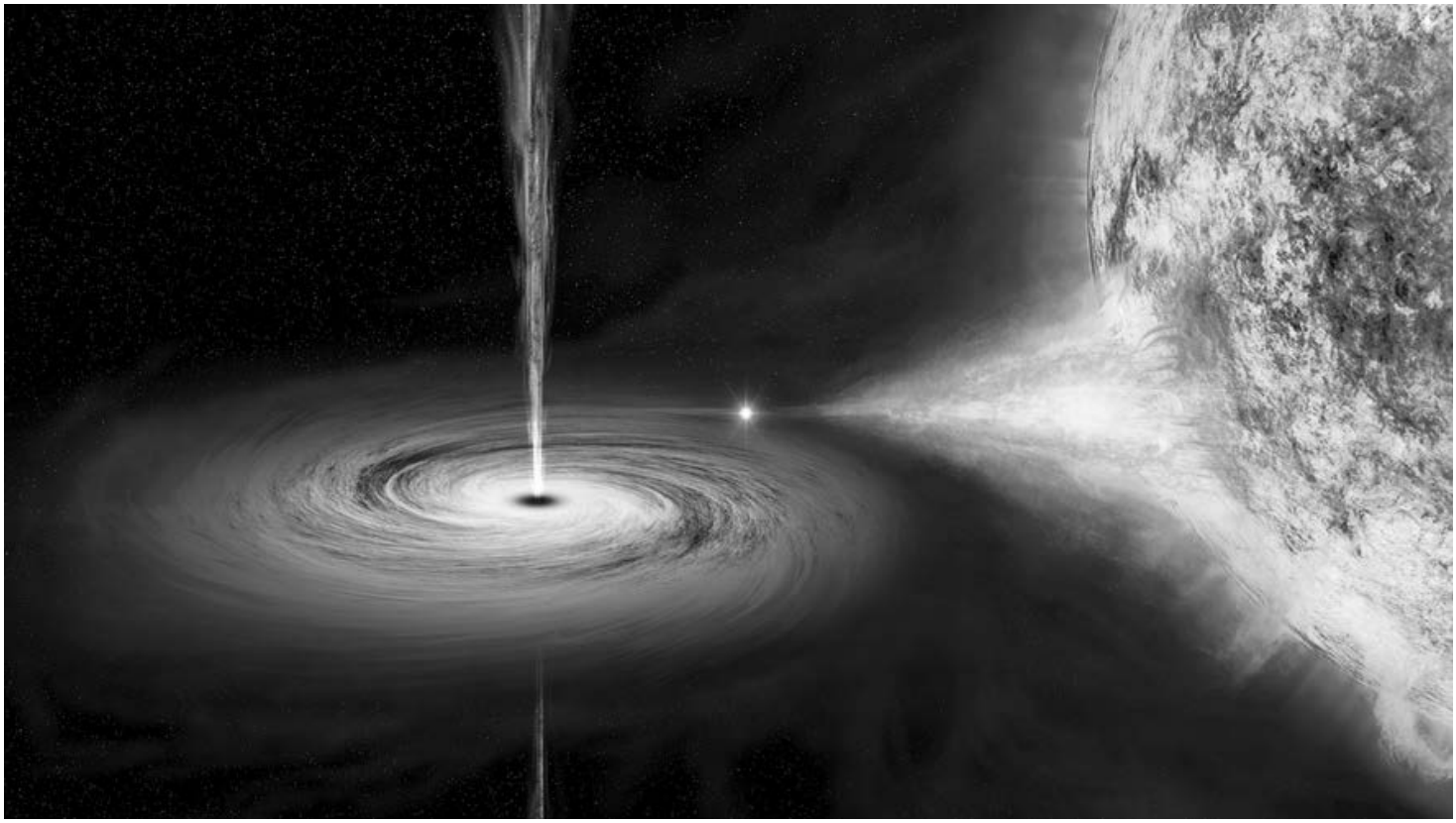
(D) vacate; ambiguous

This article is available at 5 reading levels at https://newsela.com.

This article is available at 5 reading levels at https://newsela.com.

What is a black hole?

By NASA.gov on 03.02.20
Word Count **841**
Level **MAX**



TOP: The black hole Cygnus X-1 formed when a large star caved in. This black hole pulls matter from the blue star beside it; NASA/CXC/M.Weiss. BOTTOM: An artist's drawing shows the current view of the Milky Way galaxy. Scientific evidence shows that in the center of the Milky Way is a supermassive black hole; NASA/JPL-Caltech.

A black hole is a region in space where the pulling force of gravity is so strong that light is not able to escape. The strong gravity occurs because matter has been pressed into a tiny space. This compression can take place at the end of a star's life. Some black holes are a result of dying stars.

Because no light can escape, black holes are invisible. However, space telescopes with special instruments can help find black holes. They can observe the behavior of material and stars that are very close to black holes.

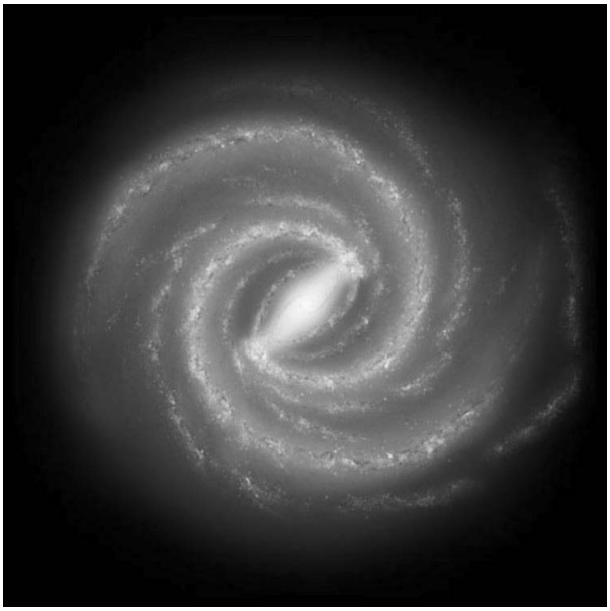
How Big Are Black Holes?

Black holes can come in a range of sizes, but there are three main types of black holes. The black hole's mass and size determine what kind it is.

The smallest ones are known as primordial black holes. Scientists believe this type of black hole is as small as a single atom but with the mass of a large mountain.

This article is available at 5 reading levels at https://newsela.com.

The most common type of medium-sized black holes is called "stellar." The mass of a stellar black hole can be up to 20 times greater than the mass of the sun and can fit inside a ball with a diameter of about 10 miles. Dozens of stellar mass black holes may exist within the Milky Way galaxy.



The largest black holes are called "supermassive." These black holes have masses greater than 1 million suns combined and would fit inside a ball with a diameter about the size of the solar system. Scientific evidence suggests that every large galaxy contains a supermassive black hole at its center. The supermassive black hole at the center of the Milky Way galaxy is called Sagittarius A. It has a mass equal to about 4 million suns and would fit inside a ball with a diameter about the size of the sun.

How Do Black Holes Form?

Primordial black holes are thought to have formed in the early universe, soon after the big bang.

Stellar black holes form when the center of a very massive star collapses in upon itself. This collapse also causes a supernova, or an exploding star, that blasts part of the star into space.

Scientists think supermassive black holes formed at the same time as the galaxy they are in. The size of the supermassive black hole is related to the size and mass of the galaxy it is in.

If Black Holes Are "Black," How Do Scientists Know They Are There?

A black hole cannot be seen because of the strong gravity that is pulling all of the light into the black hole's center. However, scientists can see the effects of its strong gravity on the stars and gases around it. If a star is orbiting a certain point in space, scientists can study the star's motion to find out if it is orbiting a black hole.

When a black hole and a star are orbiting close together, high-energy light is produced. Scientific instruments can see this high-energy light.

A black hole's gravity can sometimes be strong enough to pull off the outer gases of the star and grow a disk around itself called the accretion disk. As gas from the accretion disk spirals into the black hole, the gas heats to very high temperatures and releases X-ray light in all directions. NASA telescopes measure the X-ray light. Astronomers use this information to learn more about the properties of a black hole.

Could A Black Hole Destroy Earth?

Black holes do not wander around the universe, randomly swallowing worlds. They follow the laws of gravity just like other objects in space. The orbit of a black hole would have to be very close to the solar system to affect Earth, which is not likely.

This article is available at 5 reading levels at https://newsela.com.

If a black hole with the same mass as the sun were to replace the sun, Earth would not fall in. The black hole with the same mass as the sun would keep the same gravity as the sun. The planets would still orbit the black hole as they orbit the sun now.

Will The Sun Ever Turn Into A Black Hole?

The sun does not have enough mass to collapse into a black hole. In billions of years, when the sun is at the end of its life, it will become a red giant star. Then, when it has used the last of its fuel, it will throw off its outer layers and turn into a glowing ring of gas called a planetary nebula. Finally, all that will be left of the sun is a cooling white dwarf star.

How Is NASA Studying Black Holes?

NASA is learning about black holes using spacecraft like the Chandra X-ray Observatory, the Swift satellite and the Fermi Gamma-ray Space Telescope. Fermi launched in 2008 and is observing gamma rays - the most energetic form of light - in search of supermassive black holes and other astronomical phenomena. Spacecraft like these help scientists answer questions about the origin, evolution and destiny of the universe.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which of the following details from the article shows that scientists do not fully understand how black holes are created?

(A) ...space telescopes with special instruments can help find black holes.

(B) Dozens of stellar mass black holes may exist within the Milky Way galaxy.

(C) A black hole cannot be seen because of the strong gravity that is pulling all of the light into the black hole's center.

(D) ...these help scientists answer questions about the origin, evolution and destiny of the universe.

2 The article suggests that each of the following plays an important role in scientists' current understanding of black holes EXCEPT:

(A) the mass of individual black holes

(B) the holes' locations within different galaxies

(C) the force of gravity coming from the holes' center

(D) the location of the sun in relation to the nearest black hole

3 How does the article develop the idea that black holes have a significant effect on their surroundings?

(A) by explaining how black holes use gravity to absorb matter

(B) by discussing scientists' belief that black holes exist at the center of every galaxy

(C) by detailing the sizes and masses of black holes that have been discovered

(D) by explaining the events that lead to the creation of black holes

4 Which of the following aspects of the article is NOT thoroughly discussed?

(A) whether black holes are capable of changing sizes

(B) whether scientists are able to see black holes using telescopes

(C) the effect of black holes on other bodies in space

(D) the effect of black holes on the creation of galaxies

This article is available at 5 reading levels at https://newsela.com.

Wanted: An orbiting garbage collector to clean up space

By Rachel Feltman, Washington Post, adapted by Newsela Staff on 05.17.18
Word Count **613**
Level **MAX**



Image 1. There are a lot of satellites floating around space with nowhere to go. Scientists are working on getting rid of the satellites that are no longer working in space. Image from NASA.

The night sky is full of stars, but it's also full of garbage.

Humans put lots of satellites up there. About 1,700 working spacecraft are in orbit around our planet today. And not every piece of machinery comes right back when its job is done. Many keep speeding through the sky long after scientists have lost touch. Those leftover space machines are liable to crash into one another and break into small pieces.

The National Aeronautics and Space Administration (NASA) estimates that there are about 23,000 pieces of space debris larger than 10 centimeters, or about four inches. They also estimate that there are about 500,000 pieces larger than one centimeter, and about 100,000,000 larger than one millimeter.

Space Garbage Moves Fast!

This article is available at 5 reading levels at https://newsela.com.

A piece of metal smaller than a sesame seed might not sound dangerous. Yet even these tiny bits can pose a big risk. The International Space Station navigates around the paths of the most dangerous hunks of junk. But tiny flakes of paint have managed to chip the craft's quadruple-thick windows. That's because space garbage moves fast.

"Because of the super-high impact speed — more than 10 times the speed of a bullet 250 miles up — even sub-millimeter debris could threaten astronauts when they conduct a spacewalk outside of the International Space Station," says J.D. Harrington. He is a NASA public affairs officer.

Small debris can punch a hole in a satellite. Meanwhile, larger debris can crush one entirely — creating even more wreckage.

"The threat from orbital debris is real," Harrington says. "Because of the ongoing space activities, the orbital debris problem is expected to worsen in the future and will present an even greater danger to future space missions."

It's becoming easier and cheaper for countries, private companies and research groups to send objects up. This has led to an increase in orbital traffic. And it means that our corner of space will have increasingly less space.

New Disposal Policy



NASA doesn't have plans to clean up what's there. However, the agency is working to keep the problem from worsening. They are ensuring that each new mission includes clear arrangements to dispose of spacecraft that no longer work and any pieces they eject.

And there are potential solutions in the works from others: At the 2017 European Conference on Space Debris, presenters discussed ideas for disposing of space junk. Some scientists suggest pushing junk off into a higher orbit, while others vote for capturing it with nets and harpoons or magnets. In May, the International Space Station is expected to deploy a test project. It's called RemoveDEBRIS. It will capture several pieces of pretend garbage before burning itself up in Earth's atmosphere.

But while we wait for someone to design the ultimate space vacuum, are folks on Earth safe from the danger of falling debris? The short answer is yes. Junk falls down all the time: About 200 pieces of debris re-entered the atmosphere in 2016 alone. Most of that burns up and breaks down in the process. The pieces that remain are unlikely to cause harm. Most of the Earth is either covered in ocean or has plenty of open space, so chances are any hunks of junk will hit spots without humans there to get hurt.

Oh No! The Sky Is Falling!

There's only one known case of a human getting hit with a piece of spacecraft — Lottie Williams in Tulsa, Oklahoma, in 1997. She didn't even get a bruise from the accident! You're way, way more likely to get struck by lightning.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which statement is a MAIN idea of the article?

(A) The increase in orbital traffic means there will be even more space junk and more problems for future space missions.

(B) Many spacecraft don't come back to Earth after they stop working but in fact keep traveling through the sky.

(C) Astronauts are afraid to go on spacewalks outside of the International Space Station because of large space debris.

(D) The 2017 European Conference on Space Debris has come up with more ideas than NASA has for cleaning up space debris.

2 Which sentence from the article would be MOST important to include in a summary of the article?

(A) The International Space Station navigates around the paths of the most dangerous hunks of junk.

(B) It's becoming easier and cheaper for countries, private companies and research groups to send objects up.

(C) It will capture several pieces of pretend garbage before burning itself up in Earth's atmosphere.

(D) Most of the Earth is either covered in ocean or has plenty of open space, so chances are any hunks of junk will hit spots without humans there to get hurt.

3 What is MOST likely the reason the author included the information about the International Space Station’s window getting chipped?

(A) to describe some of the experiments the ISS is testing for the RemoveDEBRIS project that will get rid of space junk

(B) to show that the greatest danger to the ISS is the large pieces of debris orbiting around it

(C) to demonstrate that the damage done by small debris is actually worse than the damage done by large debris

(D) to highlight how even the smallest pieces of debris can cause damage to other spacecraft

4 Which answer choice accurately characterizes NASA's reaction to the space junk problem?

(A) NASA is not addressing the problem of space debris that already exists but has rules to ensure that new missions plan how to get rid of their garbage.

(B) NASA is not addressing the problem of space debris that already exists and does not have any ideas to prevent more space debris from forming in the future.

(C) NASA is focusing primarily on the space debris that is already in space and has not addressed the debris that might be left by future missions.

(D) NASA is focusing primarily on the space debris that is already in space but also will attempt to solve the problem of future space garbage.

This article is available at 5 reading levels at https://newsela.com.

Dream Job: Food chemist

By Peg Lopata, Cricket Media on 03.22.20
Word Count **617**
Level **MAX**



Uma Parasar is a senior research fellow with the research and development flavors team at International Flavors and Fragrances, Inc (IFF). She helps make sure the flavors her company makes are safe to eat and drink. Photo: Uma Parasar

Do you ever wonder what makes some packaged foods and drinks taste great? Well, a chemist such as Uma Parasar might be the one to thank. Parasar is a senior research fellow with the research and development flavors team at International Flavors and Fragrances, Inc (IFF). You can taste flavors her lab has created in all kinds of things — juices, yogurts, candy, potato chips and chocolate. Specifically, as a toxicologist, Parasar is responsible for making sure the flavors her company makes are safe to eat and drink.

Question: Why do you like chemistry?

Answer: We humans are made up of chemicals and so is the natural world, as well as the materials-based world. Embracing chemistry helps us appreciate our amazing world and not fear it. I wanted to be a chemist to solve problems. My specialty, toxicology, helps create a safe world. Arguably, toxicology is the oldest scientific discipline, as the earliest humans had to recognize which plants were safe to eat.

Q: Do you have any favorite food chemicals?

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A: Yes, vanillin. It's the chemical responsible for the scent in vanilla — and one of the most widely used flavor in foods, including ice cream and cookies.

Q: How do chemists create flavors in a lab?

A: We use special equipment to trap odors to learn which chemical is responsible for which smell. Remember, taste is 90 percent smell. Then we recreate that smell by mixing the molecules of that chemical in a bottle. I am working on meat-free protein alternatives right now. We can create something that mimics the taste of meat using non-meat ingredients.

Q: What are some other favorite projects you've worked on?

A: I've worked on a plant extract that makes your mouth tingle and another that makes everything you taste after, even a sour lemon, taste sweet. Also, I've worked on alternative dairy products — especially interesting to me because I'm lactose intolerant. I've worked on soy milk to mask its harsh aftertaste.

Q: What's a chemical you've studied that smells strange?

A: Geosmin. It smells like earth, especially after it has rained.

Q: Can flavorings solve problems?

A: Yes. In the United States, oranges have recently been attacked with a fungal infection that is greatly affecting the crop and their quality. Juice from these oranges doesn't taste sweet enough. But by using molecules naturally occurring in oranges, then synthesizing them in the lab, we can make juice from poor-quality oranges have the sweetness and taste we are used to. We call these "nature identical," meaning we make in the lab what nature makes in the natural world.

We also have a new technology that can convert fresh produce (which may be farm waste) into powders that retain color, taste and nutrients. For example, we can make a strawberry powder that can be added to smoothies using berries that would otherwise be wasted. We can thus prevent waste and provide nutritious solutions.

Q: What's new in the flavor world?

A: The sit-down lunch and breakfast have been replaced by smoothies and protein bars. Natural offerings have increased significantly to meet customer demands.

Also, flavors have gone global because more people are traveling internationally. We eat something far from home and then want it in our grocery stores.

Q: So chemists like you try to make those flavors. Could you possibly make a type of pepper that won't make us sneeze?

A: It's possible! Piperine is the active component in pepper that makes us sneeze.

Q: What's the long-term goal for your work?

A: My goal is to continue to make products that are tasty, healthy, nutritious and better for the planet.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the following selection from the article.

> *Embracing chemistry helps us appreciate our amazing world and not fear it. I wanted to be a chemist to solve problems. My specialty, toxicology, helps create a safe world. Arguably, toxicology is the oldest scientific discipline, as the earliest humans had to recognize which plants were safe to eat.*

What conclusion is BEST supported by the paragraph above?

(A) The study of toxicology has not significantly changed throughout human history.

(B) Toxicology is primarily the study of which plants are safe for human consumption.

(C) People who study toxicology learn what food is safe by studying early humans.

(D) Some understanding of toxicology has always been necessary for human survival.

2 Which sentence from the article BEST explains how the flavor world is responding to changes in how we eat today?

(A) I've worked on a plant extract that makes your mouth tingle and another that makes everything you taste after, even a sour lemon, taste sweet.

(B) We call these "nature identical," meaning we make in the lab what nature makes in the natural world.

(C) Natural offerings have increased significantly to meet customer demands.

(D) My goal is to continue to make products that are tasty, healthy, nutritious and better for the planet.

3 How did Uma Parasar affect the production of orange juice?

(A) She created a cure for a fungal infection that affected the orange crop.

(B) She invented a natural substitute for orange juice that can be synthesized in a lab.

(C) She determined that oranges could be made into a powder for use in smoothies.

(D) She ensured that poor-quality oranges could still be used to make flavorful juice.

4 Which of the following MOST influences a person's sense of taste?

(A) the tingling sensation caused by food

(B) the smell that is emitted by food

(C) the overall sweetness of a food

(D) the amount of vanillin in food

This article is available at 5 reading levels at https://newsela.com.

Dream Jobs: Particle physicist

By Alexa Kurzius on 03.11.20
Word Count **857**
Level **MAX**



Scientist Jessica Esquivel stands in front of a giant electromagnet that she uses in her daily work studying very small particles that are in the universe. Photo by: Reidar Hahn/Fermilab

Most workdays, Jessica Esquivel searches for a tiny, pesky particle that is nearly impossible to observe. She and other scientists are using this particle to learn about new, undiscovered physics. Known as a muon, it's like an electron, but it's about 200 times more massive and much more elusive. "I can't look at it under a microscope and see what it looks like," she says.

Instead, she relies on a giant circular electromagnet 50 feet in diameter that shoots particles at nearly the speed of light. An electromagnet is a type of magnet in which the magnetic field is generated by an electric current. The hope is that this electromagnet — also known as a particle storage ring — at Fermilab in Batavia, Illinois, will teach physicists more about muons and how they behave in the universe.

Studying Physics

Physics is the study of the nature and properties of energy and matter. Particle physicists, like Esquivel, focus on the tiny, subatomic particles that are smaller than an atom, such as electrons and muons. These particles, along with others like quarks and neutrinos, make up our universe.

This article is available at 5 reading levels at https://newsela.com.

But very little is known about most of them because they pop into and out of existence for very brief moments. "There are no answers to the questions we are asking," Esquivel says. And often, a new discovery leads to many more questions than answers.

Today, Esquivel is comfortable with a profession full of tough questions and uncertainty. But it wasn't always that way. Growing up in McAllen, Texas, Esquivel was fascinated by outer space. She loved watching science fiction movies with her aunt and attending math and science summer camps. Later, she went to specialized middle and high schools for science. And though she was often one of few Afrolatinx women in these environments (Esquivel is black and Mexican), it didn't affect her as much because she could identify with other groups in her Latino community.

That changed when she went off to college and graduate school. As an applied physics and electrical engineering major, Esquivel was often one of a few women in her college classes at St. Mary's University in San Antonio, Texas. When she got to graduate school, she was the only Afrolatinx, the only lesbian and practically the only woman in the physics department at Syracuse University in Syracuse, New York. "I had persistent feelings of not belonging," she says.

Though she struggled, she learned she was not alone in wanting more diverse representation in science. Her family, teachers and mentors encouraged her along the way. She especially credits her undergraduate physics professor, Richard Cardenas, who was recognized by President Obama for advocating underrepresented groups to pursue science. "If it weren't for him, I wouldn't be where I am today," she says.

This mentorship continued during her graduate studies, with some professors helping her stick with her studies when she wanted to quit. Ultimately, she stuck with her passion for physics and received her Ph.D. in 2018. She began working at Fermilab full-time soon after. "It just goes to show the importance of having good mentors," she says.

How National Labs Help Support Scientific Discovery

National labs like Fermilab are instrumental in helping scientists conduct basic research, which aims to increase our knowledge and understanding of the world around us. Basic research is different from applied research, which uses scientific discovery to solve a particular problem.

During World War II, the U.S. government funded a lot of scientific research related to radar, telecommunications and atomic energy. This led to many advances in these fields, as well as others. National labs were created following World War II to build on this success, enable scientists to continue their research, and provide the highly technical, expensive equipment for use in ongoing research.

Today, there are 17 Department of Energy national labs nationwide. Scientists from around the world can visit the labs and conduct basic and applied research projects there. Fermilab, located 40 miles outside of Chicago, Illinois, focuses entirely on particle physics and related fields. The large experiment that Esquivel works on for her research is just one of many at the lab.

For the muon experiment, Esquivel collaborates with a team of scientists. They shoot muons into the particle storage ring. Then they watch for collisions between the muons and virtual particles that pop in and out of existence in the storage ring. Normally, muons spin like a top, though this spinning action changes when they collide with another subatomic particle. The team uses precise measurement tools, such as electromagnetic probes and calorimeters, to measure the magnetic

This article is available at 5 reading levels at https://newsela.com.

field and the energies of the muons. This is so they can see into what these collisions look like. It requires massive amounts of data from these collisions to interpret their observations precisely.

