



Ninth Grade

Summer At-Home Learning

Everything you need to provide summer lessons at home.

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.

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Texas Education Agency

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 Covid-19 crisis.

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Table of Contents

Introduction

Getting Started	5
Establishing a Schedule for Learning	6
Sample Schedules	7
Learning Goals for Students	8

English I

Week 1	11
Week 2	12
Week 3	13
Week 4	14
Additional Lessons	15

Algebra I

Week 1	19
Week 2	20
Week 3	21
Week 4	22
Additional Lessons	23

Geometry

Week 1	25
Week 2	26
Week 3	27
Week 4	28
Additional Lessons	29

Biology

Week 1	31
Week 2	32
Week 3	33
Week 4	34
Additional Lessons	35

World Geography

Week 1	39
Week 2	40
Week 3	41
Week 4	42
Additional Lessons	43



Ninth Grade Summer At-Home Learning



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.

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6

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
	0

Note: May schedule time as family schedule allows.



Ninth Grade Summer At-Home Learning

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.



Ninth Grade Summer At-Home Learning



Day 1

Personal Growth: "To My Dear and Loving Husband"

- Read and annotate the poem "To My Dear and Loving Husband" (p. 48).
- Answer both the text-dependent questions and the discussion questions following the passage.

Day 2

Personal Growth: "Romeo and Juliet"

- Read and annotate the excerpt from the drama "Romeo and Juliet" (p. 52)
- Answer the text dependent questions following the passage.

Day 3

Personal Growth: "YouTube Users with Disabilities Help to Normalize Differences on Platform"

- Read and annotate "YouTube Users with Disabilities Help to Normalize Differences on Platform" (p. 56).
- Respond in writing to the following prompt: Make and support a claim about why someone should read this text. What makes this text worth reading? What will a reader gain or what might a reader do after reading this? Support your response with specific details from the text.

Day 4

Personal Growth: "The Biology of Awareness"

- Read and annotate the article "The Biology of Awareness" (p. 59).
- Answer the text dependent quiz questions following the passage.
- Compare "The Biology of Awareness" to Tuesday's reading of "YouTube Users with Disabilities Help to Normalize Differences on Platform" (pg. 56) and respond in writing to the following prompt: What is one thing both authors would agree on? What is something that the authors would disagree about?

Day 5

Personal Growth: "I'm Happiest When Most Away"

- Read and annotate the poem "I'm Happiest When Most Away" (p. 63).
- Answer the text dependent questions and the discussion questions following the passage.



Day 1

Personal Growth: "Don't Despair if You Ate the Marshmallow Right Away"

- Read and annotate the article "Don't Despair if You Ate the Marshmallow Right Away" (p. 67).
- Answer the text dependent quiz questions following the passage.

Day 2

Personal Growth: "Don't Despair if You Ate the Marshmallow Right Away"

- Reread the article "Don't Despair if You Ate the Marshmallow Right Away" (p. 67).
- Write a paragraph that explains the central idea of the article. Use at least two details from the article to support your response.

Day 3

Personal Growth: "Texting Can be a Positive and Powerful Force, Experts Say"

- Read and annotate the article "Texting Can be a Positive and Powerful Force, Experts Say" (p. 71).
- Answer the text dependent quiz questions following the passage.

Day 4

Personal Growth: "Texting Can be a Positive and Powerful Force, Experts Say"

- Reread the article "Texting Can be a Positive and Powerful Force, Experts Say" (p. 71).
- Answer the following prompt: according to the article, in what ways can texting be beneficial in today's society? Choose three of these benefits and use evidence from the source to explain why these improve life for citizens.

Day 5

Personal Growth: "More People Are Using Fluoride-Free Toothpaste; Dentists Are Worried"

- Read the article "More People Are Using Fluoride-Free Toothpaste; Dentists Are Worried" (p. 76).
- Answer the text dependent questions quiz following the passage.



English I

Week 3

Day 1

Argument, Bias, and Persuasion: "Can Television Be Considered Literature and Taught in English Classes?"

- Read and annotate the essay "Can Television Be Considered Literature and Taught in English Classes?" (p. 81).
- Answer text dependent questions 1–5.

Day 2

Argument, Bias, and Persuasion: "Can Television Be Considered Literature and Taught in English Classes?"

- Reread the essay "Can Television Be Considered Literature and Taught in English Classes?" (p. 81).
- Respond in writing to discussion questions.

Day 3

Argument, Bias, and Persuasion: "Should we Terraform Mars?"

- Read and annotate the essay "Should we Terraform Mars?" (p. 88).
- Answer text dependent questions 1–6.

Day 4

Argument, Bias, and Persuasion: "Should we Terraform Mars?"

- Reread the essay "Should we Terraform Mars?" (p. 88).
- Respond in writing to the discussion questions.

Day 5

Argument, Bias, and Persuasion: "A Time for Choosing"

- Read the excerpt from the speech "A Time for Choosing" (p. 93).
- Answer the text dependent questions following the passage.



Day 1

Argument, Bias, and Persuasion: "Day of Infamy"

- Read and annotate the speech "Day of Infamy" (p. 98)
- Answer the text dependent questions.

Day 2

Argument, Bias, and Persuasion: "PRO/CON Should all High-Schoolers Take Courses in Personal Finance?"

Read and annotate the article "PRO/CON Should all High-Schoolers Take Courses in Personal Finance?" (p. 102)

- Answer the text dependent quiz questions.
- Respond to the following prompt: Summarize the central idea of both the PRO and the CON
 perspectives in a few lines. What claims made by the author of the chosen article are not
 supported by evidence? Give two to three examples from the text to better illustrate your point.

Day 3

Argument, Bias, and Persuasion: "The Value of Being Confused"

- Read and annotate the article "The Value of Being Confused" (p. 155)
- Answer text dependent questions 1–5.

Day 4

Argument, Bias, and Persuasion: "The Value of Being Confused"

- Reread the article "The Value of Being Confused" (p. 107).
- Respond in writing to the discussion questions.

Day 5

Argument, Bias, and Persuasion: "The Difference Between Empathy and Sympathy"

- Read and annotate the article "The Difference Between Empathy and Sympathy" (p. 112)
- Answer the text dependent quiz questions.



Additional Lessons

□ Additional Lesson 1

Making Change: "What is Economics?"

- Read and annotate the article "What is Economics?" (p. 116).
- Answer the text dependent quiz questions following the passage. As you work, go back into the text and highlight the evidence that supports your answer choices.

Additional Lesson 2

Making Change: "What is Economics?"

- Reread the article "What is Economics?" (p. 116).
- Create a job advertisement for a local paper, or job networking site, for an economist. The ad must include information about what economists should know, as well as what specific experiences they should have in the past.

□ Additional Lesson 3

Making Change: "What's in Your Wallet? Uh, I Mean, What Apps are on Your Smartphone?"

- Read and annotate the article "What's in Your Wallet? Uh, I Mean, What Apps are on Your Smartphone?" (p. 121).
- Answer the text dependent quiz questions following the passage.

□ Additional Lesson 4

Making Change: "What's in Your Wallet? Uh, I Mean, What Apps are on Your Smartphone?"