There are still so many things that scientists don't know about subatomic particles. But for now, Esquivel is excited to continue her work on them. "Everything around us is made from these fundamental building blocks," she says. Learning more about them "helps us understand how atoms interact with each other and how galaxies form," she says.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which of the following would BEST describe Jessica Esquivel's reaction to working with muons?

(A) She thinks it is boring work because she rather be studying electrons using circular electromagnets.

(B) She thinks it is exciting work because she loves studying subatomic particles under the microscope.

(C) She thinks it is frustrating work because very little is known about muons and it makes experiments seem pointless.

(D) She thinks it is interesting work and is enthusiastic about learning more about muons' role in the formation of galaxies.

2 Which of the following BEST explains how Jessica Esquivel interacted with Richard Cardenas?

(A) Esquivel and Cardenas worked together to bring more diverse representation to Syracuse University.

(B) Esquivel and Cardenas worked together on the experiment that studied the effects of virtual particles on muons.

(C) Esquivel was encouraged by Cardenas to continue her physics studies despite feeling like an outsider in the physics department.

(D) Esquivel was the main reason why Cardenas was honored by President Obama for his work with underrepresented groups in science.

3 A reader of the article suggested that the author included the section "Studying Physics" to describe the work Esquivel does today.

Is this a reasonable claim? Which selection from the article BEST supports your answer?

(A) Yes; "Particle physicists, like Esquivel, focus on the tiny, subatomic particles that are smaller than an atom, such as electrons and muons."

(B) Yes; "'There are no answers to the questions we are asking,' Esquivel says. And often, a new discovery leads to many more questions than answers."

(C) No; "Today, Esquivel is comfortable with a profession full of tough questions and uncertainty. But it wasn't always that way."

(D) No.; "Growing up in McAllen, Texas, Esquivel was fascinated by outer space. She loved watching science fiction movies with her aunt and attending math and science summer camps."

4 Read the following paragraph from the Introduction [paragraphs 1-2].

> *Instead, she relies on a giant circular electromagnet 50 feet in diameter that shoots particles at nearly the speed of light. An electromagnet is a type of magnet in which the magnetic field is generated by an electric current. The hope is that this electromagnet — also known as a particle storage ring — at Fermilab in Batavia, Illinois, will teach physicists more about muons and how they behave in the universe.*

What is the MAIN reason why the author includes this paragraph in the article?

(A) It describes how Fermilab formed and why it is important.

(B) It describes the experiment that Esquivel is working on at Fermilab.

(C) It explains why Esquivel first got interested in particle physics.

(D) It explains why Esquivel felt that she did not belong to her physics program.

This article is available at 5 reading levels at https://newsela.com.

Dream Jobs: Doctor and researcher

By Alexa Kurzius on 04.07.20
Word Count **1,116**
Level **MAX**



Image 1. Russell Joseph Ledet is earning his medical degree and business degree at Tulane University in New Orleans, Louisiana. Ledet wants to focus on child and adolescent psychiatry so that he can help children in his community. Photo: NYU School of Medicine

When Russell Joseph Ledet and a group of black medical students visited a plantation museum, he knew the trip would make a big impact. Fifteen students from Tulane University stood in short white coats in front of what used to be the slave quarters of the Whitney Plantation. Today, it is a museum in Edgard, Louisiana. They took photos and shared them on Twitter, getting more than 88,000 views and 21,000 retweets. "We are truly our ancestors' wildest dreams," wrote his classmate Sydney Labat on Twitter.

You might say Ledet himself is his own wildest dream, choosing a career in medicine and scientific research when he never even thought he was smart enough to go to college. After serving in the U.S. Navy for almost 10 years, he completed an undergraduate degree in chemistry and biology and a Ph.D. in molecular oncology.

Now, he is earning his medical degree and business degree at Tulane University in New Orleans, Louisiana. And though the focus of his studies has changed throughout the years, his passion for science and helping people has remained constant. "I want to help my community through science and medical research," he said.

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Background And Interest In Science



Ledet grew up in Lake Charles, Louisiana, a small city about two hours east of Houston, Texas. The city is anchored by a chemical plant that many locals, such as Ledet's uncles, worked at. Ledet and his sister were raised by a single mom who worked as a nurse's aide. "There were times when we struggled to make ends meet," he said. High school was also tumultuous due to a rocky relationship with his mother's boyfriend. His classes, at the time, were an afterthought. "I didn't think college was an option," he said.

Ledet finished high school a year early instead and enlisted in the Navy, where he could get a steady paycheck and a nice place to live. After boot camp, the Navy relocated him to Washington, D.C., and later Pensacola, Florida, where he trained in cryptology. This is the study of coded messages or secure communication. It has real-life applications today with transmitting electronic data and information.

All service members and veterans of the armed forces can get tuition assistance for college or trade schools through the GI Bill. Signed into law by President Franklin D. Roosevelt in 1944, the GI Bill was created to provide education, loan, and unemployment benefits to help service members and veterans in their civilian lives. In Ledet's case, his wife, Mallory Alise convinced him to go to college on the GI Bill, telling him that he was smart enough to do so. Ledet began studying social work at Southern University and A&M College in Baton Rouge, Louisiana, but soon transitioned to a dual chemistry and biology major after taking an introductory class and getting encouragement from his professor. "I loved everything about chemistry," he said. "It just made sense to me."

Later, another professor encouraged him to apply for summer research positions, which are like internships but for scientific research careers. Students help conduct experiments in government, university and industry labs. In the summers between college classes, Ledet worked at Louisiana State University and Merck Pharmaceuticals in Boston, Massachusetts.

From these experiences, Ledet learned how much he loved the research process, which includes asking questions, conducting experiments and analyzing data to answer a scientific question. He applied and got into a doctorate (Ph.D.) program at New York University in New York City. Ledet studied oncology, or the study of cancer. Specifically, he studied molecular oncology, which combines chemistry with the study of cancer at the genetic level. He ended up in a lab studying prostate cancer, the most commonly diagnosed cancer in black men. His research was funded by the Ford Foundation and the Howard Hughes Medical Institute. "I wanted to study the things that might affect me or someone like me in my lifetime," he said.

During his Ph.D. studies, he met other black scientists who could identify with his experiences. Marcus Lambert, a dean at Weill Cornell Medical College and a researcher in educational and health equity, served as a mentor. Phillip Thomas, a Ph.D. student in pharmacology, or the study of medicines, was his close friend.

This was important, given that only about 2,200 black or African American students earn their Ph.D. each year, and less than 6 percent of full-time faculty at colleges and institutions are black.

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"At times I felt like I didn't fit the mold," Ledet said. "I looked different and talked differently from those around me," he said. Having mentors and friends that "just understood me and my culture was really meaningful," he said.



Looking Ahead

Ledet received his Ph.D. in 2018. Yet, he wanted to influence his community not just with scientific research, but medicine too. So Ledet decided to go to medical school. He chose Tulane University in New Orleans, Louisiana, because of its similarity to his community growing up and the support he received from a local church that he now attends. Later, he learned that he received a full scholarship.

With his medical degree, Ledet wants to focus on child and adolescent psychiatry so that he can help children who struggled like he did as a youth. "I know I am not the only one who went through tumultuous stuff," he said. He hopes to connect his Ph.D. studies to investigate the prevalence of mood and behavior disorders in minority communities.

Ledet acknowledges that he had a difficult journey to get to where he is today. Part of it he attributes to a socio-economic disparity that many people of color experience. "Growing up, I didn't have access to professional mentors who could steer me in the right direction," he said. But he made up for it by being curious and asking questions of everyone he met and admired as an adult. This led him to try a variety of career paths, and it ultimately led him to pursue the scientific career he has today. "Curiosity is the first sign that you love science," he said.

Though it might seem insurmountable, Ledet is confident that people of all backgrounds can pursue scientific careers. "Dare to be what you doubt you can be," he said. "It worked for me."

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Quiz

1 Read the following sentence from the Introduction [paragraphs 1-3].

"I want to help my community through science and medical research," he said.

Which answer choice BEST supports the idea that Russell Joseph Ledet plans to use his work to improve the lives of people with experiences similar to his?

(A) You might say Ledet himself is his own wildest dream, choosing a career in medicine and scientific research when he never even thought he was smart enough to go to college. After serving in the U.S. Navy for almost 10 years, he completed an undergraduate degree in chemistry and biology and a Ph.D. in molecular oncology.

(B) After boot camp, the Navy relocated him to Washington, D.C., and later Pensacola, Florida, where he trained in cryptology. This is the study of coded messages or secure communication. It has real-life applications today with transmitting electronic data and information.

(C) He applied and got into a Ph.D. program at New York University in New York City. Ledet studied oncology, or the study of cancer. Specifically, he studied molecular oncology, which combines chemistry with the study of cancer at the genetic level.

(D) With his medical degree, Ledet wants to focus on child and adolescent psychiatry so that he can help children who struggled like he did as a youth. "I know I am not the only one who went through tumultuous stuff," he said.

2 Read the following sentences from the article.

1. *Ledet and his sister were raised by a single mom who worked as a nurse's aide.*
2. *In Ledet's case, his wife, Mallory Alise convinced him to go to college on the GI Bill, telling him that he was smart enough to do so.*
3. *Ledet began studying social work at Southern University and A&M College in Baton Rouge, Louisiana, but soon transitioned to a dual chemistry and biology major after taking an introductory class and getting encouragement from his professor.*
4. *He chose Tulane University in New Orleans, Louisiana, because of its similarity to his community growing up and the support he received from a local church that he now attends.*

Which two sentences taken together provide the BEST evidence to support the idea that motivation provided by those around Ledet helped to change the course of his career?

(A) 1 and 2

(B) 2 and 3

(C) 3 and 4

(D) 1 and 4

3 Which of the following BEST explains how the information about photos of Ledet and other students at the Whitney Plantation interacts with the statistics about black and African American students earning their Ph.D. each year?

(A) The information about the photos introduces the significance of Ledet's achievements, and the statistics further develop and support this idea.

(B) The information about the photos introduces the difficulty of earning a college degree, and the statistics contrast and contradict this idea.

(C) The information about the photos categorizes Ledet as a chemistry student, and the statistics highlight his skill in a different category of study.

(D) The information about the photos categorizes Tulane University as a top medical school, and the statistics elaborate on its value for students.

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4 Which of the following would BEST describe Ledet's reaction to his academic success?

(A) Ledet wishes that he could have spent more of his academic career focused on psychiatry.

(B) Ledet feels thankful that he was able to train in cryptology while also serving in the Navy.

(C) Ledet believes it shows that anyone can overcome hardship with curiosity and hard work.

(D) Ledet understands that starting with a Ph.D. makes getting a medical degree much easier.

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US History

World War I was World's First "Total War"

By Jennifer D. Keene, The Gilder Lehrman Institute of American History, adapted by Newsela staff on 12.09.16

Word Count **1,145**

Level **1030L**



TOP: View of USS ARIZONA on the East River in New York City, 1916. The powerful battleship was later used to guard President Wilson on his way to the Paris Peace Conference. MIDDLE: Woodrow Wilson's Message Calling for War, April 2, 1917. Gilder Lehrman Collection. BOTTOM: Cartoon showing the gap left by the U.S. not joining the League of Nations, December 1920. Public domain

World War I swept across Europe in the summer of 1914. The Allies were England, France, Belgium, Serbia and Russia, and eventually totaled 18 nations including Japan, Italy and the United States. They fought the Central Powers, which were Germany, Austria-Hungary, the Ottoman Empire and Bulgaria. Nine million lives would be lost in the war.

In June of 1914, the heir to the Austro-Hungarian throne was shot and killed by assassins in order to gain land. This led to Germany attacking Belgium and France in August 1914. In the early months of the war, Germany, France and Britain dug dirt trenches that ran 460 miles from the North Sea to Switzerland, where millions of soldiers would live and die.

Americans debated for two and a half years about joining the war. In 1914, President Woodrow Wilson said the United States would stay neutral, because many Americans were immigrants from countries of both the Central Powers and the Allies. They disagreed over which countries had

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started the war and which countries should be supported by America, so Wilson urged Americans not to take sides.

For the U.S., staying neutral was difficult

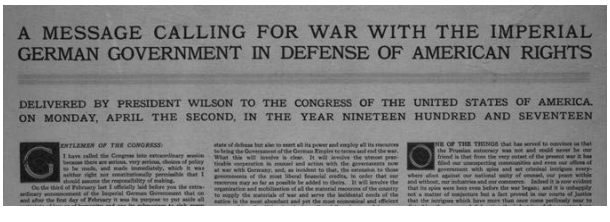
However, America traded with both England, of the Allies, and Germany, of the Central Powers. Staying neutral was difficult. Wilson worried that U.S. business could be hurt by the war. At first, Wilson stopped American banks from loaning money to countries fighting the war. This would make it impossible for them to buy what they needed to continue fighting. England, France and the Allies started running out of money and stopped buying American goods. This plan was not working, so American banks were allowed to loan money to the Allies again. The war hurt American and German trade, too. The English blockade of battleships stopped U.S. ships from bringing goods to Germany. Germany fought back with a new weapon. German U-boats, or submarines, sunk ships going between England and America.

On May 7, 1915, a German U-boat sank the Lusitania, a British passenger ship sailing off the coast of Ireland. More than 100 Americans were killed. The Germans said they had put warnings in American newspapers telling passengers to stay off ships heading to the war zone. Germany also said the Lusitania had been carrying war supplies for England. However, to this day, this has never been proved to be true. Wilson warned Germany that Americans must be able to travel and trade with any country.

Germany said it would honor Wilson's demands. But three months later, a German U-boat sank another British passenger ship. Two Americans died. To calm Wilson, Germany promised to stop surprise attacks on passenger ships. The Germans also stopped surprise attacks on supply ships. These promises helped keep the United States out of the war in 1915 and 1916.

Germany tried to stir up trouble between the U.S. and Mexico

In January of 1917, German U-boats started sinking many Allied ships. Germany didn't think the United States was prepared to join the war. Meanwhile, Arthur Zimmermann, a German leader, also tried to stir up trouble between the United States and Mexico. He sent a telegram to Mexico asking the country start a border war with the United States. In return, Germany would get back Mexican land that had become Texas, New Mexico and Arizona. The English got a copy of the telegram, broke the secret code and sent the information to Wilson. The telegram was put in the U.S. newspapers, showing that Germany was America's enemy. Two months later, German U-boats sank three American merchant ships.


A MESSAGE CALLING FOR WAR WITH THE IMPERIAL GERMAN GOVERNMENT IN DEFENSE OF AMERICAN RIGHTS

DELIVERED BY PRESIDENT WILSON TO THE CONGRESS OF THE UNITED STATES OF AMERICA, ON MONDAY, APRIL THE SECOND, IN THE YEAR NINETEEN HUNDRED AND SEVENTEEN

GENTLEMEN OF THE CONGRESS:

I have called the Congress into extraordinary session because there are serious, very serious, choices of policy to be made, and made immediately, which it was neither right nor constitutionally permissible that I should assume the responsibility of making.

On the third of February last I officially laid before you the extraordinary announcement of the Imperial German Government that on and after the first day of February it was its purpose to put

state of defense but also to exert all its power and employ all its resources to bring the Government of the German Empire to terms and end the war. What this will involve is clear. It will involve the utmost practicable cooperation in counsel and action with the governments now at war with Germany, and, as incident to that, the extension to those governments of the most liberal financial credits, in order that our resources may so far as possible be added to theirs. It will involve the organization and mobilization of all the material resources of the country to supply the materials of war and serve the incidental needs of the nation in the most economical and yet the most liberal and efficient

ONE OF THE THINGS that has served to convince us that the Prussian autocracy was not and could never be our friend is that from the very outset of the present war it has filled our unsuspecting communities and even our offices of government with spies and set criminal intrigues everywhere afoot against our national unity of counsel, our peace within and without, our industries and our commerce. Indeed it is now known that its spies were here even before the war began; and it is unhappily too true, too painfully true, that not a few men, born and bred under the open process of our own laws, have been tempted to betray their country for the sake of the money, the position, and the

Wilson asked Congress for a declaration of war on April 2, 1917. Wilson said the United States must go to war because the world "must be made safe for democracy." War was officially declared against Germany on April 6, 1917.

World War I involved all Americans. The government set goals for manufacturing, farming, transportation and selecting men for the military. Patriotic posters, pamphlets, films and speakers in markets, fairs and churches encouraged Americans to support the war. Americans were told "food will win the war." So there were wheatless Mondays,

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meatless Tuesdays and porkless Saturdays to save food for the troops. Laws were passed that made it a crime to keep people from joining the army or helping the enemy.

Meanwhile, the Russian Revolution began in the spring of 1917. By November, Russia left the Allies and stopped fighting in the war.

Wilson's "Fourteen Points" focused on the end of the war

On January 8, 1918, Wilson gave his "Fourteen Points" speech to Congress about what would happen at the end of the war. He spoke of democracy, people voting for their leaders, countries without weapons, countries freely trading and nations meeting together to solve problems and avoid wars.

General John J. Pershing was the leader of the American army in Europe. The troops fought in the trenches with the Allies, climbing out in the spring of 1918 to push the Germans out of France and back to their own border. Peace finally came at 11 a.m. on November 11, 1918. The Americans had lost 53,400 on the battlefield. Disease killed 63,100. Most died from the Spanish influenza. This sickness spread to the United States and killed more than half a million Americans in 1918.



THE GAP IN THE BRIDGE.

The Versailles Peace Treaty was signed in 1919 by 27 countries. This treaty made Germany pay for rebuilding countries that were attacked, and it took away all of Germany's weapons. The treaty created a League of Nations that would work to solve problems between countries and avoid wars. Many Republicans in Congress were against the League of Nations and worried the United States would lose control of how it worked with other countries. The U.S. had plans to expand its power in Central America and worried the League of Nations might stop this. Wilson wanted the country to join the League of Nation. Unfortunately, he had a stroke and was too sick to get more support. The treaty was rejected by the Senate twice in 1919 and 1920. The war officially ended for the United States in October 1921, when the Senate approved separate peace treaties with Germany, Austria and Hungary.

The United States never joined the League of Nations, but Wilson's goals in his "Fourteen Points" speech of spreading democracy, people voting for their leaders, countries without weapons, countries freely trading and nations meeting together to solve problems and avoid wars, guided America for many years.

Jennifer D. Keene, professor of history at Chapman University in California, is the author of "The United States and the First World War" (2000), "Doughboys, the Great War and the Remaking of America" (2001), and "World War I" (2006). She is currently working on a book detailing African-American soldiers' experience during the First World War and another on the significance of World War I for American society.

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Quiz

1 Which paragraph from the section "For the U.S., staying neutral was difficult" explains Wilson's strategies to keep America out of the war?

2 Which of the following sentences from the article presents the STRONGEST evidence that America suffered greatly due to the war?

(A) England, France and the Allies started running out of money and stopped buying American goods.

(B) Two months later, German U-boats sank three American merchant ships.

(C) So there were wheatless Mondays, meatless Tuesdays and porkless Saturdays to save food for the troops.

(D) This sickness spread to the United States and killed more than half a million Americans in 1918.

3 Which of the following MOST influenced Wilson's decision for the United States to declare war on Germany?

(A) the sinking of the Lusitania by the Germans

(B) the war's negative impact on American trade

(C) the telegram a German leader sent to Mexico

(D) the need to protect Americans traveling in Europe

4 Based on the article, how did Wilson's ideas about Germany change between 1914 and 1917?

(A) At first, Wilson believed Germany was an important trading partner, but later viewed Germany as a danger to America.

(B) At first, Wilson felt Germany was neutral toward the U.S., but later decided Germany was gaining too much power over America.

(C) At first, Wilson thought Germany had no interest in America, but later discovered Germany planned a secret attack on the U.S.

(D) At first, Wilson was sure that Germany would be defeated by the Allies, but later realized that Germany would not be defeated without help from the U.S.

This article is available at 5 reading levels at https://newsela.com.

The stock market crash in 1929: Warning signs went unheeded

By History.com, adapted by Newsela staff on 08.22.19
Word Count **1,290**
Level **1050L**



People gather across from the New York Stock Exchange in New York City on Black Thursday, October 24, 1929. Thousands of investors lost their savings in the worst stock market crash in Wall Street history on October 29 after a five-day frenzy of heavy trading. Too much speculation with borrowed money had inflated market values unrealistically. Photo from AP

In the spring and summer of 1929, the U.S. economy was booming. Banks and businesses were turning profits, jobs were plentiful, and investors in the stock market were watching their wealth grow. That period of economic growth and prosperity was called the Roaring '20s, referring to the 1920s.

At the time, the Federal Reserve (the Fed) — the U.S. central bank — felt the stock market was rising too fast. (The stock market is a trading system where people can invest — buy or sell shares — in companies.) It feared a crash. The Fed wanted to cool the market off, so it raised interest rates to make it more expensive to invest in stocks. Meanwhile, an increasingly vocal minority of economists and bankers were beginning to wonder how long the prosperity could last.

The Beginning Of The Stock Market Collapse

This article is available at 5 reading levels at https://newsela.com.

In 1929, experts like Yale economist Irving Fisher swore that if the economy slowed down, it would just be a harmless slump. Others predicted a steeper drop. But nobody, absolutely nobody, foresaw the stock-market collapse that happened in late October.

On two straight days, dubbed Black Monday and Black Tuesday, the stock market fell by 25 percent. Investors started panicking, selling their shares at lower and lower prices. By mid-November the stock market had lost half its value. When it finally hit rock bottom in 1932, the Dow Jones Industrial Average — an index that tracks the values of the largest companies in the U.S. and is one measure of the stock market's value — had withered away by a shocking 90 percent. The stock market crash of 1929 contributed to devastation across most of the U.S. economy. Banks went bankrupt, businesses went out of business, and unemployment soared. It was an economic disaster remembered as the Great Depression.

Hindsight is 20/20 is a familiar saying, meaning it's easy to see clearly what was going to happen after it happens. But even so, signals back in the summer of 1929 pointed to trouble ahead.

Experts Offer Their Opinions

Gary Richardson is an economics professor at the University of California, Irvine. He is also a former historian for the Federal Reserve. He has researched the Fed's role in the 1929 crash and the Great Depression that followed. He says that the first warning sign of a coming market correction was that most everyone agreed the rapidly rising market of the late 1920s couldn't last. A stock market correction is usually defined as a drop of 10 percent or more in the overall market.

"People could see in 1928 and 1929 that if stock prices kept going up at the current rate, in a few decades they'd be astronomic," says Richardson. The question was not about whether the wild stock market rise was going to end. The question was how it would end.

Economist Roger Babson was one of the most prominent prophets of economic doom at that time. He concluded that stock prices were wildly inflated. He also predicted the coming panic. In September 1929, Babson told a National Business Conference in Massachusetts that "sooner or later a crash is coming which will take in the leading stocks and cause a decline ... [T]he time is coming when the market will begin to slide off, sellers will exceed buyers and paper profits will begin to disappear."

Others, like Yale economist Fisher, brushed off fears of a correction. He had concluded that high stock prices were supported by the soaring profits of corporations. In response to Babson's dark predictions, Fisher famously told a crowd of stock brokers that stock prices had reached "what looks like a permanently high plateau." That was on October 15, 1929. Black Monday fell two weeks later.

Boom And Bust Markets

Richardson says that Americans had shown a uniquely bad habit for creating boom/bust markets. In other words, Americans invested in ways that caused different business sectors to shoot up (boom) and crash down (bust). This was true long before the stock market crash of 1929.

When a specific business market got hot — whether it was railroads, oil, construction, or another sector — these banks would loan money to investment brokers. They, in turn, made this money available so investors could buy stock shares on margin. Buying "on margin" essentially means

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borrowing money to buy an investment. An investor, for instance, might pay 10 percent to buy a share of stock. The other 90 percent is borrowed.

Buying on margin lets investors purchase more stock with less money. If all goes well, they can pay back the borrowed money from the money they make when the stock's price goes up. It's risky, however, since the broker can issue a "margin call" at any time. They can ask for immediate repayment of the borrowed money. If the share price has gone down, the investor will have to pay back the full loan balance plus fees. This practice was one of the reasons Congress created the Federal Reserve in 1914. It wanted to slow this kind of market speculation that relied on borrowed money.

The Fed Takes Action, Warns Banks

Starting in 1928, the Fed launched a very public campaign to slow down runaway stock prices. It cut off easy credit, or cheap loans, to investors, Richardson says. Back in 1929, the message was "Stop loaning money to investors," says Richardson. "This is creating a problem."