- Reread the article "What's in Your Wallet? Uh, I Mean, What Apps are on Your Smartphone?" (p. 121).
- Write a detailed paragraph that explains the central idea of the article. Use at least three details from the text to support your response.

Additional Lesson 5

Making Change: "Creating a Personal Budget"

- Read and annotate the article "Creating a Personal Budget" (p. 125).
- Answer the text dependent quiz questions following the passage.

□ Additional Lesson 6

Community: "Study Shows One Brain's Electrical Pulses Can Influence Those of Another"

- Read and annotate the article "Study Shows One Brain's Electrical Pulses Can Influence Those of Another" (p. 129).
- Answer the text dependent quiz questions following the passage.
- □ Additional Lesson 7

Community: "Study Shows One Brain's Electrical Pulses Can Influence Those of Another"

- Reread the article "Study Shows One Brain's Electrical Pulses Can Influence Those of Another" (p. 129).
- Answer the following questions in a well-crafted paragraph: What is group brain synchrony? What is one key finding from the study about group interactions? Support your answer using details from the text.



English I

□ Additional Lesson 8

Community: "Native American Activism in the 1960s and 1970s"

- Read and annotate the article "Native American Activism in the 1960s and 1970s" (p. 133).
- Answer the text dependent quiz questions following the passage.

Additional Lesson 9

Community: "Native American Activism in the 1960s and 1970s"

- Reread the article "Native American Activism in the 1960s and 1970s" (p. 133).
- Answer the following prompt: In what ways was the idea of an occupation symbolic of what the Native Americans were trying to accomplish by protesting? Use evidence from the article to support your claim.

□ Additional Lesson 10

Community: "Mexicans Set Social Structure Aside to Provide Earthquake Relief"

- Read the article "Mexicans Set Social Structure Aside to Provide Earthquake Relief" (p. 138).
- 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.

□ Additional Lesson 11

Education: "The Last Class: The Story of a Little Alsatian"

- Read and annotate the short story "The Last Class: The Story of a Little Alsatian" (p. 142).
- Answer text dependent questions 1–4.

□ Additional Lesson 12

Education: "The Last Class: The Story of a Little Alsatian"

- Reread the short story "The Last Class: The Story of a Little Alsatian" (p. 142).
- Respond in writing to the discussion questions.
- □ Additional Lesson 13

Education: "Village Schools and Traveling Soldiers"

- Read and annotate the article "Village Schools and Traveling Soldiers" (p. 148).
- Answer text dependent questions 1–5.

□ Additional Lesson 14

Education: "Village Schools and Traveling Soldiers"

- Reread the article "Village Schools and Traveling Soldiers" (p. 148).
- Respond in writing to the discussion questions.

□ Additional Lesson 15

Education: "International Lifestyle Concepts are Catching on in the U.S."

- Read and annotate the article "International Lifestyle Concepts are Catching on in the U.S." (p. 153).
- Answer the text dependent quiz questions.



English I

□ Additional Lesson 16

Resilience and Success: "Curiosity Changes the Brain to Boost Memory and Learning"

- Read and annotate the article "Curiosity Changes the Brain to Boost Memory and Learning" (p. 158).
- Answer the text dependent Quiz questions.

□ Additional Lesson 17

Resilience and Success: "Curiosity Changes the Brain to Boost Memory and Learning"

- Reread the article "Curiosity Changes the Brain to Boost Memory and Learning" (p. 158).
- Respond to the following prompt in writing: 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 18

Resilience and Success: "Research Shows Friends Are Good for Your Health"

- Read and annotate the article "Research Shows Friends Are Good for Your Health" (p. 162).
- Answer the text dependent quiz questions.

□ Additional Lesson 19

Resilience and Success: "The Tipi Goes Modern and Bright for a Special Museum Exhibit"

- Read and annotate the article "The Tipi Goes Modern and Bright for a Special Museum Exhibit" (p. 167).
- Answer the text dependent quiz questions.

□ Additional Lesson 20

Resilience and Success: "No Magic Wand: How J.K. Rowling Became the First Billionaire Author"

- Read and annotate the article "No Magic Wand: How J.K. Rowling Became the First Billionaire Author" (p. 172).
- Answer the text dependent quiz questions.





Week 1

Day 1

Strategic Solving: Day 1 of 4

- Complete the warmup and getting started sections (p. 180).
- Complete activity 1.1.

Day 2

Strategic Solving: Day 2 of 4

• Complete activity 1.2 (p. 182).

Day 3

Strategic Solving: Day 3 of 4

• Complete activity 1.3 and Talk the Talk (p. 184).

Day 4

Strategic Solving: Day 4 of 4

• Complete the Assignment section (p. 186).

Day 5

MP3 and DVDs: Day 1 of 5

• Complete activity 2.1 (p. 190).



Week 2

Day 1

MP3 and DVDs: Day 2 of 5

• Complete activity 2.2 (p. 191).

Day 2

MP3 and DVDs: Day 3 of 5

• Complete activity 2.3 (p. 193).

Day 3

MP3 and DVDs: Day 4 of 5

• Complete activity 2.4 and Talk the Talk (p. 197).

Day 4

MP3 and DVDs: Day 5 of 5

• Complete the Assignment section (p. 200).

Day 5

Tic Tac Bingo: Day 1 of 2

- Complete the warmup and getting started sections (p. 202).
- Complete activity 3.1 (p. 204).



Week 3

Day 1

Tic Tac Bingo: Day 2 of 2

• Complete the Assignment section (p. 206).

Day 2

Solving Linear Equations: Day 1 of 2

• Complete section I and II (p. 209).

Day 3

Solving Linear Equations: Day 2 of 2

• Complete section III (p. 211).

Day 4

Crossing Paths: Day 1 of 4

- Complete the warmup and getting started sections (p. 213).
- Complete activity 1.1.

Day 5

Crossing Paths: Day 2 of 4

• Complete activity 1.2 (p. 219).



Week 4

Day 1

Crossing Paths: Day 3 of 4

• Complete activity 1.3 and Talk the Talk (p. 222).

Day 2

Crossing Paths: Day 4 of 4

• Complete the Assignment section (p. 225).

Day 3

The Road Less Traveled: Day 1 of 4

- Complete the warmup and getting started sections (p. 227).
- Complete activity 2.1.

Day 4

The Road Less Traveled: Day 2 of 4

• Complete activity 2.2 (p. 232).

Day 5

The Road Less Traveled: Day 3 of 4

• Complete activity 2.3 and Talk the Talk (p. 236).



Additional Lessons

□ Additional Lesson 1

The Road Less Traveled: Day 4 of 4

• Complete the Assignment section (p. 239).

Additional Lesson 2

Rockin' Roller Rinks: Day 1 of 4

- Complete the Warmup and Getting Started sections (p. 241).
- Complete activity 4.1.

□ Additional Lesson 3

Rockin' Roller Rinks: Day 2 of 4

- Complete activity 4.2 (p. 246).
- □ Additional Lesson 4

Rockin' Roller Rinks: Day 3 of 4

• Complete activity 4.3 and Talk the Talk (p. 248).