Banks didn't get the message, so the Fed resorted to "direct action." It was more like a direct threat. In a letter to every commercial U.S. bank under the Fed's authority, the central bank said that if a bank continued to lend to brokers and investors, the Fed would no longer lend money to the bank for its own operations. But that threat didn't work either.

In a last-ditch effort to undercut the spike in stock prices, the Fed decided to raise interest rates in August 1929. Interest rates are fees financial institutions charge banks, businesses, and individuals that borrow money. Higher interest rates mean higher costs for borrowing money. They in turn drive up business costs.

Investors may have missed the first two signs that the Fed wanted to slam the brakes on the stock market. This signal, though, should have been abundantly clear.

Bad Timing For Fed Interest Rate Hike

Unfortunately, the timing of the interest rate hike couldn't have been worse. Little did the Fed know that the U.S. economy had reached its peak in August 1929. Tightening the credit market was supposed to shrink stock prices by maybe 10 percent, says Richardson. Instead, it helped trigger a 90 percent dive.

Today, there are many tools for analyzing every angle of the economy and stock market. Back in 1929, there were fewer such indicators available to investors. Still, there were enough to get a sense of whether the economy was expanding or contracting. Monthly figures were published, for example, about leading indicators such as new housing permits and manufacturing orders.

"Economy Was Starting To Cool Down"

"In 1929, it was clear that there had been this big boom but that the economy was starting to cool down," says Richardson. "Just like today, there was a lot of discussion in the press about whether the economy had reached a peak or not. That all got resolved very quickly with the crash and its aftermath."

New middle-class investors seeking easy riches definitely contributed to the 1929 stock market boom and bust. However, plenty of very sophisticated investors also missed signs of the pending

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crash. And even those who were smart enough to foretell a market slide couldn't have imagined the economic disaster that was unfolding; an economic depression that would drag on for a decade.

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Quiz

1 Which answer choice describes two central ideas of the article?

(A) A panic occurred when the stock market began to crash in October of 1929; it is easy to see now how remaining calm would have helped prevent further disaster.

(B) The period of economic growth and prosperity was called the Roaring '20s; investors were putting all of their money and their hopes in the stock market continuing to rise.

(C) A number of actions by experts and investors contributed to the stock market crash of 1929; most failed to predict how events would lead to the stock market crash.

(D) The stock market crash was an economic disaster that happened just before the Great Depression of the 1930s; many people lost their homes as well as their jobs or businesses.

2 Which statement would be MOST important to include in a summary of the article?

(A) Hindsight is 20/20 is a familiar saying that means it's easy to see clearly what was going to happen after it happens.

(B) By the time the Fed took action to try to slow the actions of banks and the growth of the stock market, it was too late to prevent a crash.

(C) Americans have always invested heavily in whichever business is hottest at the moment, from railroads and construction to oil production.

(D) According to experts, a stock market correction is usually defined as a drop of 10 percent or more in the overall market in a short period.

3 What is one reason why the author includes information about buying "on margin"?

(A) to suggest one solution to the problems that were facing the Fed at the time

(B) to describe the effects of the Roaring '20s on people's ability to take out loans

(C) to elaborate on the reasons why the Federal Reserve was created in 1914

(D) to illustrate a primary cause of the inflation that intensified the size of the crash

4 What is the MAIN reason the author included the section "Experts Offer Their Opinions"?

(A) to outline the contrasting views regarding the signs and predictions of a stock market crash

(B) to illustrate that members of a National Business Conference could have stopped the crash

(C) to emphasize Gary Richardson's dedicated research on the Great Depression and the crash

(D) to argue that Irving Fisher was the primary person to blame for the stock market crash

This article is available at 5 reading levels at https://newsela.com.

Great Depression: The New Deal

By Thomas Kessner, The Gilder Lehrman Institute of American History, adapted by Newsela staff on 12.20.16

Word Count **916**
Level **1040L**



TOP: President Franklin Delano Roosevelt signs the National Labor Relations Act. Courtesy of Getty Images. BOTTOM: Men from the Reforestation Army, part of the Civilian Conservation Corps created by President Roosevelt's New Deal programs, clear brush from a hillside in the St. Joe National Forest and plant seedlings, Idaho, 1930s. Courtesy of Getty Images

Franklin Delano Roosevelt is the only president in U.S. history to have served three terms. His years in office — from 1933 to 1945 — are seen very differently by different people. For some, he was a brilliant leader who helped save the country in a time of great peril. Others view him as a president who gave the government too much power over American citizens and their businesses.

Franklin Roosevelt (1882–1945) was the only son of a wealthy upstate New York family. A distant relative of Theodore Roosevelt, he married the president's niece, Eleanor Roosevelt, in 1905. Trained in the law, he soon made his way into New York Democratic politics, and in 1910 he won election to the state Senate.

Stock market collapses

In 1928, Roosevelt was elected governor of New York. Soon after, the Great Depression followed the collapse of the stock market in October 1929. Millions of people across the country lost their

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jobs. In New York, Roosevelt introduced a series of measures that provided relief for the unemployed and helped to create new jobs. These steps made Roosevelt widely popular.

In 1932, the Democratic Party nominated FDR to run for president. The nation was trapped in the depths of the Depression and Roosevelt promised a "new deal" to help those in need. He easily defeated President Herbert Hoover, who was seeking a second term, and became the 32nd president of the United States.

Once in office, Roosevelt quickly took a series of bold and far-reaching steps. His administration introduced many new programs and agencies that provided assistance to the needy and tried to make people's lives more secure. Collectively, these reforms and programs are known as the New Deal.

New federal welfare system

Over the next eight years, the New Deal created a new federal welfare system. It included unemployment insurance for those who had lost their jobs and social security pensions to give the elderly money in retirement.

Another important part of the New Deal was its massive system of federal works projects. These were designed to put people back to work. The result included many new school buildings, post offices, airports, federal housing projects and dams.



One example of the colossal scale of these projects was the Tennessee Valley Authority. An immense project spread over seven states, its goal was to modernize the region. The Authority built dams to protect lowlands against floods. It brought electricity and running water to thousands of rural households that never had them before.

During these years Roosevelt also introduced higher tax rates for the wealthy, whom he said must pay their fair share. He signed legislation establishing the 40-hour workweek. Another new law set a minimum wage, or an amount per hour that employers cannot pay less than.

Fireside chats

Despite bitter opposition from some, Roosevelt was an extremely popular president. His frequent radio broadcasts, known as "fireside chats," and his many press conferences made him seem less distant than any president before him. In 1936, he won a second term in a landslide of votes.

There were areas in which Roosevelt failed to live up to his progressive ideals, however. For example, the New Deal did little to address widespread discrimination against black Americans. Many of the New Deal programs tolerated racial discrimination that prevented blacks from getting good jobs.

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If combatting the Depression was the focus of Roosevelt's first two terms, foreign affairs took over by the late 1930s. War was brewing in Europe. In response, Congress passed neutrality acts designed to prevent U.S. involvement. Roosevelt was unable to ignore British pleas for assistance, however, especially after the fall of France in June 1940. He used a variety of creative methods to begin sending arms to Britain.

In 1940, Roosevelt ran for a third term, campaigning on a promise to keep the United States out of war. After his historic re-election, however, the situation in Europe turned more grim. Roosevelt began providing strong support to British forces by sending massive quantities of arms and equipment.

Japan attacks Pearl Harbor

Soon, the United States was no longer able to avoid becoming involved in the war. On December 7, 1941, Japan attacked U.S. ships at Pearl Harbor, Hawaii, and three days later, Germany and Italy declared war on the United States.

In 1942, Roosevelt learned of Nazi efforts to wipe out the Jewish population in all areas that fell under their control. The president failed to respond to this Holocaust. He refused to let European Jews move to the United States and ignored pleas to have American warplanes bomb the rail lines leading to the death camps.

Despite this terrible failing, it cannot be denied that Roosevelt was a great war president. His leadership was key to the eventual Allied victory.

What Roosevelt could not do was end the Great Depression, despite all his New Deal programs. Only World War II could do that, with its relentless demand for production, manpower and constant spending. What the New Deal did accomplish was to greatly expand the social safety net to help those Americans in need. In addition, it dramatically increased the federal government's control over many aspects of American life.

Thomas Kessner, a history professor at The Graduate Center, The City University of New York, is the author of "Capital City: New York City and the Men behind America's Rise to Dominance, 1860–1900" (2003), and "The Flight of the Century: Charles Lindbergh and the Rise of American Aviation" (2010).

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the following sentences from the section "New federal welfare system."

Over the next eight years, the New Deal created a new federal welfare system. It included unemployment insurance for those who had lost their jobs and social security pensions to give the elderly money in retirement.

Which word/phrase from the text helps the reader understand the meaning of "welfare system"?

(A) the New Deal

(B) unemployment insurance

(C) lost their jobs

(D) give the elderly

2 Read the sentence below from the section "New federal welfare system".

During these years Roosevelt also introduced higher tax rates for the wealthy, whom he said must pay their fair share.

Which sentence uses "share" in the same way as the sentence above?

(A) My nephew shared his pie with his sister.

(B) Other countries do not share our values.

(C) She had never shared the secret before.

(D) You already submitted your share of the rent.

3 Read the following paragraph from the section "Fireside Chats."

Despite bitter opposition from some, Roosevelt was an extremely popular president. His frequent radio broadcasts, known as "fireside chats," and his many press conferences made him seem less distant than any president before him. In 1936, he won a second term in a landslide of votes.

How does this paragraph contribute to the development of the idea that Roosevelt was a popular president?

(A) It explains how Roosevelt was seen as accessible by the American people.

(B) It describes how Roosevelt really appreciated using fires in the White House.

(C) It tells that Roosevelt faced a close battle for his second term as president.

(D) It highlights Roosevelt's resistance to being known by his people.

4 Why does the author include the section "Japan attacks Pearl Harbor"?

(A) to discuss how the New Deal helped the economy

(B) to contrast between Roosevelt and Japanese leaders

(C) to explain what happened during a terrible time in U.S. history

(D) to show how Roosevelt was a great wartime leader

This article is available at 5 reading levels at https://newsela.com.

Farming and the Dust Bowl During the Great Depression

By UShistory.org and the Library of Congress, adapted by Newsela staff on 04.06.17
Word Count **1,001**
Level **1060L**



A dust storm looms large over a farm during the Dust Bowl of the 1930s. Photo from: U.S. Department of Agriculture.

In the years after World War I, farmers faced tough times. Most Americans were living in good fortune in the 1920s, but for the American farmer, the Great Depression began early.

In the 1920s, many farmers found themselves in a continual cycle of debt. Their money problems stemmed from falling farm prices and the need to purchase expensive machinery. When the stock market crashed in 1929, sending prices in an even more downward cycle, many American farmers wondered if their hardscrabble lives would ever improve.

Agricultural Adjustment Administration is introduced

The first major project of the New Deal, an ambitious set of laws passed during the Great Depression, aimed to help farmers by raising farm prices to the levels they were at from 1909-14. The Agricultural Adjustment Administration was created for this purpose. One method of driving up prices is to limit supply. Simply put, if farmers produced less, the prices of their crops and livestock would increase.

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The AAA identified seven basic farm products: wheat, cotton, corn, tobacco, rice, hogs and milk. Farmers who produced these goods were paid by the AAA to reduce the number of acres that crops were grown on or the amount of livestock raised. In other words, farmers were paid to farm less!

Newspapers and the public immediately cried foul. To meet the demands set by the AAA, farmers plowed under millions of acres of already planted crops. Six million young pigs were slaughtered to meet the guidelines. In a time when many were out of work and tens of thousands were starving, this wastefulness was considered downright wrong.

Nevertheless, farm income did increase under the AAA. Cotton, wheat and corn prices doubled in three years. Despite having misgivings about working with the government, farmers overwhelmingly approved of the program.

Sharecropping system disappears

Unfortunately, the benefits did not trickle down to the poorest. Farmers who didn't own the land they worked on did not receive government aid — instead the government dollars went to their landlords. The owners often bought better machinery with the money, which further reduced the need for farm workers.

The Supreme Court put an end to the AAA in 1936, by declaring it unconstitutional. At this time, President Franklin Roosevelt's administration decided to repackage parts of the program to try to save the environment. Not only were farmers in the 1920s facing an economic depression, they were also up against an environmental crisis. After years and years of plowing and planting, much of the soil of the Great Plains had become depleted and weak. Winds blew clouds of dust that fell like brown snow across the region as residents of the "Dust Bowl" moved west in search of better times.

Billowing clouds of dust

Between 1930 and 1940, the southwestern Great Plains region of the United States suffered a severe drought. Once a semi-dry grassland, the treeless plains became home to thousands of settlers when, in 1862, Congress passed the Homestead Act. Most of the settlers farmed their land or grazed cattle. The farmers plowed the prairie grasses and planted dryland wheat. As the demand for wheat products grew, cattle grazing was reduced, and millions more acres were plowed and planted.

Dryland farming on the Great Plains led to the eventual destruction of the prairie grasses. Gradually, the land was laid bare, and significant environmental damage began to occur. Among the natural elements, the strong winds of the region were particularly devastating.

With the onset of drought in 1930, the over-farmed and over-grazed land began to blow away. Winds whipped across the plains, raising billowing clouds of dust. The sky could darken for days, and even well-sealed homes could end up with a thick layer of dust on the furniture. In some places, the dust drifted like snow, covering farm buildings and houses. The crisis affected 19 states in the heartland of the United States. With no chance of making a living, farm families abandoned their homes and land in these areas, fleeing westward to become migrant laborers.

In all, 400,000 people left the Great Plains, victims of the combined action of severe drought and poor soil conservation practices. In his 1939 book "The Grapes of Wrath," author John Steinbeck

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described the flight of some of these families: "They streamed over the mountains, hungry and restless — restless as ants, scurrying to find work to do — to lift, to push, to pick, to cut — anything, any burden to bear, for food. The kids are hungry. We got no place to live. Like ants scurrying for work, for food, and most of all for land."

Desperate times and desperate measures

The Soil Conservation and Domestic Allotment Act paid farmers to plant clover and alfalfa instead of wheat and corn. These crops help restore the soil so that other crops can be grown in it in the future. At the same time, the government achieved its goal of reducing the land farmers were using to grow underpriced goods.

Another major problem faced by American farmers had to do with mortgages. A mortgage is a loan a family can take out to buy a home. It was becoming harder for farmers to keep up with the monthly payments on their mortgages, and many ended up losing their property to the banks in a process called a foreclosure. Across the Corn Belt of the Midwest, the situation grew desperate. Farmers pooled money to bail out needy friends. Minnesota and North Dakota passed laws restricting farm foreclosures. In Le Mars, Iowa, an angry mob beat a foreclosing judge almost to death in April 1933.

FDR intended to stop the madness. The Farm Credit Act, passed in March 1933, helped farmers avoid foreclosures. The Frazier-Lemke Farm Bankruptcy Act helped farmers buy back lost land.

While these laws and government programs helped ease some of the burdens on American farmers in the 1920s and '30s, times continued to be tough. America would not fully recover from the Great Depression until the 1940s.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Why were the 1920s harder for farmers than they were for the rest of the country?

(A) After the stock market crashed and the US economy failed, the price of food fell dramatically.

(B) Farmers had to buy expensive new machinery while making less money off falling food prices.

(C) Environmental disasters around the country impacted farmers at higher rates than average people.

(D) The government implemented new health regulations that made it harder for farmers to sell their crops.

2 The central idea of the article is developed by:

(A) contrasting earlier farming conditions with the ones that arose during the Great Depression

(B) describing the difficulties farmers faced and the government's efforts to help

(C) highlighting the impact technology had on farming techniques and workers

(D) summarizing the events of the Great Depression that affected the farming industry

3 How did the government try to help farmers during this period?

1. The Agricultural Adjustment Administration paid them to destroy some of their crops and livestock in order to raise the prices on them.
2. The Soil Conservation and Domestic Allotment Act helped them renew their land by paying them to plant new crops that would recover the soil.
3. The Farm Credit Act tried helped farmers avoid the rash of bank foreclosures on farms happening across the country.

(A) 1 and 2

(B) 1 and 3

(C) 2 and 3

(D) 1, 2, and 3

4 Which of the following sentences from the article BEST develops a central idea?

(A) Their money problems stemmed from falling farm prices and the need to purchase expensive machinery.

(B) The owners often bought better machinery with the money, which further reduced the need for farm workers.

(C) Not only were farmers in the 1920s facing an economic depression, they were also up against an environmental crisis.

(D) The Soil Conservation and Domestic Allotment Act paid farmers to plant clover and alfalfa instead of wheat and corn.

5 What was the relationship between how much food was available to how much it cost during the Depression?

(A) When there was less food to buy, the price of food rose because people were willing to spend more money on it.

(B) When there was less food to buy, the price of food dropped because the government forced farmers to lower their prices.

(C) When there was more food to buy, the price of food rose because farmers had more control of the prices.

(D) When there was more food to buy, the price of food dropped because the government bought all the food in bulk and distributed it for free.

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6 Which BEST describes the structure of the section "Desperate times and desperate measures"?

(A) cause and effect

(B) simple to complex

(C) chronological order

(D) compare and contrast

7 Which statement best describes the relationship between the Dust Bowl, The Depression, and migration trends?

(A) More people left farmland to find jobs in urban centers on the East Coast.

(B) More people moved into the deserted areas of the Great Plains seeking cheap land.

(C) More people moved from farms in the South to land further North where rainfall was more consistent.

(D) More people from the Great Plains moved Westward to seek out new jobs and opportunities.

8 What role does the section "Agricultural Adjustment Administration is introduced" play in the article as a whole?

(A) It explains why many of the governments efforts to help farmers failed.

(B) It introduces the argument against government involvement in the farming industry.

(C) It gives a summary of a major government project created during the Great Depression.

(D) It provides an example of a government project aimed at helping farmers.

This article is available at 5 reading levels at https://newsela.com.

The Holocaust, Part One: The Rise of Adolf Hitler and World War II

By History.com, adapted by Newsela staff on 02.23.17
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Level **1040L**



National Socialist German Workers' Party members, known as Nazis, salute their leader Adolf Hitler (center) in 1930. Four years later, he became the sole leader of Germany. Photo from: Wikimedia Commons

The first in a two-part series

The word "Holocaust" comes from the Greek words "holos" (whole) and "kaustos" (burned). The term was historically used to describe a sacrificial offering burned on an altar.

Since 1945, however, the word has become synonymous with one of the darkest chapters in human history: the mass murder of some 6 million European Jews by the German Nazi regime during World War II. Millions of others from targeted groups were also put to death, including Roma (sometimes negatively called Gypsies), homosexuals and people with disabilities. Jews, though, were the Nazis' main targets and victims.

To Nazi leader Adolf Hitler, Jews were an inferior race. He and his followers considered Jews an alien threat to German racial purity and society. Once he came to power, he was able to turn his nightmarish ideas into deadly action. Hitler's "Final Solution" — now known as the Holocaust —

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happened under the cover of world war. As world powers concentrated on battlefronts, Nazis constructed mass killing centers in the concentration camps of Nazi-occupied Europe.

Historical anti-Semitism and Hitler's rise to power

Anti-Semitism, or anti-Jewish bigotry, had roots in Europe long before Hitler's rise. Followers of the Jewish faith were often viewed as strange outsiders by their Christian neighbors. However, an intellectual movement in the 17th and 18th centuries, called the Enlightenment, emphasized religious tolerance. In the 19th century, Napoleon and other European rulers passed laws ending official discrimination against Jews. But anti-Jewish feelings did not end. In many places, hateful attitudes became less about religious differences and more about racial hostility.

The roots of Hitler's vicious brand of anti-Semitism are unclear. Born in Austria in 1889, he served in the German army during World War I, which began in 1914. After its defeat in 1918, Germany was left with a shattered government and ruined economy. Like many anti-Semites in Germany, Hitler blamed the Jews for the country's downfall. This ignored the fact that some 100,000 German Jews fought for their country during the war.

Soon after the World War I ended, Hitler joined a political group that became the National Socialist German Workers' Party. It was better known to English speakers as the Nazis. In 1923, Hilter was found guilty of treason for his leadership role in an attempt to overthrow the government of Bavaria, a German state.

While imprisoned, Hitler wrote the book "Mein Kampf"—"My Struggle" — in which he predicted a European war that would result in "the extermination of the Jewish race in Germany." Hitler was obsessed with the idea of the superiority of the "pure" German race, which he called "Aryan." He also argued for the need for "Lebensraum," or living space, for that race to expand.

In the years after he was released from prison, Hitler took advantage of the weakness of his political opponents. He built his party's power. On January 20, 1933, he was named chancellor of Germany. The next year he anointed himself "der Führer" — Germany's supreme ruler. Huge Nazi rallies drove home the message of party strength.

The twin goals of racial purity and territorial expansion were the core of Hitler's worldview. After 1933, they became the driving forces behind his foreign and domestic policy.

Nazis start the "Aryanization" of Germany

The Nazis opened the first concentration camp at Dachau, Germany, in March 1933. Many of its prisoners were the Nazis' political enemies. By July that year, such camps held some 27,000 prisoners. Like the network of labor and prison camps that followed, Dachau was under the control of Heinrich Himmler. Himmler served as head of the elite Nazi guard, the Schutzstaffel (SS). He later became chief of the German police, or Gestapo.

In 1933, Jews in Germany numbered around 525,000, about 1 percent of Germany's population. During the next six years, Nazis undertook the "Aryanization" of Germany. They dismissed Jews from civil service. They closed Jewish-owned businesses and stripped Jewish lawyers and doctors of their clients. Under the Nuremberg Laws of 1935, anyone with three or four Jewish grandparents was considered a Jew. Those with two Jewish grandparents were designated Mischlinge, or half-breeds.

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Under these laws, Jews of all ages became routine targets for discrimination and persecution. This came to a head on Kristallnacht, or the "night of broken glass," in November 1938. Synagogues, Jewish buildings of worship, were burned and windows in Jewish shops were smashed. Some 100 Jews were killed and thousands more arrested. Between 1933 and 1939, hundreds of thousands of Jews fled Germany if they could. Those who remained lived in a constant state of uncertainty and fear.

World War II begins

In September 1939, the German army invaded the western half of Poland, marking the beginning of World War II. German forces soon forced tens of thousands of Polish Jews from their homes. They were sent to Jewish areas in Polish cities known as ghettos where they were surrounded by high walls and barbed wire. These virtual prison camps suffered widespread poverty and hunger. In addition, overpopulation made them breeding grounds for deadly diseases like typhus.

In the fall of 1939, Nazi officials began identifying about 70,000 Germans with physical and mental disabilities. Hilter planned for them to be systematically gassed to death in the so-called euthanasia program. After German religious leaders protested, Hitler officially ended the program in August 1941, but it continued in secret. By the war's end in 1945, some 275,000 people with disabilities had been killed. In hindsight, it seems clear that this program served as a test run for the Holocaust.

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Quiz

1 Read the section "Historical anti-Semitism and Hitler's rise to power."

Select the paragraph that suggests Hitler's anti-Jewish sentiment was not unheard of in Europe before his rise to power.

(A) Anti-Semitism, or anti-Jewish bigotry, had roots in Europe long before Hitler's rise. Followers of the Jewish faith were often viewed as strange outsiders by their Christian neighbors. However, an intellectual movement in the 17th and 18th centuries, called the Enlightenment, emphasized religious tolerance. In the 19th century, Napoleon and other European rulers passed laws ending official discrimination against Jews. But anti-Jewish feelings did not end. In many places, hateful attitudes became less about religious differences and more about racial hostility.

(B) The roots of Hitler's vicious brand of anti-Semitism are unclear. Born in Austria in 1889, he served in the German army during World War I, which began in 1914. After its defeat in 1918, Germany was left with a shattered government and ruined economy. Like many anti-Semites in Germany, Hitler blamed the Jews for the country's downfall. This ignored the fact that some 100,000 German Jews fought for their country during the war.

(C) Soon after the World War I ended, Hitler joined a political group that became the National Socialist German Workers' Party. It was better known to English speakers as the Nazis. In 1923, Hilter was found guilty of treason for his leadership role in an attempt to overthrow the government of Bavaria, a German state.

(D) While imprisoned, Hitler wrote the book "Mein Kampf"—"My Struggle" — in which he predicted a European war that would result in "the extermination of the Jewish race in Germany." Hitler was obsessed with the idea of the superiority of the "pure" German race, which he called "Aryan." He also argued for the need for "Lebensraum," or living space, for that race to expand.

2 Which section of the article BEST highlights the idea that Hitler's political party took many steps to remove Jews from German life?

(A) Introduction [paragraphs 1-3]

(B) "Historical anti-Semitism and Hitler's rise to power"

(C) "Nazis start the Aryanization of Germany"

(D) "World War II begins"

3 Read the section "Historical anti-Semitism and Hitler's rise to power."

Which of the following MOST influenced Hitler's political philosophy?

(A) his misunderstanding of the Jewish religion

(B) his service in the German army

(C) his study of historical movements that expressed hateful religious ideas

(D) his country's downfall after World War I

4 Finish the sentence below.

In the introduction [paragraphs 1-3], the author MAINLY explains the significance of the Holocaust by .....

(A) highlighting the depths of the horrible things that occurred.

(B) summarizing its dominant political philosophy.

(C) explaining its long-term impacts.

(D) contrasting it with other anti-religious movements.

This article is available at 5 reading levels at https://newsela.com.

The Road to Pearl Harbor

By USHistory.org, adapted by Newsela staff on 05.04.17
Word Count **1,003**
Level **1130L**



German dictator Adolf Hitler accepts the ovation of the Reichstag in Berlin, Germany, after announcing the "peaceful acquisition of Austria" in 1938. It set the stage to annex the Czechoslovakian Sudetenland, largely inhabited by a German-speaking population. Photo from the National Archives

Storm clouds were darkening around the world. While Americans struggled to make ends meet during the Great Depression, dictatorship swept Italy and Germany.

Nations fell victim to new aggressive leaders. Japan struck first, invading China, then Italy struck at Ethiopia. Germany, led by Adolf Hitler, was the greatest fear. Like dominoes, the nations surrounding Germany began to fall. The world braced itself for another great conflict. Remembering the scars caused by World War I, Americans hoped to remain separate from the danger.

Reactions to a troubled world

The day after Franklin Roosevelt took the oath of office as president the Nazi government gave Adolf Hitler control of Germany. Germany had become very poor after it lost World War I. Now, Hitler vowed to make Germany strong again.

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Authoritarianism and militarism were spreading across Europe and East Asia. In 1936, Hitler and the Italian dictator, Benito Mussolini, formed the Rome-Berlin Axis. The alliance's name reflected its leaders' belief that the imaginary line that connected the two capitals would be the axis around which the entire world would revolve. Later in 1936, Hitler broke the Treaty of Versailles, which was signed after World War I to keep the peace. Spain had its own dictator rise to power.

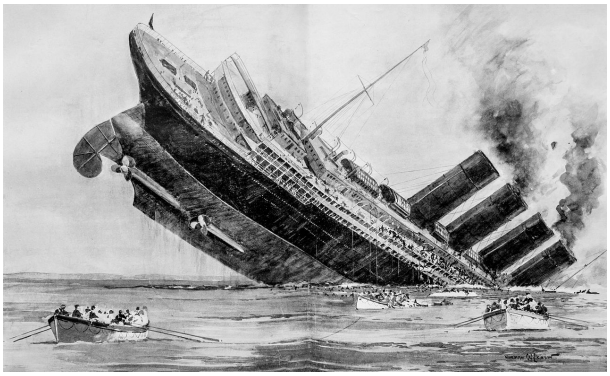
Meanwhile, Europe, America, Britain, and France sat on the sidelines. No government was willing to confront the dictators, for fear of repeating World War I.

1930s isolationism

At the dawn of the 1930s, foreign policy was not a burning issue for the average American. The stock market had just crashed causing the Great Depression and each passing month brought greater and greater hardships, as businesses closed and many people lost their jobs and homes. U.S. citizens were convinced the most important problems to be tackled were in the U.S., not Europe.

A series of laws were passed by Congress called the Neutrality Acts. Congress passed these laws in hopes of avoiding the traps that plunged the U.S. into World War I. The Neutrality Act of 1935 prohibited the shipping of arms to nations at war, even the victims of attacks.

The Neutrality Act of 1936 added more restrictions. No loans could be made to nations at war, and Americans weren't permitted to travel on the ships of nations at war. Congress wanted no more incidents like the sinking of the Lusitania – when a German submarine sunk the British ship Lusitania carrying British and Americans during World War I, killing 1,198 people on board.



A Neutrality Act of 1937 limited any trade to belligerent nations to a "cash and carry basis." This meant that a nation buying good from the U.S. would have to use its ships to transport goods to avoid American entanglements on the high seas.

Lend-Lease

Britain and France declared war on Nazi Germany on September 3, 1939. Two days later, President Roosevelt issued a proclamation of neutrality. However, FDR knew that the only chance Britain and France would have to defeat the German Reich was to have ample supplies of weaponry. He immediately began to press Congress to repeal the arms embargo that banned weapons sales. FDR wanted to be able to sell arms to Britain and France, as long as they used their own ships and paid all at once.

Americans who believed the U.S. should stay isolated were concerned, but support for the President's idea was strong enough. The Neutrality Act of 1939 ended the arms embargo and permitted the sales of weapons on a "cash and carry" basis.

On April 9, 1940, the German blitzkrieg – sudden strike – moved rapidly into Denmark and Norway. The German military steadily advanced through the Netherlands, Belgium, Luxembourg and into northern France. The French were forced to surrender to the Germans. Britain was the only democracy in Europe opposing Germany.

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Prime Minister Winston Churchill desperately pleaded with Roosevelt for assistance. Slowly but surely American public opinion shifted toward helping the British, but a great debate raged about how the U.S. should do it.

Britain simply did not have the money to pay for all the weapons they needed, so Roosevelt hatched a new plan called Lend-Lease. Roosevelt publicly mused that if a neighbor's house is on fire, nobody sells him a hose to put it out. Common sense says that the hose is lent to the neighbor and returned when the fire is extinguished. The United States could simply lend Great Britain the weapons it would need to fight the war. Congress hotly argued over the proposal. Senator Robert Taft retorted: "Lending war equipment is a good deal like lending chewing gum. You don't want it back."

In March 1941, Congress approved the Lend-Lease Act, which Hitler saw as a declaration of war, leading him to order attacks on American ships.

Roosevelt began his third term – the first of any president. In his famous Four Freedoms Speech, he urged Congress and Americans to take action, and explained what he believed were the rights of the world's citizens and why America should lead the way in securing these freedoms.

The first is freedom of speech and expression. The second is freedom of every person to worship God in his own way. The third is freedom from want, which means having enough food, clothing and a place to live. The fourth is freedom from fear, which means a world-wide reduction of weapons so that no nation will be in a position to attack any neighbor.

In the end, it was Japan who provoked the United States into war. Viewing the United States as the only nation standing against its domination of the Pacific, Japan launched a ruthless surprise attack against American naval bases at Pearl Harbor on December 7, 1941. Faced with an assault on its own forces, the United States finally entered World War II.



This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which idea is BEST supported by the following paragraph from the section "1930s isolationism"?

The Neutrality Act of 1936 added more restrictions. No loans could be made to nations at war, and Americans weren't permitted to travel on the ships of nations at war. Congress wanted no more incidents like the sinking of the Lusitania – when a German submarine sunk the British ship Lusitania carrying British and Americans during World War I, killing 1,198 people on board.

(A) Americans were still angry with Germany for the sinking of the Lusitania.

(B) Nations at war were angered by the serious limitations the U.S. put in place.

(C) Many more American deaths were prevented by the Neutrality Act of 1936.

(D) U.S. foreign policy was shaped by the negative effects of World War I.

2 Which of the following selections from the article BEST supports the idea that Roosevelt believed U.S. involvement in the war was essential?

(A) Two days later, President Roosevelt issued a proclamation of neutrality. However, FDR knew that the only chance Britain and France would have to defeat the German Reich was to have ample supplies of weaponry.

(B) Roosevelt publicly mused that if a neighbor's house is on fire, nobody sells him a hose to put it out. Common sense says that the hose is lent to the neighbor and returned when the fire is extinguished.

(C) In his famous Four Freedoms Speech, he urged Congress and Americans to take action, and explained what he believed were the rights of the world's citizens and why America should lead the way in securing these freedoms.

(D) Viewing the United States as the only nation standing against its domination of the Pacific, Japan launched a ruthless surprise attack against American naval bases at Pearl Harbor on December 7, 1941.

3 HOW do the introduction [paragraphs 1-2] and the final paragraph of the article relate to one another?

(A) Both describe military aggression that caused nations to become involved in World War II.

(B) Both describe domestic reasons why Americans favored an isolationist foreign policy.

(C) Both describe problems the U.S. had with getting actively involved in World War II.

(D) Both describe the effects of poverty on the rise of dictators around the world.

4 Read the sentences from the article below.

U.S. citizens were convinced the most important problems to be tackled were in the U.S., not Europe.

Americans who believed the U.S. should stay isolated were concerned, but support for the President's idea was strong enough.

Slowly but surely American public opinion shifted toward helping the British, but a great debate raged about how the U.S. should do it.

HOW does the relationship between these sentences develop the CENTRAL idea of the article?

(A) They illustrate the two effects of American foreign policy and their primary cause.

(B) They outline a problem with American involvement in the war and two solutions.

(C) They demonstrate the evolution of Americans' ideas about the war in response to events.

(D) They emphasize the causes of Americans' growing support for involvement in the war.

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This article is available at 5 reading levels at https://newsela.com.

The Holocaust, Part Two: The "Final Solution"

By History.com, adapted by Newsela staff on 02.23.17
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Level **1030L**



A doctor stands at the center with Holocaust survivors at the entrance to the newly liberated Auschwitz concentration camp in 1945. Photo from: Fine Art Images/Heritage Images/Getty Images

The second in a two-part series

Throughout the spring and summer of 1940, the German army expanded Adolf Hitler's empire in Europe. Nazi soldiers conquered Denmark, Norway, the Netherlands, Belgium, Luxembourg and France. Beginning in 1941, Jews from all over the continent were transported to Poland. They were placed in confined city sections called ghettos. In June 1941, the German raid on the Soviet Union marked a new level of brutality in warfare. Mobile killing units would murder more than 500,000 Soviet Jews and others over the course of the German occupation.

On July 31, 1941, one of Hitler's top commanders wrote about the need for a "final solution" to "the Jewish question." Beginning in September 1941, every person designated as a Jew in German-held territory was marked with a yellow star. This made all of them open targets. Tens of thousands of Jews were soon being deported to the Polish ghettos.

Since June 1941, experiments with mass killing methods had been ongoing at the concentration camp of Auschwitz. That August, officials used a pesticide called Zyklon-B to gas 500 Soviet

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prisoners of war to death. Nazi leaders soon placed a huge order for the gas, a disturbing sign of the coming Holocaust.

Germans built mass killing centers in Poland

Beginning in late 1941, the Germans began transporting huge numbers of people from the ghettos in Poland to the concentration camps. They started with those people viewed as the least useful: the sick, the old, the weak and the very young. The first mass gassings began at the camp of Belzec on March 17, 1942.

Five more mass killing centers were built at camps in occupied Poland. These camps included Chelmno, Sobibor, Treblinka, Majdanek and Auschwitz. From 1942 to 1945, Jews were deported to the camps from all over Europe. The heaviest deportations took place during the summer and fall of 1942, when more than 300,000 people were deported from the Warsaw Ghetto alone.

The Nazis tried to keep the operation of the camps a secret, but the scale of the killing made this impossible. Eyewitnesses brought reports of Nazi atrocities to the Allied governments, who were fighting against Germany in the war. The Allied powers included Britain, France, the United States and many other countries. Their governments were harshly criticized after the war for their failure to respond to news of the Holocaust.

This lack of action was most likely due to the Allied focus on winning the war at hand. But it was also a result of the governments' refusal to believe that such atrocities could be occurring on such an enormous scale. At Auschwitz alone, more than 2 million people were murdered. A large population of Jewish and non-Jewish prisoners worked in the labor camp there. Only Jews were gassed to death, but thousands of others died of starvation or disease. During the summer of 1944, even as Germany was beginning to lose the war, a large part of Hungary’s Jewish population was deported to Auschwitz. As many as 12,000 Jews were killed every day.

Germany surrenders after Hitler's death

By the spring of 1945, German leadership was suffering from internal conflict. Several Nazi leaders were trying to distance themselves from Hitler and take power. In his last will, dictated in a German bunker on April 29, Hitler blamed the war on “international Jewry and its helpers.” The following day, he committed suicide. Germany’s formal surrender in World War II came barely a week later, on May 8, 1945.

German forces had begun evacuating many of the death camps in the fall of 1944. They forced prisoners to march away from the advancing enemy's army. These so-called “death marches” resulted in the deaths of some 250,000 to 375,000 people. In his book “Survival in Auschwitz,” the Italian Jewish author Primo Levi described life in the camp the day before Soviet troops arrived in January 1945: “We lay in a world of death and phantoms. The last trace of civilization had vanished around and inside us. The work of bestial degradation, begun by the victorious Germans, had been carried to a conclusion by the Germans in defeat.”

Germans and Jews were deeply affected by the Holocaust

The wounds of the Holocaust were slow to heal. Survivors of the camps found it nearly impossible to return home. In many cases they had lost their families and been denounced by their non-

This article is available at 5 reading levels at https://newsela.com.

Jewish neighbors. As a result, the late 1940s saw a great number of refugees and other displaced populations moving across Europe.

In 1945, the Allies began the Nuremberg Trials, an effort to punish the villains of the Holocaust. The trials brought Nazi atrocities to horrifying light. Increasingly, there was pressure on the Allied powers to create a homeland for Jewish survivors of the Holocaust. This eventually led to the establishment of the state of Israel in 1948.

Over the years that followed, ordinary Germans struggled with the Holocaust's bitter legacy. Meanwhile, survivors and the families of victims sought repayment for the wealth and property stolen from them during the Nazi years. In 1953, the German government began to make payments to individual Jews and to the Jewish people. This was a way of acknowledging responsibility for the crimes committed in their name.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the introduction [paragraphs 1-3].

What purpose does the introduction serve in developing the main idea of the article?

(A) It outlines the effects of mobile killing units on Jewish people in the Soviet Union.

(B) It describes conditions in ghettos that encouraged Nazis to move Jewish people to camps.

(C) It gives background regarding relationships between different countries in Europe before the war.

(D) It explains the deliberate steps taken by Nazis in planning and preparing for the Holocaust.

2 Which section of the article highlights the idea that many people believed the Allies should have done more to prevent the Holocaust?

(A) Introduction [paragraphs 1-3]

(B) "Germans built mass killing centers in Poland"

(C) "Germany surrenders after Hitler's death"

(D) "Germans and Jews were deeply affected by the Holocaust"

3 All four selections below help make the claim that the Nazis continued to murder Jews even after they knew they would not win the war.

Which is the STRONGEST piece of evidence to support this claim?

(A) At Auschwitz alone, more than 2 million people were murdered. A large population of Jewish and non-Jewish prisoners worked in the labor camp there.

(B) During the summer of 1944, even as Germany was beginning to lose the war, a large part of Hungary's Jewish population was deported to Auschwitz. As many as 12,000 Jews were killed every day.

(C) Several Nazi leaders were trying to distance themselves from Hitler and take power. In his last will, dictated in a German bunker on April 29, Hitler blamed the war on "international Jewry and its helpers."

(D) German forces had begun evacuating many of the death camps in the fall of 1944. They forced prisoners to march away from the advancing enemy's army.

4 Why does the article include the section "Germans and Jews were deeply affected by the Holocaust"?

(A) to demonstrate that the Holocaust had a lasting impact on individuals and the world

(B) to explain how Germany decided to make payments to individuals and the Jewish people

(C) to describe the process and results of the Nuremberg Trials on those who witnessed them

(D) to emphasize the poor treatment Jewish people received from their neighbors during the war

This article is available at 5 reading levels at https://newsela.com.

A photographer's photos show WWII life of Japanese in America

By Newsela staff on 01.02.20
Word Count **655**
Level **930L**



On December 7, 1941, Japan attacked Pearl Harbor, a large American naval base in Hawaii. The U.S. government did not think Japanese American people on the West Coast were loyal to the country. The government made them leave their homes and move to "internment camps," or War Relocation Centers. These camps were mostly in the desert and were filled with simple wooden homes called "barracks."

The government sent a photographer named Dorothea Lange to take pictures of the Japanese Americans leaving their homes and of their new lives at the camps. She was well known for the pictures she took during the Great Depression. The government did not use her photos. Instead, her work was quietly given to the U.S. National Archives.

A sign saying "I am an American" hangs above the window of a store in March 1942. The sign was put up on December 8, 1941, a day after the attack on Pearl Harbor. The business is owned by the Matsuda family, who will have to leave their business behind for the internment camp.

Children pledging allegiance to the American flag at the Raphael Weill Public School in San Francisco, California, on April 20, 1942.

This article is available at 5 reading levels at https://newsela.com.

A woman looks around while on line with others of Japanese ancestry on April 25, 1942. They are





registering themselves with the government before leaving for the internment camps.



A soldier and his mother in a



strawberry field in May 1942 in Sacramento County, California. The soldier was 23 years old and had volunteered to join the Army, but came home to help his family get ready to leave their home.

The first day at an assembly center in Stockton, California, May 19, 1942. Luggage and other bags needed to be checked for anything considered illegal by the U.S. government.



A picture of a barracks in San Bruno, California, June 16, 1942. This is a family apartment and the windows were made bigger. Five people lived in two small rooms.

Harvey Akio Itano, pictured on May 20, 1942. He was 21 years old and had graduated from college where he studied chemistry. He wanted to go into medicine and had brought his school books with him to the camp.

An elementary school class at Manzanar Relocation Center in Manzanar, California, July 1, 1942. The teachers were also Japanese Americans who had had to leave their homes behind. They were volunteers and some had just graduated college. They did not have supplies or desks for their

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classes yet, so they







sometimes held class outside.

A barracks in San Bruno, California, that was being used as a library. The librarian was Japanese American. All books and magazines were donated. The shelves were made out of scrap wood by the internees. This photo was taken on June 16, 1942.





This article is available at 5 reading levels at https://newsela.com.

Japanese Americans clear bushes to make the Manzanar Relocation Center bigger. The photo was taken on June 30, 1942.



Baseball players during a game at Manzanar Relocation Center. The sport was popular in the camps. This photo was taken on July 2, 1942.

A



grandfather teaching his grandson how to walk at the Manzanar internment camp on July 2, 1942.

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The Cold War: An age of two global economies

By Gale Cengage Learning, adapted by Newsela staff on 11.03.19
Word Count **973**
Level **1060L**



This is a general view of a plenary session of the United Nations Monetary Conference in Bretton Woods, N.H. on July 4, 1944. Delegates from 44 countries are seated at the long tables. Photo by: Abe Fox/AP Photo

World War II started in 1939 and ended in 1945. During the war, France, Great Britain, the United States and their allies fought to end the aggression of Germany, Italy, Japan and their allies.

The war had many causes. However, two of the most important were about economy and trade. Germans had grown upset at the poor state of their country's economy. Meanwhile, the majority of world governments had adopted policies that prioritized goods they made in-country over goods from abroad. This is a practice known as protectionism.

Western leaders realized that trade protectionism would have to end if the postwar world was to remain stable. As a result, they worked to establish a system for free international trade and financial exchange. In 1944, representatives from 44 nations came to the United States for the three-week Bretton Woods Monetary Conference. The attendees agreed that it was in the interests of all businesses and governments to allow the free flow of goods, services, capital and people among countries. They established the Bretton Woods system, which served as the basis for international economic policy until the end of the Cold War, which started right as WWII ended in

This article is available at 5 reading levels at https://newsela.com.

1945 and went on until 1991. The Cold War was an intense political and economic rivalry between the United States and the Soviet Union, also known as the U.S.S.R.

Bretton Woods System

Under the Bretton Woods system, the U.S. dollar was adopted as the standard unit of international exchange. The value of all other currencies was pegged to the value of the dollar. This was done because, at the time, the dollar was the only currency still backed by gold reserves. Having a currency tied to gold was important. It allowed governments to manage trade imbalances by offering gold from their national reserves to nations that were owed money.

The key idea of the Bretton Woods system was that exchange rates between currencies needed to remain fixed in their relation to one another. This exchange-rate predictability would allow the uninterrupted flow of financial capital between nations. Financial capital is money, credit or anything else that allows governments or businesses to buy what they need and sell what they want.

Under the Bretton Woods system, the United States was the economic leader of the capitalist world. At the time, U.S. industry and finance surpassed that of Europe. The use of the dollar as the standard unit of international exchange tied the strength of all nations that used it directly to the economic performance of the United States. This made American economic interests a concern for everyone involved. Other major economies participating in the Bretton Woods system included Japan, Germany, France, the United Kingdom and Italy.

Communism Vs. Capitalism

At the same time, the U.S.S.R., China and their allies developed their own economic system. This system is known as Communism. Under this system, the government controls the economy and price of goods. The people share all the property and wealth equally. In capitalist economies, government involvement in the economy is limited and markets are allowed to control their own prices. Under the Communist system, governments directly control the economic activity of their citizens. Communist nations do this by taking over industries, maintaining strict control over the flow of capital and controlling the way in which wealth is distributed.

Leaders in Communist nations saw capitalism as a threat to Communism. For this reason, they took every opportunity to spread Communism and prevent capitalism. Leaders in capitalist nations thought and did the same with their system. The spread of Communism and capitalism occurred primarily through alliances with the numerous nations that had gained independence from European empires. These nations represented valuable new markets. Nations in the Middle East and Africa also became sources of important natural resources, especially oil.

The General Agreement on Tariffs and Trade (GATT) took effect in 1948. It ended most trade barriers between capitalist countries and led to a new era of economic cooperation. The result was an increased level of international investment and trade. There was no trade between Communist and capitalist countries, however.

Europe Gains Economic Independence

European nations increasingly wanted to gain economic independence from the United States. To further this goal, they created the European Economic Community in 1958 and the European Free

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Trade Association in 1960. Together, these formed an open market for the flow of goods, capital and people in Western Europe.

In time, such multinational agreements began to replace GATT. The Bretton Woods system also began to weaken when the United States stopped tying the value of the dollar to its gold reserves in 1971. Nonetheless, the dollar remained the main reserve currency, meaning that central banks continued to buy and store dollars to support their own currencies. Dollars were also still used in trade between nations. This was tremendously helpful to the U.S. economy. It made international trade very easy. It also ensured low interest rates on foreign loans, due to the high demand for the dollar.

Overall the Cold War was a period of major economic growth around the world. This was especially true for younger and developing nations, including the oil-rich nations of the Middle East. They grew hugely wealthy due to the global demand for oil.

International trade increased during the Cold War period. Multinational corporations — companies operating in many countries — became the most important agents in this international exchange. They accounted for the majority of the total value of the global economy.

International finance also expanded during the Cold War. There was huge growth in the banking industry and an increase in foreign investment by both governments and individuals. By the time the U.S.S.R. broke apart in 1991, most of the world was involved in the global financial system. Banking had become the chief means for transferring value across borders.

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Quiz

1 Which of the following MOST influenced the start of WWII?

(A) the rivalry between the United States and the U.S.S.R

(B) cultural differences between Germany, Italy and Japan

(C) the Bretton Woods Monetary Conference

(D) bad economic conditions and decisions

2 How did the Bretton Woods Monetary Conference affect the future economy?

(A) It encouraged protectionist policies to flourish in capitalist countries.

(B) It decreased other countries' dependence on the U.S. dollar.

(C) It allowed more free trade between certain countries around the world.

(D) It caused the Cold War between the U.S. and the U.S.S.R to end.

3 Read the paragraph from the section "Bretton Woods System."

> *Under the Bretton Woods system, the United States was the economic leader of the capitalist world. At the time, U.S. industry and finance surpassed that of Europe. The use of the dollar as the standard unit of international exchange tied the strength of all nations that used it directly to the economic performance of the United States. This made American economic interests a concern for everyone involved. Other major economies participating in the Bretton Woods system included Japan, Germany, France, the United Kingdom and Italy.*

Which word from the paragraph helps you understand that the United States was starting to outperform other countries economically under the Bretton Woods system?