□ Additional Lesson 5

Rockin' Roller Rinks: Day 4 of 4

- Complete the Assignment section (p. 251).
- □ Additional Lesson 6

The County Fair: Day 1 of 4

- Complete the Warmup and Getting Started sections (p. 253).
- Complete activity 3.1.

Additional Lesson 7

The County Fair: Day 2 of 4

- Complete activity 3.2 (p. 263).
- Additional Lesson 8

The County Fair: Day 3 of 4

- Complete activity 3.3 Talk the Talk (p. 263).
- Additional Lesson 9

The County Fair: Day 4 of 4

- Complete the Assignment section (p. 269).
- □ Additional Lesson 10

Systems of Linear Equations

- Complete section I (p. 271).
- Additional Lesson 11

Skills Practice

• Complete section II (p.279).



□ Additional Lesson 12

A Constant Ratio: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 287).
- Complete activity 1.1.
- □ Additional Lesson 13

A Constant Ratio: Day 2 of 5

- Complete activity 1.2 (p. 292).
- □ Additional Lesson 14

A Constant Ratio: Day 3 of 5

- Complete activity 1.3 (p. 296).
- □ Additional Lesson 15

A Constant Ratio: Day 4 of 5

- Complete activity 1.4 and Talk the Talk (p. 298).
- □ Additional Lesson 16

A Constant Ratio: Day 5 of 5

- Complete the Assignment sections (p. 301).
- □ Additional Lesson 17

The Real Number System: Day 1 of 3

- Complete section I (p. 303).
- □ Additional Lesson 18

The Real Number System: Day 2 of 3

- Complete section II (p. 304).
- □ Additional Lesson 19

The Real Number System: Day 3 of 3

- Complete section III (p. 305).
- □ Additional Lesson 20

Practice and Review

• Return to any unfinished assignments and complete problems.



Day 1

Three Angle Measure: Day 1 of 3

- Complete the Warmup and Getting Started sections (p. 308).
- Complete activity 1.1.

Day 2

Three Angle Measure: Day 2 of 3

• Complete activity 1.2 and Talk the Talk (p. 315).

Day 3

Three Angle Measure: Day 3 of 3

• Complete the Assignment section (p. 320).

Day 4

The Tangent Ratio: Day 1 of 6

- Complete the Warmup and Getting Started sections (p. 324).
- Complete activity 2.1.

Day 5

The Tangent Ratio: Day 2 of 6

• Complete activity 2.2 (p. 372).



Week 2

Day 1

The Tangent Ratio: Day 3 of 6

• Complete the activity 2.3 (p. 332).

Day 2

The Tangent Ratio: Day 4 of 6

• Complete activity 2.4 and Talk the Talk (p. 334).

Day 3

The Tangent Ratio: Day 5 of 6

• Complete half of the Assignment section (p. 338).

Day 4

The Tangent Ratio: Day 6 of 6

• Complete the remaining problems in the Assignment section (p. 338).

Day 5

The Sine Ratio: Day 1 of 2

- Complete the Warmup and Getting Started sections (p. 342).
- Complete activity 3.1.



Day 1

The Sine Ratio: Day 2 of 2

• Complete the activity 3.2 and Talk the Talk (p. 347).

Day 2

The Tangent Ratio

• Complete the Assignment section (p. 354).

Day 3

The Cosine Ratio: Day 1 of 2

- Complete the Warmup and Getting Started sections (p. 358).
- Complete activity 4.1.

Day 4

The Cosine Ratio: Day 2 of 2

• Complete activity 4.2 and Talk the Talk (p.365).

Day 5

We Complement Each Other: Day 1 of 4

- Complete the Warmup and Getting Started sections (p. 374).
- Complete activity 5.1.



Week 4

Day 1

We Complement Each Other: Day 2 of 4

• Complete activity 5.2 (p. 378).

Day 2

We Complement Each Other: Day 3 of 4

• Complete activity 5.3 and Talk the Talk (p. 380).

Day 3

We Complement Each Other: Day 4 of 4

• Complete the Assignment section (p. 384).

Day 4

A Deriving Force: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 388).
- Complete activity 6.1.

Day 5

A Deriving Force: Day 2 of 5

• Complete activity 6.2 (p. 389).



Additional Lessons

□ Additional Lesson 1

A Deriving Force: Day 3 of 5

- Complete activity 6.3 (p. 392).
- □ Additional Lesson 2

A Deriving Force: Day 4 of 5

- Complete activity 6.4 and Talk the Talk (p. 394).
- □ Additional Lesson 3

A Deriving Force: Day 5 of 5

- Complete the Assignment section (p. 398).
- □ Additional Lesson 4

Trigonometry: Day 1 of 5

- Complete section I (p. 400).
- □ Additional Lesson 5

Trigonometry: Day 2 of 5

- Complete section II (p. 404).
- □ Additional Lesson 6

Trigonometry: Day 3 of 5

- Complete section III (p. 411).
- Additional Lesson 7

Trigonometry: Day 4 of 5

- Complete section IV (p. 416).
- □ Additional Lesson 8

Trigonometry: Day 5 of 5

- Complete section V and VI (p. 420).
- Additional Lesson 9

What Are the Chances: Day 1 of 5

- Complete the Warmup and Getting Started sections (p. 426).
- Complete activity 1.1.
- □ Additional Lesson 10

What Are the Chances: Day 2 of 5

- Complete activity 1.2 (p. 432).
- □ Additional Lesson 11

What Are the Chances: Day 3 of 5

• Complete activity 1.3 (p. 434).



□ Additional Lesson 12

What Are the Chances: Day 4 of 5

- Complete activity 1.4 and Talk the Talk (p. 437).
- □ Additional Lesson 13

What Are the Chances: Day 5 of 5

- Complete the Assignment section (p. 442).
- □ Additional Lesson 14

And: Compound Probability: Day 1 of 4

- Complete the Warmup and Getting Started (p. 446).
- Complete activity 2.1.
- □ Additional Lesson 15

And: Compound Probability: Day 2 of 4

- Complete activity 2.2 (p. 452).
- □ Additional Lesson 16

And: Compound Probability: Day 3 of 4

- Complete activity 2.3 and Talk the Talk (p. 454).
- □ Additional Lesson 17

And: Compound Probability: Day 4 of 4

- Complete the Assignment section (p. 458).
- □ Additional Lesson 18

Or: Compound Probability: Day 1 of 3

- Complete the Warmup and Getting Started (p. 460).
- Complete activity 3.1.
- □ Additional Lesson 19

Or: Compound Probability: Day 2 of 3

- Complete activity 3.2 (p. 464).
- □ Additional Lesson 20

Or: Compound Probability: Day 3 of 3

• Complete activity 3.3 and Talk the Talk (p. 467).



Day 1

Cellular Respiration: "How bread works"

- Read and annotate "How bread works" (p. 476).
- Write a summary describing how cellular respiration of yeast is used in the production of bread.

Day 2

Cellular Respiration: "All about cellular respiration"

- Read and annotate "All about cellular respiration" (p. 479).
- Create a diagram that represents the process of cellular respiration.

Day 3

Cellular Respiration: Quiz

- Reread the articles from the past two days and the diagram you made of cellular respiration.
- Take the quizzes at the end of both readings.