(A) capitalist

(B) surpassed

(C) standard

(D) major

4 Read the selection from the section "Communism Vs. Capitalism."

> *In capitalist economies, government involvement in the economy is limited and markets are allowed to control their own prices. Under the Communist system, governments directly control the economic activity of their citizens. Communist nations do this by taking over industries, maintaining strict control over the flow of capital and controlling the way in which wealth is distributed.*

Which two words would BEST replace "limited" and "distributed" in the selection above?

(A) significant; spread

(B) sporadic; saved

(C) minimal; shared

(D) critical; scattered

This article is available at 5 reading levels at https://newsela.com.

Cold War, warm hearth

By The Gilder Lehrman Institute of American History, adapted by Newsela staff on 11.03.19
Word Count **1,306**
Level **1050L**



Image 1. Families walk down the driveway while touring a model home with a concrete basement fallout shelter in Texas in 1961. Photo: Shel Hershorn/Getty Images

In the summer of 1959, a young couple married and spent their honeymoon in a fallout shelter. Life magazine featured the "sheltered honeymoon" with a photograph of the duo surrounded by canned goods and supplies. Another photograph showed them kissing as they descended 12 feet underground into the shelter.

As the couple embarked on married life, all they had to enjoy their honeymoon were some consumer goods and their privacy. This is a powerful image of the nuclear family in the nuclear age: isolated, prosperous, and protected against approaching doom by the wonders of modern technology.

The stunt was little more than a publicity device, but it has taken on symbolic significance. In the early years of the Cold War, the home seemed to offer protection from the dangers of the outside world. The message was mixed, however, for the family also seemed particularly vulnerable. It needed heavy protection against the intrusions of forces outside itself. The self-contained home held out the promise of security in an insecure world and offered a vision of abundance and

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fulfillment. As the Cold War began, young Americans were rushing into this vision of marriage and family life.

Postwar Domestic Explosion: It's Complicated

In the period after World War II, Americans were more eager than ever to start families. The bomb-shelter honeymooners were part of a group of Americans of all racial, ethnic and religious groups who lowered the age of marriage. They quickly brought the birthrate to a 20th-century high, producing the "baby boom." Although the nation remained divided along lines of race and class, family fever affected all Americans. The trend of early marriage and relatively large families lasted for more than two decades. From the late 1940s through the early 1960s, Americans married at a higher rate and at a younger age than Europeans.

Why did postwar Americans turn to marriage and parenthood with such enthusiasm and commitment? Scholars frequently point to the family boom as the result of a return to peace and prosperity. They argue that postwar Americans were eager to put the hardships of economic depression and war behind them and enjoy the abundance at home. There is, of course, some truth in this claim. However, prosperity followed other wars in our history with no similar increase in marriage and childbearing.

Peace and affluence alone do not explain the many complexities of the postwar domestic explosion. The trends went far beyond what was expected from a return to peace. Indeed, nothing on the surface of postwar America explains the rush of young Americans into marriage, parenthood and traditional gender roles.



It might have been otherwise. The Great Depression of the 1930s brought about widespread challenges to traditional gender roles that could have led to a restructured home. The war intensified these challenges and pointed the way toward major changes in the institutions of work and family life.

Wartime brought thousands of women into the paid labor force when men left to enter the armed forces. After the war, Americans had increased job and educational opportunities as well as increased access to birth control. These changes might have led young people to delay marriage and to have fewer children. Indeed, many observers at the time feared that these changes seriously threatened the American family. However, the exact opposite came to pass.

The Counterculture Remakes The Rules

Postwar American society experienced a surge in family life that included distinct roles for women and men.

This demographic explosion in the American family was a temporary change to long-term trends. It lasted only until the baby-boom children came of age. The parents, having grown up during the Great Depression and the war, had began their families during years of prosperity.

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Their children, however, grew up amid affluence during the Cold War. They reached adulthood during the 1960s and 1970s, creating the counterculture and a new women's liberation movement. In vast numbers, they rejected the political assumptions of the Cold War, along with the domestic and sexual codes of their parents. This generation brought the 20th-century birthrate to an all-time low and the divorce rate to an all-time high.

Observers often point to the 1950s as the last gasp of time-honored family life before the 1960s generation made a major break from the past. However, the comparison is shortsighted. In many ways, the youths of the '60s resembled their grandparents, who came of age in the first decades of the 20th century. Like many of their baby-boom grandchildren, the grandparents had challenged the norms of their day. They pushed the divorce rate up and the birthrate down, and they created a unique youth culture. They also behaved in similar ways politically, developing powerful feminist and civil rights movements. It is the generation in between — with its strong family values and traditional politics — that stands out as different.

What makes the postwar demographic explosion even more unusual is that it affected all groups in society. Americans of all backgrounds rushed into marriage and childbearing. Racial and class divisions were concealed beneath an appearance of unity in the period after the war. America presented itself as politically harmonious and blessed with widespread wealth. Spared the devastation of war-torn Europe and Asia, the United States embraced its position as the "leader of the free world."

Defining Security When An Ally Turns Foe

Still, major challenges lay ahead if the nation was to maintain its leadership in the world. The atomic blasts that devastated Japan marked both the end of World War II and the beginning of the Cold War. The United States now faced its former ally, the Soviet Union, as its major foe. The Cold War was largely an ideological struggle between the two superpowers. Each country hoped to increase its power and influence across the globe. In the propaganda battles of this era, American leaders promoted the "American way of life." It was characterized by affluence, located in suburbia and epitomized by white middle-class families. Increasing numbers of Americans gained access to this ideal — but not everyone could achieve it.

Poverty excluded many from suburban affluence, and racism excluded others. Nevertheless, officials insisted that the combined forces of democracy and prosperity would bring the fruits of the "good life" to all. Racial strife, they said, was declining. Workers, they argued, were prosperous. However, anxieties surrounding these issues did not disappear. Policymakers perceived racial and class divisions as particularly dangerous because dissatisfied workers and racial minorities might be drawn to left-wing politics, leading to socialism or even communism.

According to the Cold War thinking of the time, conflict within the United States would harm our image abroad and strengthen the Soviet Union. Some leaders feared it would weaken the nation, making it vulnerable to communism. The worst-case scenario was a communist takeover and the defeat of the United States in the Cold War. However, other observers worried that the real dangers to America were internal: racial strife, class conflict and disruption of the family.

To reduce these fears, Americans turned to family for support. Meanwhile, experts, leaders and politicians promoted codes of conduct and public policies that would strengthen the American home. Like their leaders, most Americans agreed that a strong family was the best protection

This article is available at 5 reading levels at https://newsela.com.

against the dangers of the Cold War era. Young adults were especially eager for the comforts and security that the nuclear family promised. The prosperous and protected home became the location of their own personal pursuit of happiness.

Elaine Tyler May is a professor of American studies and history at the University of Minnesota and the author of "Homeward Bound: American Families in the Cold War Era" (2008) and "Pushing the Limits: American Women, 1940–1961" (1994).

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the paragraph from the section "The Counterculture Remakes The Rules."

> *This demographic explosion in the American family was a temporary change to long-term trends. It lasted only until the baby-boom children came of age. The parents, having grown up during the Great Depression and the war, had begun their families during years of prosperity. Their children, however, grew up amid affluence during the Cold War. They reached adulthood during the 1960s and 1970s, creating the counterculture and a new women's liberation movement. In vast numbers, they rejected the political assumptions of the Cold War, along with the domestic and sexual codes of their parents. This generation brought the 20th-century birthrate to an all-time low and the divorce rate to an all-time high.*

Why did the author use the word "explosion"?

(A) to convey a sense of damage the sudden population growth caused to life in America

(B) to convey a sense of the significance of the sudden population growth in American society

(C) to convey a sense of the danger of nuclear weapons to families during the Cold War

(D) to convey a sense of anxiety about the spread of Communism families had during the Cold War

2 Read the paragraph from the section "Defining Security When An Ally Turns Foe."

> *Still, major challenges lay ahead if the nation was to maintain its leadership in the world. The atomic blasts that devastated Japan marked both the end of World War II and the beginning of the Cold War. The United States now faced its former ally, the Soviet Union, as its major foe. The Cold War was largely an ideological struggle between the two superpowers. Each country hoped to increase its power and influence across the globe. In the propaganda battles of this era, American leaders promoted the "American way of life." It was characterized by affluence, located in suburbia and epitomized by white middle-class families. Increasing numbers of Americans gained access to this ideal — but not everyone could achieve it.*

Which two words would BEST replace “influence” and “affluence” in the 5th and 7th sentences above?

(A) fame and power

(B) money and comfort

(C) luxury and control

(D) leadership and wealth

3 What is the MAIN reason the author includes the section “Postwar Domestic Explosion: It's Complicated”?

(A) to explain why the rise in marriage and childbirth after World War II was unique

(B) to show the influence of nuclear weapons on life in the United States after World War II

(C) to highlight the role racism and poverty played in the United States after World War II

(D) to describe why traditional gender roles in the United States were destroyed by World War II

4 What is one MAIN reason why the author includes information about racism and poverty in the article?

(A) to highlight the how capitalism helped to decrease the number of poor people in the United States after World War II

(B) to describe how the victory in World War II improved the lives of the poor in the United States

(C) to show that the ideal of a prosperous America after World War II was not available to everyone

(D) to explain why many countries decided to create communist governments after World War II

This article is available at 5 reading levels at https://newsela.com.

The Korean War and why there are two Koreas

By History.com, adapted by Newsela staff on 01.11.18
Word Count **943**
Level **1110L**



Image 1. South Korean soldiers patrol inside the barbed-wire fence at Imjingak Pavilion near the border village of Panmunjom, the demilitarized zone which has separated the two Koreas since the Korean War, in Paju, South Korea, on March 27, 2012. Photo by Ahn Young-joon for AP Photo.

On June 25, 1950, the Korean War began when some 75,000 soldiers from the North Korean People's Army poured across the 38th parallel. That was the boundary between the Soviet-backed Democratic People's Republic of Korea to the north and the pro-Western Republic of Korea to the south. This invasion was the first military action of the Cold War (1945-1991). The Cold War was a larger conflict between the United States and the Soviet Union. It was called "cold" because the U.S. and Soviet Union didn't fight each directly, but instead engaged in a war of threats.

By July, American troops and their allies, working with the United Nations, had entered the war to help South Korea. As far as American officials were concerned, it was a war against international communism led by the Soviet Union. Communism is a system where one political party controls all aspects of a country's government and society. After some early back-and-forth across the 38th parallel, the fighting stalled and casualties mounted with nothing to show for them. Meanwhile, American officials worked anxiously to fashion some sort of armistice with the North Koreans. The alternative, they feared, would be a wider war with the Soviet Union and China – or even, as some warned, World War III.

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The Two Koreas



Since the early 1900s, Korea had been a part of the Japanese empire. After Japan lost World War II (1939-1945), it fell to the Americans and the Soviets to decide what should be done with it. In August 1945, the U.S. divided the Korean peninsula in half along the 38th parallel, giving the Soviets the area north of the line and the Americans the area to its south.

By the end of the decade, two new countries had formed on the peninsula. In the south, the anti-communist dictator Syngman Rhee enjoyed the reluctant support of the American government. In the north, the communist dictator Kim Il Sung enjoyed the slightly more enthusiastic support of the Soviets. Neither dictator was content to remain on his side of the 38th parallel, and fighting had already taken place along the border – resulting in more than 10,000 deaths.

The Korean War And The Cold War

Even so, the North Korean invasion came as a surprise to American officials. To them, this was not simply a border dispute on the other side of the globe. They saw it as the first step in a communist campaign to take over the world, so they believed that staying out of the war was not an option.

At first, the U.S.-led war effort in Korea was designed simply to get the communists out of South Korea – and it went badly for the U.S. and its allies. The North Korean army was well-disciplined, well-trained and well-equipped; Rhee's forces, by contrast, were frightened, confused and seemed inclined to flee the battlefield at any provocation.

By the end of the summer, President Harry Truman and General Douglas MacArthur, the military commander in charge, had decided on a new set of war aims. Now, for the U.S. and its allies, the Korean War was an offensive war to "liberate" the North from the communists.

Initially, this new approach was a success. An amphibious assault at Inchon pushed the North Koreans back to their side of the 38th parallel. American troops crossed the boundary and headed north toward the Yalu River, the border between North Korea and Communist China. The Chinese started to worry about protecting themselves. Chinese leader Mao Zedong sent troops to North Korea and warned the United States to keep away from the Yalu boundary unless it wanted full-scale war.

"No Substitute For Victory"

This was something that President Truman and his advisers decidedly did not want. They were sure that such a war would lead to Soviet attacks in Europe, the deployment of atomic weapons and millions of senseless deaths. Yet General MacArthur believed anything short of this wider war meant knuckling under to the communists.

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As President Truman looked for a way to prevent war with the Chinese, MacArthur did all he could to provoke it. In March 1951, MacArthur sent a letter to Joseph Martin, a Republican leader in Congress, who leaked the letter to the press. "There is," MacArthur wrote, "no substitute for victory" against international communism.

On April 11, President Truman fired the general for insubordination.

The Korean War Reaches A Stalemate

In July 1951, President Truman and his new military commanders started peace talks at Panmunjom. Still, the fighting continued along the 38th parallel as negotiations stalled. Both sides were willing to accept a ceasefire that maintained the 38th parallel boundary, but they could not agree on whether prisoners of war should be forcibly sent back home. (The Chinese and the North Koreans wanted prisoners forcibly sent home; the United States said no.) Finally, after more than two years of negotiations, the different sides signed an armistice on July 27, 1953. The agreement allowed the POWs to stay where they liked; drew a new boundary near the 38th parallel that gave South Korea an extra 1,500 square miles of territory; and created a 2-mile-wide "demilitarized zone" that still exists today.

Casualties Of The Korean War

The Korean War was relatively short but exceptionally bloody. Nearly 5 million people died. More than half of these – about 10 percent of Korea's prewar population – were civilians. (This rate of civilian casualties was higher than that of World War II.) Almost 40,000 Americans died in action in Korea, and more than 100,000 were wounded.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the paragraph from the section "The Two Koreas."

> *Since the early 1900s, Korea had been a part of the Japanese empire. After Japan lost World War II (1939-1945), it fell to the Americans and the Soviets to decide what should be done with it. In August 1945, the U.S. divided the Korean peninsula in half along the 38th parallel, giving the Soviets the area north of the line and the Americans the area to its south.*

Why does the author include this paragraph in the article?

(A) to explain the circumstances behind the formation of two countries on the Korean peninsula

(B) to describe the influence that the Japanese empire had on Korea before the country was divided

(C) to suggest that the U.S. was solely responsible for dividing Korea into two sections after World War II

(D) to explain why Korea was a problem for both the Americans and the Soviets after World War II

2 Read the paragraph from the section "No Substitute For Victory."

> *As President Truman looked for a way to prevent war with the Chinese, MacArthur did all he could to provoke it. In March 1951, MacArthur sent a letter to Joseph Martin, a Republican leader in Congress, who leaked the letter to the press. “There is,” MacArthur wrote, “no substitute for victory" against international communism.*

How does the last sentence of the paragraph contribute to the MAIN idea of the article?

(A) It helps explain why President Truman chose General MacArthur as a leader in the Korean War.

(B) It reflects how Congress felt about continuing the Korean War until victory was achieved.

(C) It reinforces the idea that the U.S. entered the war in Korea to stop the spread of communism.

(D) It describes how General MacArthur was affected when the press published a letter he wrote.

3 Read the list of sentences from the article.

1. *After some early back-and-forth across the 38th parallel, the fighting stalled and casualties mounted with nothing to show for them.*
2. *The alternative, they feared, would be a wider war with the Soviet Union and China – or even, as some warned, World War III.*
3. *The North Korean army was well-disciplined, well-trained and well-equipped; Rhee’s forces, by contrast, were frightened, confused and seemed inclined to flee the battlefield at any provocation.*
4. *They were sure that such a war would lead to Soviet attacks in Europe, the deployment of atomic weapons and millions of senseless deaths.*

Which two sentences taken together provide the STRONGEST evidence to support President Truman's decision to seek peace with North Korea?

(A) 1 and 2

(B) 1 and 3

(C) 2 and 4

(D) 3 and 4

This article is available at 5 reading levels at https://newsela.com.

4 Read the following statement.

Ending the Korean War was not an easy task.

Which sentence from the article BEST supports this statement?

(A) Meanwhile, American officials worked anxiously to fashion some sort of armistice with the North Koreans.

(B) Neither dictator was content to remain on his side of the 38th parallel, and fighting had already taken place along the border – resulting in more than 10,000 deaths.

(C) At first, the U.S.-led war effort in Korea was designed simply to get the communists out of South Korea – and it went badly for the U.S. and its allies.

(D) Finally, after more than two years of negotiations, the different sides signed an armistice on July 27, 1953.

This article is available at 5 reading levels at https://newsela.com.

Causes of the Vietnam War, 1945-1954

By ThoughtCo.com, adapted by Newsela staff on 11.21.19
Word Count **901**
Level **1060L**



(From left) Nikita Khrushchev of the Soviet Union, Mao Zedong of China and Ho Chi Minh of Vietnam attend a banquet in Beijing, China, October 1, 1959, to celebrate the 10th anniversary of communist rule in China. Photo by AP

The causes of the Vietnam War date back to the end of World War II. During WWII, Japan occupied the French colony Indochina, which was made up of present-day Vietnam, Laos and Cambodia. In 1941, a Vietnamese nationalist movement, the Viet Minh, was formed by Vietnamese communist leader Ho Chi Minh. With the support of the United States, Ho Chi Minh fought a guerrilla war against the Japanese. Ultimately, Japan ended up granting the country independence in name only. On August 14, 1945, Ho Chi Minh launched the August Revolution.

The French Return

Minh and his army defeated the Japanese. The Allied Powers, however, decided that the region should return to French control. France did not have the troops to retake the area, though, and Chinese forces ended up taking control of the north while the British landed in the south. Under pressure from the Soviet Union, Ho Chi Minh tried to negotiate with the French, who wanted their colony back. The French were allowed back into Vietnam after they promised that the country would gain independence as part of the French Union.

This article is available at 5 reading levels at https://newsela.com.

First Indochina War

However, discussions soon broke down. In December 1946, the French shelled the city of Haiphong and forced their way into the capital, Hanoi. These actions set off a conflict between the French and the Viet Minh, known as the First Indochina War. Fought mainly in North Vietnam, it began as a low-level, rural guerrilla war, as Viet Minh forces conducted hit-and-run attacks on the French. In 1949, fighting escalated as Chinese communist forces from the south of the country began supplying the Viet Minh with weapons.

The conflict ended when the French were defeated at Dien Bien Phu in 1954.

The war was ultimately settled by the Geneva Accords of 1954. It temporarily divided the country at the 17th parallel. It is a circle of latitude 17 degrees north of the equator. The Viet Minh remained in control of the north and a non-communist state was formed in the south under Prime Minister Ngo Dinh Diem. This division was supposed to last only until 1956, when national elections would decide the future of the nation.

The Politics Of U.S. Involvement

Initially, the United States had little interest in Vietnam and Southeast Asia. However, it soon became clear that the post-WWII world would be dominated by the U.S. and the Soviet Union. The U.S. began isolating communist movements. This strategy ultimately formed into two ideologies: containment and the domino theory. Containment claimed that the goal of communism was to spread to capitalist states and that the only way to stop the spread was to "contain" communism within its borders. Springing from containment was the concept of the domino theory. Under this idea, if one state in a region were to fall to communism, then the surrounding states would become communist, as well. These concepts guided U.S. foreign policy for much of the Cold War.

In 1950, the U.S. decided to combat the spread of communism in Vietnam. It began supplying advisers to the French military in Vietnam and funding its efforts against the communist Viet Minh. In 1956, American advisers were sent to train the army of the new Republic of Vietnam in the south. The U.S. goal was to create a force capable of resisting communist forces, but the militia they put together, the Army of the Republic of Vietnam (ARVN), was never very good.

The Diem Regime

A year after the Geneva Accords, Prime Minister Diem began what he called the "Denounce the Communists" campaign in the south. Throughout the summer of 1955, communists and other opposition members were jailed and executed. In addition to attacking communists, Diem, who was Roman Catholic, attacked Buddhist sects. This further estranged the largely Buddhist Vietnamese people and eroded support. It is estimated Diem executed up to 12,000 opponents and jailed as many as 40,000. To further cement his power, Diem held a rigged ballot on the future of the country in October 1955. He declared the Republic of Vietnam, with its capital at Saigon.

Despite this, the U.S. actively supported the Diem government as a defense against communism in the north. In 1957, a low-level guerrilla movement began to emerge in the south. Two years later, Viet Minh groups successfully pressured Ho's government into issuing a secret resolution calling for an armed struggle in the south. Military supplies from the communist north began to flow into the south along the Ho Chi Minh Trail. The following year, the National Front for the Liberation of South Vietnam, the Viet Cong, was formed to carry out the fight.

This article is available at 5 reading levels at https://newsela.com.

Deposing Diem

The situation in South Vietnam continued to get worse. The Diem government was corrupt, and the ARVN could not fight off the Viet Cong. In 1961, American President John F. Kennedy sent more money, weapons and supplies. Discussions began in Washington, D.C., regarding the need to overthrow Diem and put a new leader in place in Saigon. On November 2, 1963, the CIA aided a group of ARVN officers who captured and killed Diem. Political instability followed, with the rise and fall of several military governments. To help deal with the chaos, Kennedy increased the number of U.S. advisers in South Vietnam. After Kennedy was assassinated later that month, Lyndon B. Johnson became president. He renewed America's commitment to fighting communism in the region.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Which statement would be MOST important to include in a summary of the article?

(A) The United States funded the fight against the communist Viet Minh.

(B) The French were defeated at Dien Bien Phu.

(C) President Kennedy sent U.S. advisers to South Vietnam.

(D) The Geneva Accords of 1954 ended the First Indochina War.

2 Which two of the following sentences from the article include central ideas of the article?

1. *The causes of the Vietnam War date back to the end of World War II.*
2. *In December 1946, the French shelled the city of Haiphong and forced their way into the capital, Hanoi.*
3. *A year after the Geneva Accords, Prime Minister Diem began what he called the "Denounce the Communists" campaign in the south.*
4. *Despite this, the U.S. actively supported the Diem government as a defense against communism in the north.*

(A) 1 and 2

(B) 3 and 4

(C) 1 and 4

(D) 2 and 3

3 Which of the following MOST influenced the creation of the Army of the Republic of Vietnam?

(A) the corruption of the Diem government

(B) the need to aid the French military in the First Indochina War

(C) the U.S. desire to fight against communist forces

(D) the fighting between North and South Vietnam

4 How did the U.S. government affect Diem's regime in South Vietnam?

(A) The U.S. government had Diem killed because his government was corrupt.

(B) Diem's regime was aided by the United States in rigging a national election.

(C) The U.S. government sent more soldiers to help Diem and the ARVN.

(D) Diem's regime worked with the U.S. government to jail political enemies.

This article is available at 5 reading levels at https://newsela.com.

Birth of the Civil Rights Movement, 1941-1954

By National Park Service, adapted by Newsela staff on 05.08.17
Word Count **625**
Level **1120L**



A photo of the Zoot Suit Riots on June 7, 1943, in Los Angeles, California. Thousands of policemen, soldiers, sailors and marines roamed the streets of L.A. They were looking for Mexican-American youths wearing zoot suits. They stopped this streetcar during their search. Crowds jammed downtown streets to watch the servicemen tear clothing off the zoot suiters they caught. The mob considered the zoot suiters to be "unpatriotic" and "hoodlums" during World War II. AP Photo

America changed tremendously during World War II, creating a driving force for civil rights that transformed American life. African-Americans migrated to the North, where they had the right to vote. New government policies laid the groundwork for the end of racial segregation. Civil rights became a national issue for the first time since the Reconstruction era, the period after the Civil War between North and South.

Minorities, such as African-Americans, served in the military but fought in units that were segregated from white soldiers. However, the defense industry also created new jobs that eventually brought about social and legislative reform. Millions of married women and mothers worked outside the home for the first time, and some remained employed after the war was over.

Approximately 65,000 Native Americans left their reservations to work in wartime industries and serve in the armed forces. African-Americans demanded their fair share of jobs and an end to segregation in government departments and the military. President Franklin D. Roosevelt

This article is available at 5 reading levels at https://newsela.com.

responded by banning discrimination in defense industries. To assure that companies complied, he formed the Federal Employment Practices Committee (FEPC). This committee held hearings to expose racial discrimination and helped African-Americans in the North find work. The formation of the FEPC also led to the first civil rights case regarding equal employment for Latinos. Protests were held before the FEPC to expose the fact that Latinos were still denied jobs in many war industries. Despite their American citizenship, they were considered "aliens" by employers.

African-Americans were denied mortgages and loans

Even as people of color served in the military, those at home still faced racial discrimination from federal and local governments. African-Americans were refused home loans partly because of the government's support for a practice called redlining. Beginning in the late 1930s, lines were drawn on government maps around black neighborhoods. Within these neighborhoods, banks refused to give out any mortgages or loans. Redlining prevented investments from flowing in, and made poor neighborhoods poorer. It also prevented African-Americans from owning their own homes, the most important way of building wealth in the 20th century.

Other minorities had to fight for equal rights as well. During World War II, nearly 110,000 people of Japanese descent from Oregon, Washington and California were sent to internment camps. In 1942, Federal Executive Order 9066 ordered civilians cleared from "military areas," but only Japanese-Americans were forced to leave. In the Zoot Suit Riots of 1943, police did not protect Latino teenagers who were attacked by white servicemen for wearing zoot suits, a fashion of the time. Many Chinese also struggled against anti-Chinese racism and were only allowed to immigrate to the U.S. in 1943. Native Americans were denied the right to vote in six states. They were accused of not being able to read, not being citizens and not paying taxes.

NAACP blasts segregation

World War II spurred a strong sense of injustice among African-Americans. The National Association for the Advancement of Colored People (NAACP) began major attacks against discrimination and segregation. It was encouraged by the record of black servicemen in the war and financial support from white donors.

Social pressure to end segregation also increased during and after the war. In 1944 the Swedish economist Gunnar Myrdal published "An American Dilemma," which gives a blunt account of the history of racial injustice in the U.S. The book became extremely influential. In 1946, President Harry S. Truman established a federal civil rights committee that called for an end to segregation in America.

In 1948, based on the committee's findings, Truman issued Executive Order 9981, desegregating the military. It also led to the 1954 Supreme Court decision ending segregation in the country's schools. Many scholars consider it the birth of the modern civil rights movement.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the four statements below. Which statement shows the order of government action during and after World War II? >1. Executive Order 9981; formation of the federal civil rights committee; formation of the FEPC; Executive Order 9066 >2. Executive Order 9066; formation of the FEPC; formation of the federal civil rights committee; Executive Order 9981 >3. Formation of the FEPC; Executive Order 9066; formation of the federal civil rights committee; Executive Order 9981 >4. Formation of the FEPC; Executive Order 9066; Executive Order 9981; formation of the federal civil rights committee.

(A) Statement 1

(B) Statement 2

(C) Statement 3

(D) Statement 4

2 Read the sentence from the first paragraph of the article.

New government policies laid the groundwork for the end of racial segregation.

What is the meaning of the phrase "laid the groundwork" as it is used above?

(A) completed what was already started

(B) put the beginning steps in place

(C) remained essentially inactive

(D) continued to create barriers

3 Based on Truman's Executive Order 9981, what can we assume about the findings of the federal civil rights committee?

(A) The civil rights committee probably found that separation of races in the military was fair.

(B) The civil rights committee probably found that African Americans had equal rights and access to jobs.

(C) The civil right committee probably found that Latinos faced far more discrimination that African-Americans

(D) The civil rights committee probably found that segregation was bad for the country and the military.

4 Read the selection from the third paragraph of the article.

This committee held hearings to expose racial discrimination and helped African-Americans in the North find work. The formation of the FEPC also led to the first civil rights case regarding equal employment for Latinos. Protests were held before the FEPC to expose the fact that Latinos were still denied jobs in many war industries.

The author uses the word "expose" to mean:

(A) reveal

(B) betray

(C) insult

(D) endanger

This article is available at 5 reading levels at https://newsela.com.

5 What would be one of the long-term effects of redlining on African-American families?

(A) They accumulated wealth through work rather than by owning homes, meaning African-Americans owned small businesses.

(B) Large numbers of African-Americans would migrate to northern cities, meaning that the South became largely white.

(C) They participated in the FEPC in order to find better housing options, leading to them moving into the suburbs.

(D) They failed to accumulated wealth that could be passed on to their children, keeping many African-Americans in poverty.

6 Which two sentences from the article would be MOST important to include in a summary?

1. *America changed tremendously during World War II, creating a driving force for civil rights that transformed American life.*
2. *President Franklin D. Roosevelt responded by banning discrimination in defense industries.*
3. *Even as people of color served in the military, those at home still faced racial discrimination from federal and local governments.*
4. *In 1942, Federal Executive Order 9066 ordered civilians cleared from "military areas," but only Japanese-Americans were forced to leave.*

(A) 1 and 3

(B) 1 and 4

(C) 2 and 3

(D) 2 and 4

7 Read the sentence from the article. >Protests were held before the FEPC to expose the fact that Latinos were still denied jobs in many war industries. Why were protests necessary?

(A) Because the focus of the FEPC was discrimination against African Americans.

(B) Because Latinos were not seen as Americans despite their citizenship.

(C) Because Latinos were not included in the civil rights movement.

(D) Because the federal civil rights committee wanted to study Latinos separately.

8 Which central idea is BEST supported by the section "NAACP blasts segregation"?

(A) Some examples of discrimination had the unspoken support of the government.

(B) Minorities served in the military but fought in units segregated from white soldiers.

(C) Many groups in America continued to face discrimination even after serving in the military.

(D) Social and legal pressure forced the government to begin changing discriminatory policies.

This article is available at 5 reading levels at https://newsela.com.

Organizations of the civil rights movement

By ThoughtCo.com, adapted by Newsela staff on 06.07.19
Word Count **569**
Level **1040L**



Band of CORE demonstrators cross the Brooklyn Bridge into Manhattan in New York City, July 17, 1965, during a protest march to police headquarters. The group was protesting the fatal shooting of a black man by a rookie patrolman in Brooklyn's Bedford Stuyvesant section July 15. Photo by Dave Pickoff for AP.

The modern civil rights movement began with the Montgomery Bus Boycott of 1955, and lasted until the late 1960s. It was led by several organizations, which worked together to create change in U.S. society. Four of the most important organizations are listed below.

National Association For The Advancement Of Colored People (NAACP)

The oldest, largest and most well-known U.S. civil rights organization is the National Association for the Advancement of Colored People (NAACP). The Association works to ensure "political, educational, social, and economic equality for all." It seeks to end "racial hatred and racial discrimination."

The NAACP was founded in 1909. It was established in response to a wave of mobs killing black people, and an anti-black race riot in Illinois the year before. Its founders included several descendants of prominent 19th-century antislavery crusaders.

This article is available at 5 reading levels at https://newsela.com.

During the civil rights movement, the NAACP helped to integrate public schools in the South. Most significantly, its lawyers won the key 1954 Supreme Court case Brown v. Board of Education. As a result of that victory, segregation was outlawed in all U.S. public schools.

In 1955, a local chapter secretary of the NAACP named Rosa Parks refused to give up her seat on a segregated bus in Montgomery, Alabama. Her actions set the stage for the Montgomery Bus Boycott. During the boycott, African-Americans refused to ride Montgomery city buses as a protest against segregated seating. The success of the boycott led to the development of a national civil rights movement.

The NAACP played a key role in the passage of the Civil Rights Act of 1964 and the Voting Rights Act of 1965.

Congress Of Racial Equality (CORE)

The Congress of Racial Equality (CORE) also played an important role in the civil rights movement.

CORE was established in Chicago in 1942. Its founders were James Farmer Jr., George Jouser, James R. Robinson, Bernice Fisher, Homer Jack and Joe Guinn. Membership was open to "anyone who believes that 'all people are created equal' and willing to work towards the ultimate goal of true equality throughout the world."

CORE developed and participated in various national campaigns. Among them were the March on Washington and the Freedom Rides.

Southern Christian Leadership Conference (SCLC)

The Southern Christian Leadership Conference (SCLC) was closely associated with Martin Luther King Jr. It was established in 1957 following the success of the Montgomery Bus Boycott.

Unlike the NAACP, the SCLC did not recruit individual members. Instead, it worked with local organizations and churches to build its membership.

The SCLC sponsored various campaigns and marches. Among them were the Albany Movement in Georgia, and the Selma Voting Rights March and the Birmingham Campaign in Alabama.

Student Nonviolent Coordinating Committee (SNCC)

In April 1960, SCLC official Ella Baker met with a group of student activists at Shaw University in Raleigh, North Carolina. King wanted the students to work with the SCLC. Baker, however, urged them to create their own independent organization. Baker won the students over, and the Student Nonviolent Coordinating Committee (SNCC) was established.

Student James Lawson wrote a mission statement for the new organization: "We affirm the philosophical or religious ideals of nonviolence as the foundation of our purpose, the presupposition of our faith, and the manner of our action. Nonviolence, as it grows from Judaic-Christian traditions, seeks a social order of justice permeated by love." That same year, Marion Barry was elected as the SNCC's first chairman.

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 Read the paragraph from the section "Student Nonviolent Coordinating Committee (SNCC)."

> *In April 1960, SCLC official Ella Baker met with a group of student activists at Shaw University in Raleigh, North Carolina. King wanted the students to work with the SCLC. Baker, however, urged them to create their own independent organization. Baker won the students over, and the Student Nonviolent Coordinating Committee (SNCC) was established.*

What conclusion is BEST supported by the paragraph above?

(A) King tried to recruit each of the student activists individually to work with the SCLC.

(B) Baker liked the idea of student activists creating an organization of their own.

(C) King thought the student activists would fail if they tried to form their own organization.

(D) Baker wanted the student activists to create a new organization so she could leave the SCLC.

2 Read the following statement.

> *One way that civil rights organizations tried to create change in U.S. society was though the legislative process.*

Which sentence from the article provides the BEST support for the above statement?

(A) It was led by several organizations, which worked together to create change in U.S. society.

(B) During the boycott, African-Americans refused to ride Montgomery city buses as a protest against segregated seating.

(C) The NAACP played a key role in the passage of the Civil Rights Act of 1964 and the Voting Rights Act of 1965.

(D) The Congress of Racial Equality (CORE) also played an important role in the civil rights movement.

3 What is the MAIN reason the author includes the section “Southern Christian Leadership Conference (SCLC)"?

(A) to show that some civil rights organizations were founded by more than one person

(B) to explain that some civil rights organizations included people of different races

(C) to describe one of the civil rights organizations that was a leader in the civil rights movement

(D) to show how difficult it was for one civil rights organization to work toward equality

4 The author includes information about the NAACP first.

What is a reason why the author chose to provide information about CORE next?

(A) The NAACP was the largest civil rights organization, and CORE was the second largest.

(B) CORE was an important civil rights organization that was established after the NAACP.

(C) The NAACP sent an official to recruit for their organization, but she helped start CORE instead.

(D) CORE was influenced by the NAACP to extend membership to anyone who was interested in equality.

This article is available at 5 reading levels at https://newsela.com.

Heroes of the civil rights movement were not all men

By USA Today, adapted by Newsela staff on 10.26.18
Word Count **923**
Level **1070L**



Image 1. Coretta Scott King, an American civil rights campaigner and widow of Martin Luther King Jr., stands behind a podium covered in microphones at a rally for peace in Vietnam at Central Park in New York City, April 27, 1968. Photo from Hulton Archive/Getty Images

On that historic August day in 1963, Martin Luther King Jr. delivered his famous "I Have a Dream" speech. What we didn't get to hear was what the women of the civil rights movement dreamed of. That's because not one of them spoke at length during the March on Washington.

Daisy Bates was a leader in the movement to end segregation in Arkansas. She gave a brief pledge on August 28, 1963, before the "Tribute to Negro Women Fighters for Freedom." The tribute was an addition to the program meant to appease black women who felt that their voices were being ignored.

The civil rights movement could not have happened without women. They were grassroots organizers, educators and writers. They built organizations, developed legal arguments and mentored young activists. They fought ardently against racism, but they also battled another form of oppression: sexism.

This article is available at 5 reading levels at https://newsela.com.

"There were hundreds of unnamed women who participated in the movement," Barbara Reynolds, a journalist and minister, said "It was not just a few leaders — it was women ... who really put their mark on history."

Outside Looking In

Many of these women were architects in their own right, yet they found themselves outside of King's inner circle.



"Dr. King was a chauvinist," Reynolds said. Men like him "could not assert their manhood in the general society, because they would be killed if they stood up for anything." Instead, they asserted their masculinity in other ways within their own community, often by mistreating women.

The women of the civil rights movement understood that their fight for human rights needed to address the dual forces of racism and sexism. They understood that for the movement to be effective, it needed to include all kinds of people. Together, many women worked to build new political movements free of all forms of prejudice.

These Women Were Influencers

The courage of black female activists influenced other protest movements, too. These included the feminist movement, the fight for gay rights and the protests over the Vietnam War.

Coretta Scott King, a leader in her own right, used her talent as a singer to raise awareness and funds for her husband's movement. She also advocated for human rights broadly. She was an earlier critic of the Vietnam War than her husband, and she persuaded him to speak out against it.



King was the face of the Southern Christian Leadership Conference (SCLC). This was one of the most prominent African-American civil rights organizations of its time. However, it was the political shrewdness of lifelong activist Ella Baker that birthed the organization and set its agenda, historian Barbara Ransby wrote. Baker is viewed by some as the most influential woman in the civil rights movement.

"Baker operated in a political world that was, in many ways, not fully ready for her," Ransby wrote. "She inserted herself into leadership situations where others thought she simply did not belong. Her unique presence pioneered the way for fuller participation by other women in political organizations."

The March Down Independence Avenue

This article is available at 5 reading levels at https://newsela.com.

The Oscar-nominated film "Selma" focused on King's role in the Selma to Montgomery Voting Rights marches in 1965. However, it was Diane Nash, barely a presence in the film, who was one of its major organizers. Nash also helped to organize the campaign to integrate lunch counters in Nashville in 1960.

Even when history does remember women, it tends to treat them as fables rather than human beings. Take Rosa Parks, who has been immortalized as an accidental hero.

"Everyone seems to think she was a frail little woman who was tired — that woman whose feet hurt," Reynolds said. The truth is that Parks was a lifelong activist for racial justice. What she was tired of, Reynolds said, was "being put on the back of the bus."

Dorothy Height, a major leader of her day who served as president of the National Council of Negro Women, stood on the platform with King during the March on Washington. Still, she said many women were furious about their mistreatment during it.

To bring attention to the distinct oppression women faced, Height, along with several other black female leaders, held a parallel march of their own. The women marched down Independence Avenue, while the men marched down Pennsylvania Avenue.

Moving Forward With The New Generation

Today, there's a new generation of black female activists fighting for social justice. Three of them — Alicia Garza, Patrisse Cullors and Opal Tometi — founded and lead Black Lives Matter.

Donna Brazile, a Democratic political leader, said the nation should be ready for more of them.

"Black women are taking an active role in beginning what I call the next phase of the black political movement, which is to prepare for a century in which the minority citizens of today will become the majority citizens of tomorrow," she said. "Black women are going to lead that way, but we're not going to be alone. We're going to bring as many people with us. Because in moving the country forward, we can leave no one behind."

This article is available at 5 reading levels at https://newsela.com.

Quiz

1 How did African-American women in the civil rights movement MOST influence other movements for political change?

(A) They thought the civil rights movement should focus on fighting against discrimination by race.

(B) They opposed prejudice in all forms and sought to include all kinds of people in the movement.

(C) They organized and marched against racism in places in the South such as Selma, Alabama.

(D) They delivered speeches against racism after the "I Have A Dream" speech in Washington, D.C.

2 Read the sentences below from the article.

1. *On that historic August day in 1963, Martin Luther King Jr. delivered his famous "I Have a Dream" speech.*
2. *Coretta Scott King, a leader in her own right, used her talent as a singer to raise awareness and funds for her husband's movement.*
3. *The Oscar-nominated film "Selma" focused on King's role in the Selma to Montgomery Voting Rights marches in 1965.*
4. *Dorothy Height, a major leader of her day who served as president of the National Council of Negro Women, stood on the platform with King during the March on Washington.*

Which two sentences reflect CENTRAL ideas of the article?

(A) 1 and 2

(B) 1 and 3

(C) 2 and 3

(D) 2 and 4

3 Based on the article, what did African-American women struggle against that men did not face?

(A) Black women faced discrimination by race unlike black men.

(B) Black women fought against peaceful protests unlike black men.

(C) Black women fought against sexism that did not affect black men.

(D) Black women fought for citizenship, a right held by black men.

4 Which statement would be MOST important to include in a summary of the article?

(A) Black women played many key roles in the civil rights movement.

(B) Black women created the Black Lives Matter movement.

(C) Black female activists influenced the fight for gay rights.

(D) Black female leaders held a separate march for women.

5 According to the article, which unique contribution did African-American women make rather than men?

(A) Women helped organize protests for civil rights throughout the South.

(B) Women organized and marched for civil rights in places like Selma, Alabama.

(C) Women influenced other protest movements for civil rights in the South.

(D) Women saw the fight against racism as part of a larger fight against sexism and oppression.

This article is available at 5 reading levels at https://newsela.com.

6 What is one reason why the author includes the information about the film "Selma"?

(A) to show that a film about the civil rights movement was worthy of an Oscar nomination

(B) to explain some of the effects of the Selma to Montgomery Voting Rights marches in 1965

(C) to describe a problem that the Selma to Montgomery Voting Rights marches addressed

(D) to explain how a film about the civil rights marches treated a black woman organizer of the marches

7 Based on the article, how did sexism shape the experience of African-American women in the civil rights movement?

(A) They faced discrimination that prevented them from voting.

(B) They could not organize marches or deliver public speeches against sexism.

(C) They could not march in public protests, which caused women to sit at home.

(D) They were not taken seriously, leading to fewer opportunities to deliver speeches.

8 What is the MAIN reason the author includes the section “Moving Forward With The New Generation"?

(A) It provides additional examples of black female activists who participated in the civil rights movement of the 1960s.

(B) It describes some of the specific ways that black female activists are fighting for social justice in the present.

(C) It explains that black women will continue to play an important role in the social justice movements of today.

(D) It explains a problem that black female activists face in their fight for social justice.

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Legislative and Judicial Results of the Civil Rights Movement

By Encyclopaedia Britannica, adapted by Newsela staff on 05.02.17
Word Count **1,201**
Level **990L**



A black military policeman (MP) in front of a "colored" MP entrance in Georgia in 1942. In World War II, the military was segregated; black officers even had to enter some military bases through separate entrances from white officers. Black soldiers also were not given the same opportunities as white soldiers. In 1948, President Harry Truman desegregated the military.

In the mid-1950s, the American civil rights movement against segregation became well known across the country. At the end of the Civil War, the 14th and 15th amendments to the U.S. Constitution gave African-Americans their basic civil rights. However, Jim Crow laws took away these rights. These laws were passed in the South that gave states power to separate white and black people.

In 1896, the Supreme Court decided that a Jim Crow law, that allowed white and black passenger cars on trains, was legal because the train cars were "separate and equal." This now allowed separate neighborhoods, hospitals, hotels, eating places and schools.

But they were not equal. The white areas were much better, newer, larger and cleaner. Jim Crow laws also made it harder for African-Americans to vote, so the blacks had no power to change these laws. In the 1940s and 1950s, the Supreme Court started to change and found that the Jim

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Crow laws were not fair. The judges decided that buses in the South going from state to state do not have to be segregated. The Supreme Court stopped private agreements between homeowners that kept blacks from buying homes in white neighborhoods. The 1950s brought more changes. A black law student was allowed to attend classes with whites at the University of Texas and finally, in 1954, the court case Brown v. Board of Education ended the rule of separate but equal. How did that movement to end segregation happen?

Du Bois to Brown

The Pan-African movement was started in the 1800s. Many African-Americans began to get in touch with their African heritage. They also felt that African countries should be free from the European countries that controlled them. Some black leaders believed that African-Americans could not compete with white Americans and felt that they should form their own country within the United States.

W.E.B. Du Bois graduated from Harvard University and was an important civil rights leader. He felt the Pan-African movement was important, but other African-Americans had different ideas. Booker T. Washington felt African-Americans needed first to learn trades, like farming. He opened a school to train them. Washington thought it was too dangerous to challenge Jim Crow laws at the time, but Du Bois and other African-American leaders disagreed with Washington. They formed the National Association for the Advancement of Colored People (NAACP) in 1909 that fought against the Jim Crow laws. It worked to help African Americans get equal education, employment, housing, travel and equal use of places open to the public. Du Bois left the NAACP in 1934, because he was more interested in the Pan-African movement.

Other groups had different ways to fight for civil rights. When World War II began in 1941, labor leader A. Philip Randolph's wanted more jobs for African-Americans. He was forming a march of workers in Washington, D.C., which made President Franklin D. Roosevelt sign an order that African-Americans be hired in factories that built things to win the war. In 1942, the Congress of Racial Equality (CORE) was formed by white and black leaders. They used non-violent protest to try to stop segregation in Northern cities.

In 1951, a student walkout at a Virginia high school was led by Barbara Johns, age 16. This turned into a 1954 victory in the NAACP case of Brown v. Board of Education. Separate was no longer equal. However, the Supreme Court did not say exactly when all schools must have white and black students learning together. So school segregation continued.

Montgomery bus boycott to the Voting Rights Act

On December 1, 1955, Rosa Parks refused to give her seat to a white man on a city bus in Montgomery, Alabama. Her arrest led to a bus boycott. For 381 days most blacks in Montgomery refused to use buses. The boycott put the Rev. Martin Luther King Jr. into the spotlight as a leader. It also led to the December 20, 1956, Supreme Court decision that ruled against bus segregation. In January 1957, King created the Southern Christian Leadership Council (SCLC) that used non-violence to get more civil rights.

Four black college students in Greensboro, North Carolina, sparked a new phase of the Southern civil rights movement on February 1, 1960. They staged a sit-in at a drugstore lunch counter reserved for whites. Soon thousands of students in at least 60 southern cities joined the sit-ins.

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These student protesters formed their own group, the Student Nonviolent Coordinating Committee (SNCC).



Freedom Rides began in 1961. The bus riders were riding into the South to protest that black and whites still had to ride in separate parts of buses. Some of the Southern states had refused to listen to the Supreme Court. The first group of bus riders were attacked by white mobs in Alabama. These riders continued on into Jackson, Mississippi, where they were arrested and jailed. The Freedom Rides continued and put pressure on the federal government to protect the constitutional rights of African-Americans.

Similar mass protests in dozens of other cities made white Americans more aware of Jim Crow laws throughout the South. Those mass protests led to the March on Washington for Jobs and Freedom on August 28, 1963. More than 200,000 marchers heard the Rev. Martin Luther King Jr. tell them "I Have a Dream."

The Voting Rights Act

The mass protests continued. After two years African-Americans were finally getting their right to vote. President Lyndon B. Johnson proposed and Congress passed the Voting Rights Act of 1965. It ended the payment of voting taxes and reading tests that kept African-Americans from being able to vote. Laws in the 1970s also protected voting rights for non-English-speaking U.S. citizens.

As the 20th century ends

As more African-Americans voted in elections, more African-Americans were being elected to office. Civil rights leaders, John Lewis and Andrew Young, became congressmen. In 1969, 13 African-American members of the U.S. House of Representatives formed the Congressional Black Caucus. They worked together to make laws to help the poor. Jesse Jackson ran for the Democratic presidential nomination in 1984 and 1988 and reached beyond African-American voters as he created a "Rainbow Coalition" of "red, yellow, brown, black and white" Americans.

Overall, the struggle for civil rights in the 1900s increased the responsibility of the government to enforce civil rights laws. These reforms did not, however, improve the lives of many poor African-Americans. They still lived in segregated places where housing, public schools, and health care services needed to be improved.

Into the 21st century

By the early 2000s, the Black Caucus in Congress had more than 40 members. They have helped pass laws to improve public school and college education opportunities for African-Americans. However, civil rights still need protection.

The election of Barack Obama to the U.S. presidency was a first for American society. Obama appealed to many voters. However, because of the deeply rooted race conflicts of the American past, Obama's election didn't solve race problems. Most likely, more race issues and problems lie ahead.