Day 4

Cellular Respiration: "The way kids use energy pathways helps them keep going, going, going"

- Read "The way kids use energy pathways helps them keep going, going, going" (p. 484).
- Write a short summary explaining how children are able to use energy pathways to help them keep going.
- Take the quiz at the end of the reading.

Day 5

Cellular Respiration: Response

• Respond to the question: How does cellular respiration provide organisms with chemical energy to live and grow?



Day 1

Enzymes: "Why do apple slices turn brown after being cut?"

- Read and annotate "Why do apple slices turn brown after being cut?" (p. 488).
- Explain the role that enzymes play in the color change of apples when cut.

Day 2

Enzyme: "Exploring Enzymes"

• If you have the materials, conduct the experiment and record findings using "Exploring Enzymes" (p. 491).

Day 3

Enzymes: Summary

• Explain your findings from the experiment yesterday. Describe how changing amounts of the enzyme would change the reaction.

Day 4

Enzymes: "Extremophiles have extraordinary uses in medical, engineering fields"

- Read and annotate "Extremophiles have extraordinary uses in medical, engineering fields" (p. 495).
- List and describe the enzymes from extremophiles that have been used to benefit humans.

Day 5

Enzymes: Response

• Write a short response explaining why and how enzymes benefit organisms.



Day 1

Biological Organization: "Scientists grow heart tissue using spinach veins"

- Read "Scientists grow heart tissue using spinach veins" (p. 499).
- Explain how a plant could be used to grow animal tissue.

Day 2

Biological Organization: "Why do you have two lungs but only one heart?"

- Read "Why do you have two lungs but only one heart" (p. 504).
- Summarize your understanding of why humans have one heart.

Day 3

Biological Organization: "Why do you have two lungs but only one heart?"

- Reread "Why do you have two lungs but only one heart?" (p. 504).
- Take the quiz at the end of the reading.

Day 4

Biological Organization: Summary

- Consider what you have read and your study of biology.
- Write a short summary about what has been most interesting to learn about in exploring the biological organization of organisms.

Day 5

Biological Organization: "What animal has the weirdest heart?"

- Read "What animal has the weirdest heart?" (p. 508).
- List the different types of hearts and explain if you can find a pattern.



Day 1

Cellular Specialization: "Chocolate Lab's nose knows when a diabetic emergency could be lurking"

- Read "Chocolate Lab's nose knows when a diabetic emergency could be lurking" (p 512).
- Explain why dogs are used to help detect certain scents.

Day 2

Cellular Specialization: "Everyday Mysteries: What is our strongest muscle?"

- Read "Everyday Mysteries: What is our strongest muscle?" (p. 516).
- Based on the reading, which muscle do you think is the strongest. Explain why you believe this muscle is strongest.

Day 3

Cellular Specialization: Response

• Answer the question: What are some examples of specialized cells, and how are they uniquely suited to serve specific functions?

Day 4

Cellular Specialization: Summary

• Explain why if all autosomal cells in an organism have the same DNA, there are specialized cells.

Day 5

Cellular Specialization: "The cells of the human body"

- Read and annotate "The cells of the human body" (p. 520).
- Make a table to organize and record information about the different types of cells found in the human body.



Additional Lessons

□ Additional Lesson 1

DNA: "Legend of Loch Ness monster will be tested with DNA samples"

- Read "Legend of Loch Ness monster will be tested with DNA samples" (p. 527).
- Answer the questions: How will scientists get the DNA to test for the Loch Ness monster? Could scientists not find Loch Ness DNA even if it exists?

Additional Lesson 2

DNA: "A distant relative's DNA could be used to identify you"

- Read and annotate "A distant relative's DNA could be used to identify you" (p. 530).
- Answer the questions: How is at-home DNA testing being used to find people? What are some concerns with this type of testing?

Additional Lesson 3

DNA: "A distant relative's DNA could be used to identify you"

- Reread "A distant relative's DNA could be used to identify you" (p. 530).
- Write a short summary about the pros and cons of open access to at-home DNA test results.
- □ Additional Lesson 4

DNA: "Scientists around the world are working to map animal genomes"

- Read "Scientists around the world are working to map animal genomes" (p. 534).
- Answer the questions: How will mapping the genes of thousands of animal special help? What is the benefit of this work?
- Take the quiz.

Additional Lesson 5

DNA: Response

• Write about the pros and cons of doing more DNA testing. Take a position as to whether or not you are in favor of testing and defend your position using evidence from the readings.

□ Additional Lesson 6

Genetics: "Explainer: What are blood groups and why do they matter?"

- Read and annotate "Explainer: What are blood groups and why do they matter?" (p. 537).
- Write a summary about blood groups, the discovery, and the genetics that determines the specific blood groups.

Additional Lesson 7

Genetics: "A mutation story about sickle cell"

- Read and annotate "A mutation story about sickle cell" (p. 540).
- Take the quiz.
- Additional Lesson 8

Genetics: Summary

• Write a summary of your understanding of genetic mutations related to sickle cell and include why the mutation continue to be present in humans.



Additional Lesson 9

Genetics: "Colorblind teen and two men see world anew with special eyeglasses"

- Read "Colorblind teen and two men see world anew with special eyeglasses" (p. 543).
- Answer the questions: How can colorblindness be harmful? How is colorblindness inherited, and why is it present in men more often than women?
- □ Additional Lesson 10

Genetics: Response

- Think about what you have learned this year about genetics and genetic mutations. Describe 2– 3 pieces of information you learned that were the most interesting.
- □ Additional Lesson 11

Evolution: "Breeding a grape that tastes just like cotton candy to capture consumers"

- Read "Breeding a grape that tastes just like cotton candy to capture consumers" (p. 545).
- Answer the questions: What is artificial selection of selective breeding? How are humans using artificial selection for profit?

□ Additional Lesson 12

Evolution: Response

- Think about the article read yesterday and artificial selection.
- Make a list of other examples of artificial selection.

□ Additional Lesson 13

Evolution: "Adaptation"

- Read and annotate "Adaptation" (p. 548).
- Make a list and describe the different types of adaptations in the reading.
- Take the quiz.

Additional Lesson 14

Evolution: Summary

• Write a short summary explaining evolution and natural selection as related to adaptations.

□ Additional Lesson 15

Evolution: Response

• Respond to: What is evolution and how is it driven by natural selection and artificial selection?

□ Additional Lesson 16

Ecosystems: "Keystone species"

- Read and annotate "Keystone species" (p. 553).
- Make a table to organize and record information from the reading about the different types of organisms discussed.
- □ Additional Lesson 17

Ecosystems: Response

• Answer the questions: What is the role of a keystone species? What are some examples of keystone species? What happens if a keystone species is removed from an ecosystem?



□ Additional Lesson 18

Ecosystems: "The marine food chain"

- Read and annotate "The marine food chain" (p. 558).
- Create an energy pyramid depicting the marine food chain described in the reading.
- Take the quiz.

□ Additional Lesson 19

Ecosystems: "What does a bear do in Alaska woods? Disperse seeds"

- Read "What does a bear do in Alaska woods? Disperse seeds" (p. 563).
- Answer the questions: Identify the trophic level of the bear. What roles does the bear play in the ecosystem described in the reading? How do bears help with plants in Alaska?