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Quiz

1 Which section highlights the idea that African-American leaders had different ideas about HOW to improve their communities, even sometimes strongly disagreeing with each other?

(A) Introduction [paragraphs 1-3]

(B) "Du Bois to Brown"

(C) "Montgomery bus boycott to the Voting Rights Act"

(D) "As the 20th century ends"

2 Which paragraph in the section "Montgomery bus boycott to the Voting Rights Act" demonstrates that many nonviolent protesters had to endure violence in the struggle for equal rights?

3 Which statement would be MOST important to include in a summary of the article?

(A) These laws were passed in the South that gave states power to separate white and black people.

(B) Du Bois left the NAACP in 1934, because he was more interested in the Pan-African movement.

(C) Overall, the struggle for civil rights in the 1900s increased the responsibility of the government to enforce civil rights laws.

(D) By the early 2000s, the Black Caucus in Congress had more than 40 members.

4 The CENTRAL idea of the article is developed by:

(A) providing a timeline of African-Americans' struggles to gain civil rights

(B) comparing different opinions about African-Americans' civil rights

(C) introducing leaders who had a large impact on the civil rights movement

(D) arguing that Jim Crow laws were unfair and that separate was not equal

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Lecciones de lectura y escritura

Generación Y: cuando de caridad se trata... ¡manos a la obra!

By Joyce Gannon, Pittsburgh Post-Gazette, adaptado por la redacción de Newsela on 12.22.15
Word Count **1,057**
Level **MAX**



Suzanne Haines Walsh (a la izquierda), de 60 años, quien no tiene hogar, recibe comida de los voluntarios que trabajan con el grupo Love Thy Neighbor Inc., una organización sin fines de lucro. AP/Lynne Sladky

PITTSBURGH — Hace apenas unos días en este mismo mes, durante el día nacional de la filantropía conocido como *Giving Tuesday* (Martes de Donaciones), alrededor de 100 empleados de Dick's Sporting Goods se presentaron en Sarah Heinz House, una institución ubicada en el lado norte de Pittsburgh, para limpiar, pintar y decorar con motivo de las festividades.

Mientras que millones de personas en todo el mundo aprovechan este día para realizar donaciones en línea a diversas instituciones de caridad, el grupo de Dick's —muchos de sus miembros integrantes de la generación Y, o Generación del Milenio, de entre 20 y 30 años de edad— trabajó en Sarah Heinz House codo a codo con los estudiantes de secundaria que asisten al lugar para participar en talleres, clases y otra serie de actividades que esta organización sin fines de lucro ofrece.

"Limpiaron y embellecieron por completo los gimnasios, las áreas de cocina y los salones de clase", comentaba Deb Hopkins, directora ejecutiva de Pittsburgh Cares, una organización que busca

expandir la cultura del voluntariado mediante una serie de oportunidades que pone al alcance tanto de empresas como de individuos.

Para la generación del milenio, decía, el participar en actividades prácticas que ayuden a las personas necesitadas es una labor que le resulta tanto o más gratificante que si se tratara de una contribución monetaria.

"(La generación Y) busca resultados inmediatos".

El *Giving Tuesday* —el cual surgió en el año 2012 como una especie de antídoto contra las compras frenéticas que se llevan a cabo entre los días de Thanksgiving Day y Cyber Monday— logró este año, según informan sus creadores, *the 92nd Street Y* en Nueva York, generar aproximadamente $116,7 millones como fruto de las contribuciones otorgadas por más de 700.000 donantes.

También generó una oleada de voluntariado local semejante al de la limpieza en Sara Heinz House. De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más motivada a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

"Nos hemos dado cuenta de que, para la generación del milenio, donar parte de su tiempo, habilidades y esfuerzo común a una causa noble es tan importante como lo es el donar dinero", explicaba Derrick Feldmann, investigador a cargo de The Millennial Impact Project, un estudio que se dedicó a analizar la manera en que nueve organizaciones sin fines de lucro llevaron a cabo sus campañas para la recolecta de fondos del día *Giving Tuesday*.

Con su sede ubicada en Indianápolis, el proyecto surgió en el año 2009 con el objetivo de estudiar y analizar el comportamiento de la generación Y. El estudio, que se enfoca en la postura de la generación del milenio y su aporte a la sociedad, se encuentra financiado por la Case Foundation, a cargo de los filántropos Steve y Jean Case. Case fue cofundadora de America Online.

El proyecto decidió enfocarse en *Giving Tuesday*, explicaba Feldmann, debido a que se trata de una iniciativa relativamente nueva, que se desarrolla básicamente a nivel digital y que se apoya principalmente en las redes sociales para generar contribuciones.

"Al parecer se trata de algo en lo que muy posiblemente la generación del milenio se involucraría con un alto nivel de participación... así que nos propusimos averiguar si en realidad sería o no así".

Los investigadores seleccionaron a nueve organizaciones sin fines de lucro —incluyendo las universidades de Rutgers y Otterbein, la Universidad de North Carolina y la estación pública de radio WBEZ en Chicago— y estudiaron las estrategias de mercadeo que aplicaron en los días previos a *Giving Tuesday* y de qué forma promocionaron las actividades el día del evento.

Las organizaciones sin fines de lucro que optaron por usar solo propaganda a nivel digital y que se limitaron al envío de emails y a realizar publicaciones en las redes sociales "no alcanzaron un índice de acogida elevado" por parte de lo generación Y, decía Feldmann.

Pero cuando dichas organizaciones lograron relacionar el sentido del *Giving Tuesday* con eventos prácticos, "obtuvieron el más alto nivel de receptividad por parte de la generación del milenio", puntualizó.

En el caso de la Universidad de North Carolina, por ejemplo, un consejo estudiantil de filantropía junto con un consejo de jóvenes ex alumnos organizaron en *Giving Tuesday* una serie de eventos en el campus universitario.

UNC creó su propio hashtag para ese día: #TarHeel Tuesday y alentaban a los estudiantes a que participaran como voluntarios en un programa de estudiantes embajadores y a que compartieran sus fotos en Snapchat.

La universidad logró reunir ese día cerca de $236.000 —lo que superó con creces el objetivo de $150.000 que se había propuesto alcanzar— incluyendo $23.000 aproximadamente provenientes de la generación Y quienes constituyeron el 29 por ciento de los donantes.

"Pensamos que una combinación de tácticas a nivel digital, de participación local y de buenas estrategias autorganizativas que permita a la generación del milenio apersonarse del día y poner manos a la obra sería un proyecto que tendría muy buena acogida", explicaba Feldmann.

Además del evento organizado por Dick's en Sarah Heinz House, Pittsburgh Cares también organizó una serie de actividades para *Giving Tuesday* entre las cuales estaba el contribuir con la iniciativa de U.S. Marine Corps' Toys for Tots ayudando a clasificar e inventariar los paquetes de mercancía.

En los almacenes regionales de Toys for Tots se organizó al final de la tarde una actividad para las familias en la que los niños podían ayudar a sus padres a seleccionar y empaquetar una variedad de juguetes destinados para los niños necesitados.

"Esa es otra tendencia que se observa: a la generación del milenio le gusta que sus hijos sean participativos", señalaba Hopkins. "Diariamente recibo cuatro o cinco llamadas de personas que buscan trabajo de voluntariado para niños de hasta 5 años de edad".

Sin embargo, señalaba, la idea de relacionar la filantropía con actividades prácticas en lo que a causas caritativas se refiere no es algo que se limite solo a la generación Y.

"No creo que pueda decirse que ellos muestran más interés en este tipo de experiencias que las demás personas. Es verdad que en cuanto a la tecnología son más diestros, pero fuera de eso puedo decir que existe una intensa actividad por parte de nuestros voluntarios, ya sean *baby boomers* (generación inmediata a la posguerra), personas retiradas o ancianos".

Quiz

1 Lea la siguiente oración del artículo.

Para la generación del milenio, decía, el participar en actividades prácticas que ayuden a las personas necesitadas es una labor que le resulta tanto o más gratificante que si se tratara de una contribución monetaria.

¿Cuál es la connotación de la palabra “gratificante” en la oración anterior? ¿Qué línea del texto respalda su respuesta?

(A) Tiene una connotación positiva: De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más motivada a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

(B) Tiene una connotación positiva: Con su sede ubicada en Indianápolis, el proyecto surgió en el año 2009 con el objetivo de estudiar y analizar el comportamiento de la generación Y.

(C) Tiene una connotación negativa: "Al parecer se trata de algo en lo que muy posiblemente la generación del milenio se involucraría con un alto nivel de participación... así que nos propusimos averiguar si en realidad sería o no así".

(D) Tiene una connotación negativa: “Es verdad que en cuanto a la tecnología son más diestros, pero fuera de eso puedo decir que existe una intensa actividad por parte de nuestros voluntarios, ya sean baby boomers (generación inmediata a la posguerra), personas retiradas o ancianos".

2 Lea la siguiente oración.

De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más motivada a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

¿Cuál de las siguientes versiones de la oración anterior aportaría un matiz NEGATIVO si sustituyera la frase “MOTIVADA”?

(A) De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más ALENTADA a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

(B) De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más DISPUESTA a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

(C) De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más ABATIDA a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

(D) De acuerdo a un informe publicado este mes, al parecer la generación Y se siente más SEGURA a ayudar cuando las instituciones de caridad ofrecen oportunidades para la participación activa.

3 ¿Cuál de las siguientes opciones es la que MEJOR describe la estructura de los párrafos 1-4?

(A) Proporciona una ilustración de "Giving Tuesday", luego introduce su importancia para la Generación del Milenio.

(B) Introduce el origen de "Giving Tuesday" luego explica por qué la Generación del Milenio empezó esta tradición.

(C) Demuestra cómo la Generación del Milenio es diferente a las otras generaciones y provee un ejemplo.

(D) Explica la importancia de "Giving Tuesday" y cómo se compara con Thanksgiving Day.

4 ¿Cuál será el propósito de incluir la idea que las personas de la generación de los baby boomers también les gusta ser parte de acciones filantrópicas?

(A) Para demostrar que a pesar que la mayoría de las personas que donan en Giving Tuesday es de la Generación del Milenio, hay muchas personas que pertenecen a otras generaciones que también participan. La razón por la cual las personas de la Generación del Milenio participan más en Giving Tuesday, es por su conocimiento de tecnología y redes sociales.

(B) Para demostrar que a pesar que la mayoría de las personas que donan en Giving Tuesday es de la Generación de los baby boomers, no todos ellos usan las redes sociales para hacer sus contribuciones a ese día nacional. También hay muchas personas que pertenecen a otras generaciones como los niños que también participan.

(C) Para demostrar que la mayoría de las personas que donan en Giving Tuesday es de la Generación del Milenio porque son hijos de personas que pertenecen a la generación de los baby boomers a quienes les gusta donar a causas humanitarias y eventos filantrópicos y quienes enseñaron a sus hijos e hijas a participar en la filantropía.

(D) Para demostrar que la Generación del Milenio es idéntica a la generación de los baby boomers. A las personas de la Generación del Milenio les gusta participar más en eventos y a los baby boomers les gusta ser activos por medio del voluntariado y por su demostración a querer ayudar en eventos que apoyen causas filantrópicas.

Para ganar confianza humana, una empresa le agrega "ojos virtuales" a vehículos autónomos

By Peter Holley, The Washington Post on 09.10.18
Word Count **743**
Level **MAX**



Para fomentar confianza entre peatones y vehículos autónomos, Jaguar Land Rover ha desarrollado vehículos que se conocen como ´"cápsulas inteligentes" con ojos falsos que comunican su intención a los peatones. Foto por: Jaguar Land Rover

Uno de los mayores retos a los que se enfrentan las empresas automovilísticas que desarrollan vehículos sin conductor tiene poco que ver con la robótica sofisticada o la tecnología láser.

En su lugar, deben diseñar algo mucho más impreciso, pero no menos importante: la confianza humana, el tipo de confianza que se comunica cuando los conductores humanos y los peatones hacen contacto visual en un paso peatonal.

Según las encuestas, gran parte del público alberga profundas preocupaciones sobre la seguridad de la tecnología de autoconducción, por lo que Jaguar Land Rover contrató psicólogos cognitivos para aprender "cómo el comportamiento del vehículo afecta la confianza humana en la nueva tecnología", dijo el fabricante de automóviles británico en un comunicado de prensa.

Su solución: un par de ojos grandes y caricaturescos similares a los ojos de plástico que usted probablemente usó en los proyectos de la escuela primaria.

Los ojos han sido montados en vehículos autónomos conocidos como "cápsulas inteligentes". Concebidos por un equipo de ingenieros, los ojos buscan a los peatones cercanos antes de "mirarlos" directamente, señalando silenciosamente que el vehículo los ve y planea permanecer inmóvil para que puedan pasar, dijo la compañía.

Antes y después de la interacción, los ingenieros registran los niveles de confianza para determinar si los sujetos de prueba humanos experimentaron suficiente confianza en la cápsula, dijo la compañía. Hasta ahora se ha observado la interacción de más de 500 personas con los vehículos expresivos, pero la compañía no ha publicado detalles sobre las interacciones.

"Es una reacción instintiva mirar al conductor del vehículo que se aproxima antes de caminar sobre la carretera", dijo Pete Bennett, futuro director de investigación de movilidad de Jaguar Land Rover, en una declaración. "Comprender cómo se traduce esto en el mundo más automatizado de mañana es importante".

Otras industrias también han aplicado ojos a los robots. El robot industrial Baxter tiene un rostro en forma de tableta con ojos diseñados para comunicar las intenciones del robot a los trabajadores humanos cercanos, como la concentración cuando la máquina está trabajando o la tristeza cuando está rota.

La gente se siente incómoda no solo al interactuar con los vehículos que conducen por su cuenta, sino también al viajar en ellos. Un estudio de la Asociación Automovilística Americana (AAA) de este año concluyó que el 63 por ciento de los conductores de Estados Unidos sienten miedo de ser transportados en un vehículo totalmente autónomo, en comparación con el 78 por ciento del año anterior.

Los conductores masculinos y los *millenials* son quienes más confían en la tecnología autónoma, y solo la mitad de ellos reportaron que tienen miedo de viajar en un coche totalmente autónomo, según AAA, organización que ha comenzado a instar a los fabricantes de automóviles a que eduquen a los consumidores sobre el transporte autónomo. Aunque el error humano causa más del 90 por ciento de las colisiones, la mayoría de los conductores consideran que sus habilidades al volante son mejores que el promedio y se muestran reacios a ceder el control a una máquina.

"Los estadounidenses están empezando a sentirse más cómodos con la idea de los vehículos de autoconducción", dijo en febrero Greg Brannon, director de ingeniería automotriz y relaciones industriales de la AAA. "Comparado con hace un año, AAA encontró que 20 millones más de conductores de Estados Unidos confiarían en un vehículo autónomo para llevarlos a dar un paseo".

Jaguar Land River no es la única empresa que explora cómo transmitir mensajes entre vehículos autónomos y peatones.

Este verano, una empresa emergente con sede en Mountain View, California, conocida como Drive.ai, lanzó un programa piloto en Frisco, Texas, en el área metropolitana de Dallas-Fort Worth. Los vehículos de color naranja brillante transportan autónomamente a la gente alrededor de un complejo de oficinas y parques geocercados donde unas 10.000 personas trabajan, comen y compran.

Las palabras "self-driving vehicle" (vehículo de autoconducción) envuelven a sus camionetas Nissan NV200, y los vehículos incluyen paneles exteriores con mensajes, como "esperando a que

cruce", que sustituyen al conductor humano que hace contacto visual o gesticula con un peatón en un paso peatonal.

Los representantes de la empresa han señalado que los vehículos autónomos "no entienden todavía ciertas situaciones complejas, como cuando un obrero de la construcción se comunica con gestos de la mano".

Las cápsulas inteligentes del Jaguar Land Rover todavía no se han aventurado en el mundo real y en su lugar operan en una "escena callejera fabricada en Coventry", dijo la compañía.

Quiz

1 ¿Cuáles son las principales líneas de desarrollo de la idea central del artículo?

1. Definir la tecnología de autoconducción.
2. Identificar el problema que enfrenta la tecnología de vehículos autodirigidos.
3. Explicar las soluciones actuales al problema que enfrenta la tecnología de los autos sin conductor.
4. Analizar el futuro de los vehículos sin conductor.

(A) 1 y 2

(B) 2 y 3

(C) 3 y 4

(D) 1 y 4

2 ¿Qué oración del artículo debería incluirse en el resumen por identificar y desarrollar una idea central?

(A) Uno de los mayores retos a los que se enfrentan las empresas automovilísticas que desarrollan vehículos sin conductor tiene poco que ver con la robótica sofisticada o la tecnología láser.

(B) Los ojos han sido montados en vehículos autónomos conocidos como "cápsulas inteligentes".

(C) El robot industrial Baxter tiene un rostro en forma de tableta con ojos diseñados para comunicar las intenciones del robot a los trabajadores humanos cercanos, como la concentración cuando la máquina está trabajando o la tristeza cuando está rota.

(D) Jaguar Land River no es la única empresa que explora cómo transmitir mensajes entre vehículos autónomos y peatones.

3 Lea los siguientes párrafos del artículo:

Uno de los mayores retos a los que se enfrentan las empresas automovilísticas que desarrollan vehículos sin conductor tiene poco que ver con la robótica sofisticada o la tecnología láser.

En su lugar, deben diseñar algo mucho más impreciso, pero no menos importante: la confianza humana, el tipo de confianza que se comunica cuando los conductores humanos y los peatones hacen contacto visual en un paso peatonal.

¿Cuál de las siguientes conclusiones recibe más apoyo de los párrafos anteriores?

(A) Se precisa una tecnología muy avanzada en la construcción de vehículos sin conductor.

(B) Los peatones y los conductores no confían en la comunicación que se desarrolla entre ellos.

(C) Las empresas automovilísticas consideran imprecisa la interacción entre conductor y peatón.

(D) La tecnología de autoconducción trata de desarrollar un sustituto para la comunicación humana.

4 ¿Qué fragmentos del artículo identifican las tentativas soluciones al problema de la desconfianza que generan los vehículos sin conductor?

1. *Según las encuestas, gran parte del público alberga profundas preocupaciones sobre la seguridad de la tecnología de autoconducción, por lo que Jaguar Land Rover contrató psicólogos cognitivos para aprender "cómo el comportamiento del vehículo afecta la confianza humana en la nueva tecnología", dijo el fabricante de automóviles británico en un comunicado de prensa.*
2. *Antes y después de la interacción, los ingenieros registran los niveles de confianza para determinar si los sujetos de prueba humanos experimentaron suficiente confianza en la cápsula, dijo la compañía.*
3. *Los conductores masculinos y los millenials son quienes más confían en la tecnología autónoma, y solo la mitad de ellos reportaron que tienen miedo de viajar en un coche totalmente autónomo, según AAA, organización que ha comenzado a instar a los fabricantes de automóviles a que eduquen a los consumidores sobre el transporte autónomo.*
4. *Las palabras "self-driving vehicle" (vehículo de autoconducción) envuelven a sus camionetas Nissan NV200, y los vehículos incluyen paneles exteriores con mensajes, como "esperando a que cruce", que sustituyen al conductor humano que hace contacto visual o gesticula con un peatón en un paso peatonal.*

(A) 1 y 2

(B) 2 y 3

(C) 3 y 4

(D) 1 y 4

Tiene dos títulos, pilota aviones, escribe libros y trabaja en la NASA. ¿Edad? 17 años

By Collin Binkley, Associated Press, adaptado por la redacción de Newsela on 12.03.15
Word Count **809**
Level **MAX**



Esta foto fue tomada en agosto de 2015, fue proporcionada por Shu Chien, la madre de Moshe Kai Cavalin. Muestra a su hijo en su casa de San Gabriel, California. Shu Chien via AP

BOSTON — Moshe Kai Cavalin tiene dos títulos universitarios, pero es demasiado joven para votar. Pilota aviones, pero es demasiado joven para manejar un auto solo.

La vida de Cavalin está llena de contrastes. Este adolescente de 17 años de San Gabriel (California) ha superado vertiginosamente logros importantes y su edad parece no seguirle el ritmo. Se graduó del centro de estudios superiores (*community college*) a los 11 años. Cuatro años después, obtuvo una licenciatura en matemáticas de la Universidad de California (Los Ángeles).

Este año, comenzó a tomar clases en línea para obtener una maestría en ciberseguridad de la Brandeis University, en el área de Boston. Sin embargo, decidió posponer ese objetivo durante un par de semestres mientras ayuda a la NASA a desarrollar tecnología de vigilancia para aviones y drones.

Entre una cosa y otra, ha ido acumulando una amplia lista de hazañas extracurriculares. Por ejemplo, acaba de publicar su segundo libro, basado en su experiencia tras el acoso escolar que

sufrió y las historias que le han contado otras personas. Espera sacarse la licencia de piloto de avión antes de que termine este año. En la casa familiar, cerca de Los Ángeles, tiene una colección de torneos de artes marciales.

A pesar de todo, Cavalin insiste en que es mucho más normal de lo que la gente cree. Dice que el mérito lo tienen sus padres por lograr el equilibrio entre los años de educación bien enfocada y la libertad de elegir sus actividades extraescolares. Sus eclécticos intereses provienen de su herencia cultural, comentó, ya que su madre es de Taiwán y su padre es de Brasil.

"Mi caso no es tan particular. Es solo una combinación de la forma en que me han educado, motivación e inspiración", comenta después de un turno de trabajo reciente en el Armstrong Flight Research Center de la NASA en Edwards (California). "Tiendo a no compararme a menudo con otras personas. Solo intento hacerlo lo mejor posible".

Sus padres dicen que siempre aprendió muy rápido. A los cuatro meses, señaló un avión a reacción en el cielo y dijo en chino "avión", su primera palabra. Cavalin tocó techo en sus clases en el hogar después de estudiar trigonometría a los 7 años. Después, su madre empezó a llevarlo al *community college*.

"La mayoría de la gente simplemente piensa que es un genio. Creen que es algo natural", explicaba Daniel Judge, un profesor de matemáticas que dio clase a Cavalin durante dos años en el East Los Angeles College. "En realidad, se esforzaba más que cualquier otro alumno que yo haya tenido antes".

Pero su rápido ascenso no ha estado libre de baches en el camino. Durante el college, soñaba con ser astrofísico. No obstante, cuando empezó a asistir a clases avanzadas de física, su interés se desvaneció. Su fascinación por la criptografía lo llevó hasta las ciencias informáticas.

Eso se ha ajustado más a mí, explica Cavalin. Le sorprendió que la NASA lo llamara para ofrecerle trabajo después de haberlo rechazado antes por su edad. Ricardo Arteaga, su jefe y mentor en la NASA, explica que Cavalin era perfecto para este proyecto, que combina las matemáticas, las computadoras y la tecnología aérea.

"Necesitaba un pasante o becario que supiera de software y conociera los algoritmos matemáticos", dice Arteaga. "Además, necesitaba un piloto que pudiera volar en un Cessna".

En la oficina, Cavalin es un empleado discreto con un sutil sentido del humor, cuenta Arteaga. Se ríen de las cosas que les suelen hacer gracia a los científicos. Su trabajo diario en la NASA incluye llevar a cabo simulaciones de aviones y drones que están destinados a chocar y, después, encontrar rutas para redirigirlos de forma segura.

"Se le dan muy bien las matemáticas", dice Arteaga. "Lo que estamos intentando potenciar son sus habilidades intuitivas".

Durante la conversación, Cavalin habla con la cadencia cuidada y la dicción de alguien que escoge sus palabras con esmero. Es imperturbable, al menos hasta que habla de su rechazo a que le llamen de una cierta manera: "Una palabra que no me sienta nada bien es «genio»", dijo. "Que te digan genio es llevarlo demasiado lejos".

Cuando termine su maestría en Brandeis, Cavalin espera poder obtener otra maestría en negocios en el Massachusetts Institute of Technology. Después, le gustaría fundar su propia empresa de

ciberseguridad.

Pero por ahora se limita a contar los días hasta su 18º cumpleaños, cuando podrá sacarse la licencia de manejo según las leyes de California. Como tiene que vivir lejos de casa para trabajar en la NASA, le pide al propietario de su apartamento que le lleve a comprar comida o toma un taxi. Sus colegas, más mayores que él, lo llevan a diario al trabajo.

En cuanto al resto de asuntos adolescentes, Cavalin dice que esperará hasta que tenga su doctorado para encontrar novia. Bromea, pero solo a medias.

Quiz

1 Lea el siguiente párrafo del artículo.

> *"La mayoría de la gente simplemente piensa que es un genio. Creen que es algo natural", explicaba Daniel Judge, un profesor de matemáticas que dio clase a Cavalin durante dos años en el East Los Angeles College. "En realidad, se esforzaba más que cualquier otro alumno que yo haya tenido antes".*

¿Cuál de los siguientes fragmentos del artículo apoya MEJOR el tema citado arriba?

(A) Este año, comenzó a tomar clases en línea para obtener una maestría en ciberseguridad de la Brandeis University, en el área de Boston. Sin embargo, decidió posponer ese objetivo durante un par de semestres mientras ayuda a la NASA a desarrollar tecnología de vigilancia para aviones y drones.

(B) "Mi caso no es tan particular. Es solo una combinación de la forma en que me han educado, motivación e inspiración", comenta después de un turno de trabajo reciente en el Armstrong Flight Research Center de la NASA en Edwards (California). "Tiendo a no compararme a menudo con otras personas. Solo intento hacerlo lo mejor posible".

(C) Durante la conversación, Cavalin habla con la cadencia cuidada y la dicción de alguien que escoge sus palabras con esmero. Es imperturbable, al menos hasta que habla de su rechazo a que le llamen de una cierta manera: "Una palabra que no me sienta nada bien es «genio»", dijo. "Que te digan genio es llevarlo demasiado lejos".

(D) Sus padres dicen que siempre aprendió muy rápido. A los cuatro meses, señaló un avión a reacción en el cielo y dijo en chino "avión", su primera palabra. Cavalin tocó techo en sus clases en el hogar después de estudiar trigonometría a los 7 años. Después, su madre empezó a llevarlo al community college.

2 Selección la declaración que está alineada MEJOR con los pensamientos de Moshe.

(A) Ser una persona genio no es tan fácil ya que se sufre de acoso en la escuela y muchas personas hablan de ti. También ser genio no es algo natural que llega solo, sino que se requiere saber de muchos diferentes tipos de ideas culturales para poder aprender rápido.

(B) Las personas especiales no existen. Las personas especiales que tienen la habilidad de un genio no son únicas porque hay muchas personas que se han convertido en un genio después de haber trabajado duro con motivación y educación.

(C) Los padres de familia pueden tener una influencia positiva en el crecimiento de una persona pero cuando los padres tienen diferentes culturas, el hijo tiene que navegar el mundo con diferentes herencias culturares, complicando el crecimiento del hijo.

(D) Ser llamado una persona genio no es correcto ya que nadie es un genio si no que cualquier persona puede tener grandes habilidades y capacidades mentales si se dedican al estudio y trabajan duro durante su vida para poder lograr sus metas.

3 ¿Cuál de las siguientes opciones es la que MEJOR describe la estructura del artículo?

(A) El artículo se enfoca en la vida de Moshe cuando era un bebe y como las diferentes culturas de sus padres lo llevaron a convertirse en un genio. También el artículo incluye las características de un genio.

(B) El articulo usa una estructura de orden cronológico para introducir las diferentes etapas de vida de Moshe y después emplea la comparación y contraste para comparar a Moshe con otras personas incluidas en el artículo.

(C) El artículo describe la vida de Moshe y sus logros. También el artículo desarrolla los diferentes factores que han apoyado el crecimiento y avance de Moshe.

(D) El articulo introduce un problema en la vida de Moshe y avanza con la descripción de como Moshe ha podido tener éxito a pesar de diferentes dificultades en su vida.

4 ¿Cuál será el propósito de incluir las diferentes actividades y decisiones que Moshe ha tomado en su vida y la descripción de los padres de Moshe en el artículo?

(A) Para demostrar que ser una persona con capacidades como las de Moshe no es porque es una persona genio si no porque él siempre ha hecho lo que más le interesa y se ha beneficiado de tener unos padres multiculturales que lo han apoyado y enseñado valores importantes.

(B) Para demostrar la importancia que tienen las actividades extracurriculares en la vida de un estudiante y en la habilidad de poder ser una persona exitosa con grandes logros y con posibilidades de poder trabajar en lugares prestigiosos como NASA.

(C) Para demostrar como los papas de Moshe le ayudaron a tomar decisiones y como sus padres lo han impactado durante toda su vida ya que ellos tienen la habilidad de ser multiculturales y saben más que él.

(D) Para demostrar que Moshe es un niño normal que tiene interés en temas como cualquier otro niño y por eso ser genio es algo más común de lo que la gente piensa ya que él no es el único que tiene interés en aprender y explorar.

Señuelos de pesca, negocio exitoso para empresarios adolescentes

By Michael Pearce, The Wichita Eagle on 07.31.17
Word Count **1,145**
Level **MAX**



Cinco estilos de señuelos de plástico (a la izquierda) y cinco tipos de anzuelos son vendidos actualmente por Gabe Backhus y su negocio, Double B Baits, en Herington, Kansas. La compañía, operada por adolescentes, vende también camisetas, gorras y sudaderas con capucha. (Michael Pearce/Wichita Eagle/TNS)

HERINGTON, Kan. — Tres adolescentes de 16 años, oriundos de este pueblo de Kansas, acaban de ganarle a alrededor del 90 por ciento de los participantes durante una convención nacional de clases de negocios para estudiantes de secundaria, celebrada en California.

El modelo de negocios que ellos crearon para su compañía de señuelos de pesca compitió con los de muchos estudiantes mayores, algunos de escuelas privadas de las más grandes ciudades estadounidenses, en la conferencia Futuros Líderes de Negocios de Estados Unidos (Future Business Leaders of America), celebrada en Anaheim, California.

Ahora los adolescentes están de regreso en Kansas con la meta de ampliar la compañía mejorando el producto, el embalaje, las promociones y las ventas en tiendas al detalle y en Internet.

Incluso más allá del próximo año escolar, Gabe Backhus, McKenzie Shippy y Emilie Roe hablan sobre las formas en que esta experiencia empresarial les ayudará a lo largo de la universidad y en

sus carreras como adultos.

El negocio, Double B Baits, está cumpliendo el lema de su compañía: "Kickin' Bass & Takin' Names", (una expresión que podría interpretarse en español como "triunfando y venciendo a los retadores"), según la maestra que los ayuda.

"Realmente es impresionante lo que están logrando", dijo Lisa Beye, profesora de negocios en Herington High School. "Estos chicos están obteniendo muchísima experiencia muy importante con este proyecto".

Backhus comenzó a pescar con su padre cuando tenía 2 años. A los 10 años estaba participando en torneos de pesca de róbalo en el área central de Kansas. Poco tiempo después, comenzó a pensar en hacer sus propios señuelos de pesca.

"Yo solo quería pescar algo mejor que lo que hacía todo el mundo", dijo Backhus, un chico alto y larguirucho que pierde la timidez cuando la conversación gira alrededor de la pesca de róbalos y señuelos para pescar. "Un año mi madre me regaló para Navidad un kit para hacer señuelos y comencé a hacerlos de plástico. A partir de ese momento, las cosas empezaron a expandirse".

En lugar de copiar lo que ya se hacía, Backhus buscó maneras de hacer sus señuelos más atractivos para los peces.

Sus señuelos plásticos, que incluyen una imitación de cangrejos y gusanos estilo Senko, tienen la apariencia y el olor de algo que un pez róbalo querría comer.

"Yo había oído que, cuando un pez róbalo muerde, saborear un aroma lo hace agarrarse más tiempo", dijo Backhus, "así que encontré algunas aromas en Internet y las mezclé con las carnadas. También remojo las carnadas en la aroma antes de ponerlas en el paquete".

Backhus siguió experimentando en un taller en su casa, en la parte rural de Herington. Él prueba sus creaciones en un lago de 26 acres que está, literalmente, en el patio de su casa.

El deseo de vender algunas de sus creaciones fue una progresión natural de sus ideas, dijo Backhus. Él sabía a quién pedir ayuda.

El pasado curso escolar se matriculó en Gestión de Proyectos, una clase de negocios impartida por Beye. Backhus y Beye buscaron a otros estudiantes que podían añadir sus talentos a una compañía que llamaron "Double B Baits".

McKenzie se apuntó como gerente de mercadeo; Emilie se unió al equipo para ayudar con la contabilidad.

"Yo solo les he dado sugerencias e ideas", dijo Beyes. "Ellos han sido quienes han tomado las ideas y las han puesto a funcionar. Han trabajado duro".

Beye dijo que el proyecto tuvo un impulso cuando Chris Barnes, propietario de un supermercado local, ofreció su consejo acerca de los precios y el mercadeo.

"El momento fue realmente bueno, porque él quería comenzar a vender equipos de pesca, algo que ningún lugar del pueblo quería hacer en ese entonces", dijo Beye. "Él fue uno de los primeros negocios en vender Double B Baits". Tammie Roe, la madre de Emilie, quien es contadora, prestó su experiencia al plan empresarial usado para dirigir el negocio piloto.

Uno de los mayores triunfos de la compañía llegó con la idea de mercadear camisetas y sudaderas con capucha con el logo del negocio y el lema "Kickin' Bass & Takin' Names".

"Yo les dije que eso tenía que aprobarlo el director, yo no iba a hacerlo", dijo Beye. "Lo hicieron, y yo creo que todos los chicos de la escuela tienen al menos una camiseta. Fue asombroso ver cuántos chicos hicieron fila para comprar esas cosas. Este verano comenzaron a vender gorras con el logo, pero parece que las estoy viendo por todo el pueblo".

Durante gran parte del curso lectivo, los estudiantes trabajaron para mejorar el plan empresarial que usaron para ocupar el tercer lugar en la competencia de Futuros Líderes de Negocios de Estados Unidos en Kansas. En California, llegaron hasta la ronda de 14 finalistas entre 112 escuelas. No fueron convocados entre los 10 competidores finales.

Ahora los estudiantes y la profesora trabajan para incrementar la demanda de la línea de señuelos, la cual incluye anzuelos tipo *swim* y tipo football, gusanos Senko plásticos, cangrejos, gusanos, insectos y trematodos. Backhus ha pensado en algunas mejoras y espera que más pescadores aprovechen el lado del negocio de señuelos hechos a la medida.

"Si tienen un color en particular que les gusta y no pueden encontrar, me gustaría trabajar con ellos y producir lo que buscan", dijo Backhus. "Estoy casi seguro de que podemos hacer cualquier cosa".

Los señuelos promedian unos $6 por paquete y todas las ganancias van a Backhus. McKenzie y Emilie serán recompensadas con dinero para becas cuando se gradúen en dos años.

McKenzie dijo que está de acuerdo con el arreglo y que siente que está recibiendo el pago por su esfuerzo en otras maneras.

"Poder hablar con tantas personas, en tantos lugares, realmente me ha hecho expandirme. Solamente la experiencia de ir a California y presentar nuestro plan de negocios a tanta gente fue realmente bueno para mí", dijo McKenzie. "Yo sé que todo lo que estoy aprendiendo me va a ayudar en el futuro". Ella dijo que esto podría incluir aplicar a universidades y para becas, y una posible carrera en mercadeo deportivo.

Backhus espera mantener la compañía funcionando y creciendo durante su tiempo en la universidad. Su ambición actual es ir a la Universidad Estatal de Kansas, integrarse al equipo de pesca de la escuela, el cual es campeón nacional, y especializarse en el manejo de peces o de vida silvestre.

Beye confía en que él triunfará.

"Incluso hace un año no creo que hubiera podido hacer lo que hizo en la competencia nacional, ponerse de pie y hablar con personas como esas", dijo ella. "Desde luego que hay mucho que él no sabe, pero si sigue con esto probablemente habrá una oportunidad tras otra. (En California) tuvimos muchas personas que vinieron a hablar con los chicos y a animarlos. Creo que hay mucha gente ahí afuera que van a apoyar a los jóvenes empresarios".

Quiz

1 ¿Cuál de las siguientes ideas es la que el texto MEJOR respalda en el siguiente párrafo?

En lugar de copiar lo que ya se hacía, Backhus buscó maneras de hacer sus señuelos más atractivos para los peces.

(A) Backhus no ha logrado dar todavía con los mejores señuelos.

(B) Backhus tiene mucha competencia en el mercado.

(C) Backhus estudió los señuelos que existen para hacer uno mejor.

(D) Backhus sabe que es improbable que sus señuelos llamen la atención.

2 ¿Cuál de las siguientes oraciones del artículo demuestra que Backhus ha tenido que superar sus temores?

(A) Ahora los adolescentes están de regreso en Kansas con la meta de ampliar la compañía mejorando el producto, el embalaje, las promociones y las ventas en tiendas al detalle y en Internet.

(B) "Yo solo quería pescar algo mejor que lo que hacía todo el mundo", dijo Backhus, un chico alto y larguirucho que pierde la timidez cuando la conversación gira alrededor de la pesca de róbalos y señuelos para pescar.

(C) Backhus siguió experimentando en un taller en su casa, en la parte rural de Herington.

(D) El deseo de vender algunas de sus creaciones fue una progresión natural de sus ideas, dijo Backhus.

3 ¿Cómo desarrolla el artículo la idea de que los compañeros de la escuela apoyan la iniciativa de Gabe?

(A) Indicando cuántos fueron a la competencia como muestra de apoyo.

(B) Indicando que casi todas las compras son hechas por estudiantes.

(C) Indicando que todos los estudiantes de la escuela han comprado una de sus camisetas.

(D) Indicando que los estudiantes lo han ayudado a mejorar el plan empresarial.

4 Según el artículo, los siguientes factores han influido en las aspiraciones empresariales de Gabe, EXCEPTO:

(A) El curso que tomó en la escuela.

(B) Su interés por crear mejores señuelos.

(C) El éxito que tuvo en la competencia.

(D) Las cuantiosas ganancias de sus productos.

Introducción

Debe esperar pasar aproximadamente 30 minutos revisando esta sección antes de comenzar el plan de aprendizaje de ocho semanas.

Para empezar

¡Bienvenidas familias de Texas!

El paquete de aprendizaje de verano en casa de Texas ofrece cuatro semanas de planes de aprendizaje en el hogar y lecciones adicionales para los estudiantes. Este paquete ha sido diseñado con la idea de que sea flexible y fácil de usar en familia para mantener a los estudiantes conectados a contenidos de importancia durante el verano. Aunque las sugerencias de lecciones, tareas y horarios están incluidas, los estudiantes y las familias, con el apoyo de sus escuelas, pueden completar las lecciones en una forma que cumpla con las necesidades de cada estudiante en particular.

¿Qué se ha incluido?:

- Guía introductoria para dejar al estudiante preparado para el aprendizaje
- Cuatro semanas de lecciones diarias organizadas por materia
- Lecciones adicionales para ampliar el aprendizaje más allá de cuatro semanas, si se desea
- Materiales curriculares para cada lección, incluyendo libros, artículos, hojas de ejercicios, etc.

Para empezar, revise las secciones **Estableciendo un horario de estudio** y **Metas de aprendizaje del estudiante** de este paquete. Al tener un plan programado que contenga objetivos de aprendizaje, se consigue un plan de aprendizaje que es fácil de seguir.

Visión general del paquete

El plan de cuatro semanas del paquete de aprendizaje de verano en casa está dividido por áreas de conocimiento: Inglés, matemáticas, ciencias y estudios sociales. Los estudiantes se pueden enfocar en sólo unas áreas, como Inglés o matemáticas, o en todas las áreas que se incluyen en el paquete. Las escuelas deben ayudar a los estudiantes a elegir en qué áreas de conocimiento enfocarse y en qué momento.

Cada área de conocimiento incluye lecciones en secuencia con cinco lecciones diarias por semana, empezando con la Semana 1, Día 1, y terminando con la Semana 4, Día 5, además de un grupo de lecciones adicionales para estudiantes que permite extender su aprendizaje por cuatro semanas más. Las lecciones ofrecen instrucciones detalladas y hacen referencia a los números de página de los materiales en el paquete, incluyendo artículos, libros, hojas de ejercicio y otros materiales necesarios para completar la lección.

Primeros pasos

5. Para empezar, elija simplemente un área de conocimientos y use la tabla de contenido para encontrar esa sección en el paquete.
6. Empiece con la Semana 1, Día 1, complete las actividades que se enlistan y marque cada lección que se vaya terminando.
7. Vaya moviéndose a lo largo de todas las lecciones en el orden sugerido o en la forma sugerida por la escuela.
8. Después de completar cuatro semanas de lecciones en un área de conocimientos específica, continúe con la sección Lecciones adicionales para seguir aprendiendo.

Para más información, visite TexasHomeLearning.org.

Estableciendo un horario de estudio

Se recomienda que los estudiantes establezcan un horario de aprendizaje consistente que pueda seguirse cada día dentro del plan de aprendizaje de cuatro semanas. El tener una estructura regular, ayuda a que las actividades diarias y semanales sean fáciles de seguir y estimulan el aprendizaje en casa. Por ejemplo, un estudiante puede empezar cada día con su desayuno y haciendo algo de ejercicio antes de iniciar la primera lección.

Las familias están manejando el aprendizaje en casa con muchas otras prioridades, por lo que el horario elegido debe ayudar a que el estudiante incremente sus conocimientos al mismo tiempo que cumple con las necesidades de la familia.

Al establecer una rutina consistente, las familias pueden buscar ayuda de las escuelas y considerar qué áreas de conocimiento requieren mayor apoyo para el estudiante al tiempo que se balancea el aprendizaje en casa con otras prioridades de la familia.

Los siguientes horarios de ejemplo son un punto de partida. Las familias deben ajustar el horario para satisfacer las necesidades del estudiante al mismo tiempo que consideran su propia disponibilidad para ayudar en el aprendizaje, si es que eso fuera necesario.

Chequeos diarios

Hable con su estudiante cada día en un momento que resulte cómodo en su hogar. Por ejemplo, usted quizá quiera checar brevemente unas pocas veces durante el día o quizá tener una sola sesión por la mañana o tarde, pero más larga. El objetivo de este tiempo es que los estudiantes recuerden y reflexionen acerca de lo que aprendieron durante el día.

Use el tiempo de los chequeos para iniciar conversación que incluya preguntas, tales como:

- ¿Pudiste completar todas las actividades asignadas?
- ¿Qué aprendiste/practicaste/leíste hoy?
- ¿Qué fue fácil o difícil para ti?
- ¿Tienes preguntas para tu maestro?

También use este tiempo para comunicarse con el maestro del estudiante si se necesita, para enviarle copias o ilustraciones de su trabajo, o para compartir información acerca del progreso de aprendizaje que va teniendo.

Elección de lectura diaria

Se recomiendan treinta minutos de elección de lectura diaria. El estudiante selecciona un texto de cualquier género o tema (con el consentimiento del padre o tutor). Se selecciona un libro que haya en casa o pueden considerarse los siguientes títulos:

- *Emma* de Jane Austen (ficción)
- *Great Expectations* de Charles Dickens (ficción)
- The Importance of Being Ernest de Oscar Wilde (drama)
- *Little Women* de Louisa May Alcott (ficción)
- *Metamorphosis* de Franz Kafka (ficción)
- *Othello* de William Shakespeare (drama)
- *A Raisin in the Sun* de Lorraine Hansberry (drama)
- *A Raisin in the Sun* by Lorraine Hansberry (drama)

Se alienta a los padres o tutores a que platiquen con los estudiantes acerca de lo que han leído:

- Pregúntele a su estudiante: ¿Qué cosa nueva aprendiste de leer el libro?
- Pídale a su estudiante que dibuje algo que haya aprendido del libro.
- Pídale a su estudiante que escriba acerca del libro o que responda a un tema de composición.
- Pídale a su estudiante que hable sobre el libro con alguien de la familia o un amigo.

Horarios de ejemplo

Las áreas de conocimiento incluidas en este paquete de aprendizaje de verano en casa están destacadas con una sombra gris.

Horario de ejemplo 1: Día completo de aprendizaje

Este horario funciona mejor cuando el estudiante: necesita tener acceso a todas las áreas de conocimiento; trabaja bien en forma independiente; tiene ayuda disponible durante el día.

Horario	Actividad
8:00-9:00 a.m.	Ejercicio al aire libre/Al Interior
9:00-10:00 a.m.	**Inglés**
10:00-10:15 a.m.	Descanso
10:15-11:15 a.m.	**Matemáticas**
11:15-11:30 p.m.	Descanso
11:30-12:00 p.m.	Elección de lectura
12:00-12:30 p.m.	Almuerzo
12:30-1:30 p.m.	**Ciencias**
1:30-1:45 p.m.	Descanso
1:45-2:45 p.m.	**Estudios Sociales**
2:45-3:30 p.m.	Enriquecimiento (Arte, Ejercicio al aire libre/Al interior)
3:30 p.m.	Chequeo diario

Nota: Puede usar lunes a viernes, lunes a jueves, o días alternados (lunes/miércoles/viernes).

Horario de ejemplo 2: Aprendizaje en la mañana con lectura y matemáticas nada más

Este horario funciona mejor cuando el estudiante: necesita enfocarse en lectura y matemáticas; tiene ayuda disponible por la mañana.

Horario	Actividad
8:30-9:00 a.m.	Ejercicio al aire libre/Al Interior
9:00-10:00 a.m.	**Inglés**
10:00-10:30 a.m.	Merienda y descanso
10:30-11:30 a.m.	**Matemáticas**
11:30-11:45 a.m.	Chequeo diario
11:45 a.m.	Almuerzo

Nota: Puede cambiarse a un horario por la tarde. Puede usar cada día de la semana, parte de la semana o días alternados (lunes/miércoles/viernes).

Horario de ejemplo 3: Opción de lectura solamente

Este horario funciona mejor cuando el estudiante: tiene tiempo limitado; tiene ayuda disponible limitada.

Horario	Actividad
5:00-6:00 p.m.	**Inglés**
6:00-6:30 p.m.	Elección de lectura
6:30 p.m.	Cena

Nota: Podría establecer los horarios conforme lo permitan los horarios de la familia.

Metas de aprendizaje para los estudiantes

Este paquete de aprendizaje de verano en casa ofrece lecciones diarias en cada una de las principales áreas de conocimiento. Aunque se ofrecen materiales para todas estas áreas, el estudiante, la familia o la escuela pueden elegir enfocarse en solo algunas de estas áreas con base en necesidades académicas y de horario individuales.

Inglés

Este paquete incluye conjuntos de textos alineados por temas y tópicos según el grado escolar con pasajes cortos de varios géneros que ayuden en la construcción de referencias y de contenido académico en los estudiantes. Los estudiantes deben leer, tomar notas y escribir sobre lo que leen cada día. Este paquete incluye opciones de libros que se pueden imprimir que corresponden con las lecciones de lectura planeadas.

Sugerencias de aprendizaje:

- Lee y toma notas sobre el texto seleccionado; deberás decidir si lees los pasajes en forma independiente o con un miembro de la familia.
- Habla acerca de los que tratan los pasajes.
- Resume los pasajes de tal modo que evalúes tu comprensión de éstos.
- Identifica evidencia textual que apoye tus respuestas cuando tengas que responder tanto a preguntas de opción múltiple como a un tema de composición.

Matemáticas

Los estudiantes completarán actividades y practicarán problemas que cubran contenidos y destrezas básicas sobre cualquier curso de matemáticas que estén tomando.
Sugerencias de aprendizaje: Utiliza varias estrategias para resolver problemas que te hayan funcionado antes.

Ciencias

Los estudiantes leerán artículos seleccionados, harán investigaciones simples y aplicarán sus conocimientos relacionados con las ciencias. **Sugerencias de aprendizaje:** Las investigaciones utilizan objetos comunes del hogar. Si los materiales exactos no están disponibles, los estudiantes pueden sustituirlos con materiales similares.

Estudios Sociales

Los estudiantes leerán artículos seleccionados y aplicarán su conocimiento de estudios sociales y sus destrezas. **Sugerencias de aprendizaje:** Las lecturas ofrecen información que puede usarse para apoyar posturas y contestar preguntas.

¡Estás listo ahora para empezar tu paquete de aprendizaje de verano en casa!
Para más información, visita TexasHomeLearning.org.