□ Additional Lesson 20

Ecosystems: Response

• Respond to: How do changes to ecosystems impact the organisms that call them home? How do changes to an environment impact biodiversity?





Day 1

The Five Themes of Geography: "The Five Themes of Geography Help Coordinate the Study of our Planet"

- Read and annotate the article "The Five Themes of Geography Help Coordinate the Study of our Planet" (p. 566).
- Write one paragraph summarizing the five themes of geography.

Day 2

Text Cellular Respiration: "All about cellular respiration"

- Read and annotate "All about cellular respiration" (p. 479).
- Create a diagram that represents the process of cellular respiration.

Day 3

The Five Themes of Geography: "History of the Land Bridge Theory"

- Read and annotate the article "History of the Land Bridge Theory" (p. 570).
- Answer the text dependent quiz questions.

Day 4

The Five Themes of Geography: "History of the Land Bridge Theory"

- Reread the article "History of the Land Bridge Theory" (p. 570).
- Respond to the following prompt in 2–3 paragraphs: What is the land bridge theory? Why do most scientists believe this is how people arrived in North America over 16,500 years ago? What evidence has been found that conflicts with this theory? Use evidence from the article to support your claims.

Day 5

The Five Themes of Geography: Response and Discussion

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



Day 1

Maps, Land, and Water: "Reading Maps and Globes"

- Read and annotate the article "Reading Maps and Globes" (p. 574).
- Answer the text dependent quiz questions.
- Respond to the following prompt: Pick an important scientific term used in the article. What is the term and its definition? Conclude your response by explaining why this is an important term to understand.

Day 2

Maps, Land, and Water: "Reading Maps and Globes"

- Reread the article "Reading Maps and Globes" (p. 574).
- Write one paragraph summarizing the types of maps you learned about from reading this article.
- Respond to the following prompt: How has society benefited from the various types of maps? Using evidence from the article, evaluate why people
- today should understand how to read a variety of types of maps.

Day 3

Maps, Land, and Water: "Bodies of Water: Oceans"

- Read and annotate the article "Bodies of Water: Oceans" (p. 580).
- Write one paragraph summarizing the article.
- Answer the text dependent quiz questions.

Day 4

Maps, Land and Water: "Landforms: Mountains"

- Read and annotate the article "Landforms: Mountains" (p. 584).
- Respond to the following prompt in 2–3 paragraphs: Imagine you are in charge of taking video and pictures for an upcoming documentary about mountains. What kinds of pictures and video do you need to obtain to match the information and the words that will be shared? Would you recommend any changes or additions to the information included in the article in order to make the documentary more entertaining? Use evidence from the article to support your ideas.

Day 5

Text Maps, Land, and Water: Response and Discussion

- Review the readings from this week.
- Respond to the following prompt in 2–3 paragraphs: What did you learn regarding geography this week that you did not know before? What would you like to learn more about?
- Discuss your responses with a friend or someone in your household.



Day 1

Maps, Land, and Water: "Landforms: Islands"

- Read and annotate "Landforms: Islands" (p. 587).
- Write one paragraph summarizing the passage.
- Answer the text dependent quiz questions.

Day 2

Maps, Land, and Water: "Landforms: Plateaus"

- Read and annotate "Landforms: Plateaus" (p. 590).
- Respond to the following prompt in 2–3 paragraphs: Why do you think the author only included one perspective on how plateaus are formed? Should the author always include other perspectives? Use evidence from the article to support your answer.

Day 3

Maps, Land, and Water: "Deserts, Explained"

- Read and annotate "Deserts, Explained" (p. 598).
- Write one paragraph summarizing the passage.

Day 4

Maps, Land, and Water: Response

- Consider the readings from this week.
- Respond to the following prompt in 2–3 paragraphs: Imagine you are an author and you've been tasked with writing a children's book that explains the earth's landforms and bodies of water. Choose 3–5 landforms and/or bodies of water and use your imagination to write a story.

Day 5

Maps, Land, and Water: Response and Discussion

- Consider the readings from this week.
- Respond to the following prompt in 2–3 paragraphs: Explain how physical features, such as mountains and rivers, historically have affected human settlement? Reference the texts you have read this week and last, citing 3–4 pieces of specific evidence.
- Discuss your responses with a friend or someone in your household.



Day 1

Weather and Climate: "Weather and Climate: What is Climate?"

- Read and annotate the article "Weather and Climate: What is Climate?" (p. 603).
- Write one paragraph summarizing the passage.
- Identify three or more new scientific terms and their meaning after reading this article.

Day 2

Weather and Climate: "Weather and Climate: What is weather?"

- Reread the article "Weather and Climate: What is weather?" (p. 603).
- Write one paragraph summarizing the passage.
- Identify three or more new scientific terms and their meaning after reading this article.

Day 3

Weather and Climate: Summary

- Consider the articles you've read so far this week: "Weather and Climate: What is Climate?" (p. 646) and "Weather and Climate: What is weather?" (p. 603).
- Write 2–3 paragraphs identifying the difference between climate and weather. When possible, use the new scientific terms you pulled out in previous lessons in your response.

Day 4

Weather and Climate: Response

- Consider the articles you've read so far this week: "Weather and Climate: What is Climate?" (p. 646) and "Weather and Climate: What is weather?" (p. 603).
- Respond to the following prompt in 2-3 paragraphs: Describe the current weather conditions of the region of the country you live in. What are the pros and cons of the weather in your region?

Day 5

Weather and Climate: Response and Discussion

- Consider the readings from this week.
- Respond to the following prompt in 2-3 paragraphs: What did you learn regarding weather and climate this week that you did not know before? What would you like to learn more about?
- Discuss your responses with a friend or someone in your household.



Additional Lessons

□ Additional Lesson 1

Human Geography: "Asia: Human Geography"

- Read and annotate the article "Asia: Human Geography" (p. 607).
- Write one paragraph summarizing the passage.
- Answer the text dependent quiz questions.
- □ Additional Lesson 2

Human Geography: "Asia: Human Geography"

- Reread the article "Asia: Human Geography" (p. 607).
- Respond to the following prompt in 2–3 paragraphs: Imagine you are an analyst working for a major corporation. The corporation is looking to expand to more countries overseas. What information from the article would help you understand the people and cultures in Asia?

Additional Lesson 3

Human Geography: "Africa's Rich Human Geography"

- Read and annotate the article "Africa's Rich Human Geography" (p. 612).
- Respond to the following prompt in 2–3 paragraphs: Which person or group's perspective was most fully developed in this article? Use details from the article to explain this person or group's perspective on the situation. Conclude by explaining a person or group's perspective that was not fully developed.

□ Additional Lesson 4

Human Geography: "Africa's Rich Human Geography"

- Reread the article "Africa's Rich Human Geography" (p. 612).
- Respond to the following prompt in 2–3 paragraphs: How has Africa been impacted by colonialism?
- □ Additional Lesson 5

Human Geography: Response and Discussion

- Consider the readings from this week.
- Respond to the following prompt in 2–3 paragraphs: describe the cultural geography of the two regions that you read about.
- Discuss your responses with a friend or someone in your household.

□ Additional Lesson 6

Human Geography: "Australia and Oceania: Human Geography"

- Read and annotate the article "Australia and Oceania: Human Geography" (p. 617).
- Answer the text dependent quiz questions.
- Respond to the following prompt in 2–3 paragraphs: Which person or group's perspective was
 most fully developed in this article? Use details from the article to explain this person or group's
 perspective on the situation. Conclude by explaining a person or group's perspective that was
 not fully developed.



Additional Lesson 7

Human Geography: "Australia and Oceania: Human Geography"

- Reread the article "Australia and Oceania: Human Geography" (p. 617).
- Write one paragraph summarizing the passage.
- Respond to the following prompt in 2–3 paragraphs: What historic and contemporary issues have tormented the people of Oceania? What future issues might cause the people problems? Use evidence from the article to support your answerers.
- □ Additional Lesson 8

Human Geography: "North America: Human Geography"

- Read and annotate the article "North America: Human Geography" (p. 624).
- Answer the text dependent quiz questions.

□ Additional Lesson 9

Human Geography: "North America: Human Geography"

- Reread the article "North America: Human Geography" (p. 624).
- Write one paragraph summarizing the passage.
- Respond to the following prompt in 2–3 paragraphs: What historic and contemporary issues have the people in Mexico, Canada, and the United States faced? What future issues might cause the people problems? Use evidence from the article to support your answers.

□ Additional Lesson 10

Human Geography: Response and Discussion

- Consider the readings from this week.
- Respond to the following prompt in 2–3 paragraphs: What did you learn regarding geography this week that you didn't know before? What would you like to learn more about?
- Discuss your responses with a friend or someone in your household.

□ Additional Lesson 11

Human Geography: "South America: Human Geography"

- Read and annotate the article "South America: Human Geography" (p. 629).
- Write one paragraph summarizing the passage.
- Answer the text dependent quiz questions.

□ Additional Lesson 12

Human Geography: "South America: Human Geography"

- Reread the article "South America: Human Geography" (p. 629).
- Respond to the following prompts in 1–2 paragraphs each:
 - Prompt 1: Look at a photo, image or graphic from the article. What are two important details you notice? How do these details help you understand the ideas in the article?
 Prompt 2: Imagine you are a travel agent. You need to prepare handy guides for customers looking to examine their travel options. These guides should contain information about the area, potential travel sites, interesting aspects of the area and any travel concerns. Write a description of what you need to include on your guide for South America based on evidence from the article.



Additional Lesson 13

Human Geography: "Humans are Affecting Species' Biological Carrying Capacity"

- Read and annotate the article "Humans are Affecting Species' Biological Carrying Capacity" (p. 635).
- Write one paragraph that explains the central idea of the article. Use at least two details from the article to support your response.
- Answer the text dependent quiz questions.

□ Additional Lesson 14

Human Geography: Human Impact on the Environment

- Reread the article "Humans are affecting species' biological carrying capacity" (p. 635).
- Respond to the following prompt in 2–3 paragraphs: Describe the ways in which humans can have both a positive and negative impact on the environment. Describe the things that you personally do that impact the environment.

□ Additional Lesson 15

Human Geography: Define Human Geography

- Consider the readings from this week.
- Respond to the following prompt in 3–4 paragraphs: How would you define human geography to a younger brother, sister, or student? What concepts and/or examples would you include?
- Discuss your responses with a friend or someone in your household.

□ Additional Lesson 16

World Geography Concepts: The Importance of Geography

- Consider the readings from the past eight weeks.
- Respond to the following prompt in 2–3 paragraphs: why is the study of geography important? Bring in themes and concepts you've read about over the course of these eight weeks.

□ Additional Lesson 17

World Geography Concepts: Neighborhood Map

- Consider the readings from the past eight weeks.
- Respond to the following prompt: Create a map of your neighborhood. Your map should include the physical features, streets, houses, stores, etc. Create a legend that explains the symbols you've used.

□ Additional Lesson 18

World Geography Concepts: Create a Forecast

- Consider the readings from the past eight weeks.
- Respond to the following prompt: Imagine you are a meteorologist and create a weather forecast. You can use the current weather of the region you live in or you can create an imaginary forecast based on a severe storm such as a hurricane, tornado, or snowstorm.

Additional Lesson 19

World Geography Concepts: Compare and Contrast

- Consider the readings from the past eight weeks.
- Respond to the following prompt: Compare and contrast the similarities and differences of two geographic regions. Consider using a Venn diagram to organize your thoughts.



□ Additional Lesson 20

World Geography Concepts: Response and Discussion

- Consider the readings from the past eight weeks.
- Respond to the following prompt in 2–3 paragraphs: What aspect of world geography are you most interested in? Please explain your answer and reference at least three of the readings covered here.
- Discuss your responses with a friend or someone in your household.







Name:

Class:

To My Dear and Loving Husband

By Anne Bradstreet 1678

Anne Bradstreet (née Dudley; 1612-1672) was the most famous of early English poets in her time and the first published female writer in the British-North American colonies. Addressed to Bradstreet's husband, the poem depicts the intimacy of a couple deeply in love. As you read, take notes on the structure and themes of the piece—how does the narrator describe their relationship?

- [1] If ever two were one, then surely we.If ever man were loved by wife, then thee;If ever wife was happy in a man,Compare with me ye women if you can.
- [5] I prize thy love more than whole mines of gold, Or all the riches that the East¹ doth hold.
 My love is such that rivers cannot quench, Nor ought but love from thee give recompense.² Thy love is such I can no way repay;
- [10] The heavens reward thee manifold, I pray.
 Then while we live, in love let's so persever,³
 That when we live no more we may live ever.



"we are the world" by Leo Grübler is licensed under CC BY-ND 2.0

To My Dear and Loving Husband by Anne Bradstreet is in the public domain.

- i.e. the Eastern world, a term which refers to a wide variety of cultures, socio-political systems, economies, and so on belonging to countries east of Europe (though this geographic definition is not exact, for certain places like Australia are considered more part of the Western world). In Bradstreet's time, the "East" was considered a source of riches as well as exoticism.
- 2. compensate, make amends
- 3. An alternative spelling of "persevere" that forces an accent over the 2nd "e," so as to maintain the rhyme scheme.

Text-Dependent Questions

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

- 1. Consider the structural similarities of the first 3 lines. What do these similarities contribute to the piece?
 - A. The repetition of "If ever... then..." emphasizes the narrator's stern tone, as the speaker tries to get her argument across.
 - B. The repetition of "If ever... then..." creates a humorous and light tone, as the narrator flirts with an unknown acquaintance.
 - C. The repetition of "If ever... then..." creates a serious and solemn tone, as the narrator confesses to her emotional confusion.
 - D. The repetition of "If ever... then..." emphasizes the narrator's message of love as a commitment, similar to the repetition found in wedding vows.
- 2. PART A: What does the term "recompense" most likely mean, as used in line 8?
 - A. to substitute for
 - B. to satisfy
 - C. to make up for
 - D. to swap for
- 3. PART B: Which line from the poem best supports the answer to Part A?
 - A. "I prize thy love more than whole mines of gold"
 - B. "My love is such that rivers cannot quench"
 - C. "Thy love is such I can no way repay"
 - D. "Then while we live, in love let's so persever"
- 4. Which of the following statements best summarizes the imagery used in the poem?
 - A. The poet compares her love to grand parts of nature, such as rivers and gold mines.
 - B. The poet compares her love to being of more worth than all of the material wealth found in parts of the world, such as the East and in gold mines.
 - C. The poet describes her love as transcending death and bringing their souls together as one.
 - D. The poet uses a combination of natural, material, and spiritual imagery when describing her love, making her feelings seem larger than all three.
- 5. Which of the following best describes the poet's purpose?
 - A. To profess the depths of her love to her husband and the unity she feels with him.
 - B. To explain how lost she would be without him in her life.
 - C. To extol the virtues and joys of love within the institution of marriage.
 - D. To describe and praise her husband's many attractive qualities and virtues.

6. How does the rhyme scheme of the poem contribute to the tone?

50

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 measure the value of love? What comparisons can we draw in how we view or depict love? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

2. In the context of this poem, how are we changed by love? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Class:

Excerpts from Romeo and Juliet

By William Shakespeare c. 1593

William Shakespeare (1564-1616) was an English poet, playwright, and actor. He wrote 38 plays, including Romeo and Juliet, which recounts the tragic romance of two young lovers divided by their families' ongoing feud. The following excerpts are taken from the play's prologue and its famous balcony scene. As you read, take notes on how the figurative language used throughout the passage contributes to the themes.

Prologue

CHORUS:

- [1] Two households, both alike in dignity,
 In fair Verona, where we lay our scene,
 From ancient grudge break to new mutiny,¹
 Where civil blood makes civil hands unclean.
- [5] From forth the fatal loins of these two foes A pair of star-cross'd lovers take their life; Whose misadventured piteous overthrows Do with their death bury their parents' strife. The fearful passage of their death-mark'd love,
- [10] And the continuance of their parents' rage,
 Which, but their children's end, nought could remove,
 Is now the two hours' traffic of our stage;
 The which if you with patient ears attend,
 What here shall miss, our toil shall strive to mend.²

Excerpt from Act II, Scene II

JULIET:

[15] O Romeo, Romeo! wherefore³ art thou Romeo? Deny thy father, and refuse thy name; Or, if thou wilt not, be but sworn my love, And I'll no longer be a Capulet.

ROMEO:

[Aside] Shall I hear more, or shall I speak at this?⁴



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^{1.} In this context, "mutiny" means violence or turmoil. The more modern use of "mutiny" refers to a rebellion against authority.

^{2.} Whatever hasn't been mentioned (in the prologue) will be explained on stage.

^{3. &}quot;Wherefore" means "why."

JULIET:

- [20] 'Tis but thy name that is my enemy; Thou art thyself, though not a Montague. What's Montague? it is nor hand, nor foot, Nor arm, nor face, nor any other part Belonging to a man. O! be some other name:
- [25] What's in a name? that which we call a rose By any other name would smell as sweet; So Romeo would, were he not Romeo call'd, Retain that dear perfection which he owes Without that title. Romeo, doff⁵ thy name;
- [30] And for that name, which is no part of thee, Take all myself.

ROMEO:

I take thee at thy word. Call me but love, and I'll be new baptiz'd; Henceforth I never will be Romeo.

JULIET:

[35] What man art thou, that, thus be-screen'd in night,⁶ So stumblest on my counsel?

ROMEO:

By a name I know not how to tell thee who I am: My name, dear saint, is hateful to myself, [40] Because it is an enemy to thee: Had I it written, I would tear the word.

JULIET:

My ears have not yet drunk a hundred words Of that tongue's uttering, yet I know the sound: Art thou not Romeo, and a Montague?

ROMEO:

[45] Neither, fair maid, if either thee dislike.

JULIET:

- 4. Romeo says this line as an aside, or spoken dialogue that is heard by the audience but not by the other characters in the play. Romeo says this line as an aside because Juliet is not aware that he is listening.
- 5. Doff (verb): to remove or rid of

^{6.} hidden or shrouded in darkness

How cam'st thou hither, tell me, and wherefore? The orchard walls are high and hard to climb, And the place death, considering who thou art, If any of my kinsmen⁷ find thee here.

ROMEO:

[50] With love's light wings did I o'erperch these walls;For stony limits cannot hold love out,And what love can do that dares love attempt;Therefore thy kinsmen are no stop to me.

"Excerpts from Romeo and Juliet" by William Shakespeare (1593) 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 statement best describes a theme of the play excerpts?
 - A. Love makes people more willing to change and face obstacles.
 - B. Children should be obedient and not go against their parents' wishes.
 - C. Grudges are easy to overcome, to forgive, and to forget.
 - D. People's fates are set in stone and cannot be changed.
- 2. PART B: Which of the following quotes best supports the answer to Part A?
 - A. "From forth the fatal loins of these two foes / A pair of star-cross'd lovers take their life" (Lines 5-6)
 - B. "The fearful passage of their death-mark'd love, / And the continuance of their parents' rage, / Which, but their children's end, nought could remove" (Lines 9-11)
 - C. "What's Montague? it is nor hand, nor foot, / Nor arm, nor face, nor any other part / Belonging to a man." (Lines 22-24)
 - D. "Call me but love, and I'll be new baptiz'd; / Henceforth I never will be Romeo." (Lines 33-34)
- 3. What purpose does the prologue serve in the text?
 - A. It updates the audience on the current state of the feud.
 - B. It informs the audience of past and future events in the play.
 - C. It discusses the reasons behind why the two families hate each other.
 - D. It outlines the themes of the play by describing them.
- 4. How does Juliet's monologue in lines 15-31 affect Romeo?
 - A. He is shocked by her insistence that he give up his name.
 - B. He regrets being a Montague but resigns himself to being apart from Juliet.
 - C. He is willing to give up his family name in order to be with her.
 - D. He falls more in love with her and convinces her to marry him.
- 5. Explain the figurative language Juliet uses in lines 25-26 and how it relates to a theme of the excerpts.

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YouTube users with disabilities help to normalize differences on platform

By Washington Post, adapted by Newsela staff on 10.21.19 Word Count **975**

Level 1210L



Amythest Schaber has 100,000 subscribers on YouTube. She began her channel, Neuro Wonderful Ask an Autistic, out of a desire for autism to be perceived as something different from what she was seeing. Photo by: Amethyst Schaber

Ruby Ardolf, 14, has her own YouTube channel, featuring familiar aspects of a teen's daily life, including videos of her making slime and her after-school routine. There's also merchandise with messages of kindness and inclusion.

Yet Ruby is not a typical teen vlogger. She is one of 12 people worldwide with an inherited condition called Stromme syndrome, which results in microcephaly (small brain), impaired vision and motor functioning.

YouTube channels about Ruby or other individuals with disabilities provide visibility into their daily lives and have drawn viewers, which promotes neurodiversity. Neurodiversity is the idea that developmental differences are not disorders to be treated but differences to be respected.

Special Books for Special Kids, which often shows children with disabilities, has more than 1 million subscribers.

Ruby's channel, Angie and Ruby, which co-stars and is produced by her mother, Angie Ardolf, has more than 100,000 subscribers and millions of views.

Benefits From Social Media

When Angie Ardolf learned of her daughter's condition, she started a blog for family and friends to keep up-to-date on news and information about Ruby. What she received in return was not just awareness, but people who related to her and accepted Ruby. Their YouTube channel grew out of the same desire to provide information, but this time to a larger audience.

"Since I've been posting regularly, our whole family has a better relationship overall because when we get together, they already know stuff that has been going on in her life," Angie Ardolf said. "Same at school. The girls in school they know what's going on. They can say, 'Hey I heard you went to the movies this weekend.' She can't facilitate that all the time herself."

Creators with disabilities say they have gained many benefits from social media participation. A few positives include support and acceptance, discovery of other people with similar conditions, information sharing and even income.

There also is a belief that their contributions can improve public perceptions and acceptance of people with disabilities, they say.

Amythest Schaber, 28, promotes autism awareness on YouTube and, like Ruby and Angie Ardolf, has 100,000 subscribers. Schaber began her channel, Neuro Wonderful Ask an Autistic, out of a desire for autism to be perceived as something different from what she was seeing.

"When I began to think that I might be autistic, and I went searching online, I mostly found information that was either very medicalized and difficult to understand or were resources written for the non-autistic parents of autistic children," she said. "Much of this information was presented in a negative manner that made autism seem like something scary or tragic. . . . I decided to fill the gap. My goal was to be a source of information for people who are wondering if they are autistic, or anyone who wants to learn more about autism and what being autistic means."

Elizabeth Elicessor is an assistant professor of media studies at the University of Virginia. She researches access to digital media technologies and cultures, particularly with respect to neurological and body differences. Elicessor says mainstream representations of people with disabilities are few but web content can fill that void.

"Creating content can be so important because so little mainstream content is made by or for disabled people," she said. "You don't have tons of representation with disability out there, disabled creators to follow and look up to, so content creation and creating spaces where people can see themselves either in blogging or semi-scripted contexts like web series becomes really important avenues for a different kind of media for people to engage with."

Ellcessor also cautioned against placing too much emphasis on believing that people living with disabilities experience media in a completely different way. Ellcessor said they also find information, form connections and share cat videos.

Online Accessibility

Accessing online material, however, can be a challenge for people with different abilities.

For example, people with different abilities may use assistive technology to access online material. People with difficulty seeing may require audio descriptions, while individuals who are deaf benefit from closed captioning. Many creators with disabilities may have to rely on a partner to assist them with the experience.

Other elements of social media culture can also be difficult for people with disabilities. The decision to try to make money can be tied with moral considerations that other people do not need to consider, such as a fear that viewers may misjudge the creators' intentions as self-serving rather than educational. Then there are also expectations of constant presence and availability, which can be challenging for anyone.

"As an autistic person, getting on camera and projecting a likable persona, a persona that I call YouTube Amythest, is exhausting," Schaber said. "I can schedule an entire week around creating, and then recovering from the creation of a single video."

Despite those challenges, individuals with disabilities have been successful in creating their own terms for success, Ellcessor said.

"These may be communities where it's OK to say 'not going to be on for two days, DM me if urgent' or communities where contacting others to say this person is arguing with me, I don't have energy, can you take it up instead?" she said.

Social media could redefine what is popular and promote content about education and awareness, Ellcessor said. Doing so would make room for a more diverse experience for users and creators.

Ruby's mom Angie agrees.

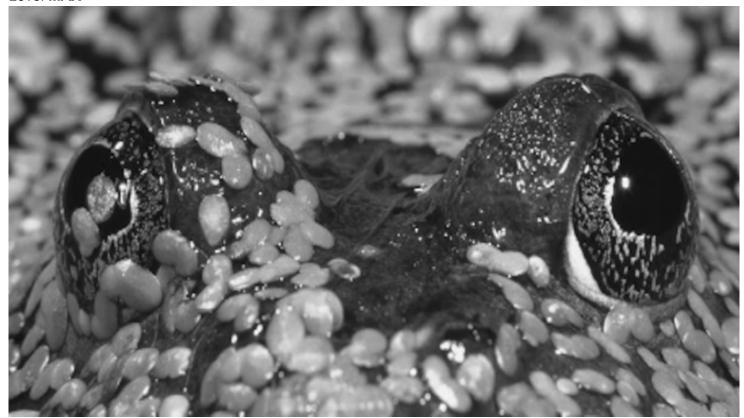
"Hearing people say that they accept her differences — Ruby is awesome. Ruby is beautiful. Ruby is funny. That has always been my mission," she said.

"YouTube or any social media is that safe place to look and to wonder and to ask a question so that when you confront someone in real life you have gotten information you need to know that everyone is different and [you can] just be friendly."

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The biology of awareness

By Ursula Goodenough, Big History Project on 08.05.16 Word Count **1,188** Level **MAX**



TOP: Bullfrog hiding in duckweed. BOTTOM: Neurons. Courtesy of Big History Project.

One of the amazing complexities of life is an organism's ability to recognize and react to its surroundings. This trait of awareness exists in the smallest single-celled organism as well as in the most complex of creatures — that is, *Homo sapiens*, like you and me.

Emergence

A living organism has thousands of different kinds of protein shapes, enabling it to self-organize and self-maintain, to reproduce and adapt. How is this even possible inside of a single cell? One useful way to think about this is with a concept called "emergence." There's a T-shirt slogan for emergence that goes, "You get something else from nothing but." What does that mean? Well, the nothing buts are important parts of a system that form relationships with, and organize themselves with respect to, one another. When that happens, the something else that wasn't there before, a new property or capability, pops through.

Let's think of some examples. We might consider an emergent property like blood circulation. The nothing buts are things like the heart, the arteries, and the capillaries that, working collectively, allow for blood circulation to take place.

There's a useful term in biology for emergent properties: traits. So blood circulation is a trait. Human-style motility is a trait, and there are countless others. An organism is thus a collection of traits. When we speak of traits, we are thinking of the large emergent part rather than the nothing buts, but we can go all the way down to the molecules, breaking the trait into little pieces, or numerous nothing buts. Then, when we put Humpty Dumpty back together again, when we assemble all the pieces and get the emergent property, we start talking about the traits that are generated.

Critical to all of this is the idea of natural selection — the process that brings new kinds of organizations and traits from one generation to the next. Natural selection is looking at traits such as blood circulation and mobility. It's not looking at the proteins and protein shapes. It can't see the genes. It has no idea how the traits are generated. The criterion for selection is whether a particular version of a trait is adaptive (favorable) or not adaptive (unfavorable) to the particular environmental context where the organism is making its living.

Traits materialize and then evolve. An example of one trait that's evolving — and that we're particularly interested in — is what we call "awareness." So how does awareness work?

Awareness

Probably the very first organisms that were ever successful already had some ability to be aware of their environment: to figure out where a food source is, or where light is. And the basic organization of awareness is shared throughout the biological world.

First, some sort of an outside signal exists for an organism to be aware of. Then, the organism must have a receptor looking for that signal. The receptor is usually a protein, and when the signal and the receptor interact, the protein changes its shape. In your nose, for example, the odor receptors are one shape when you're not smelling anything; but when a particular odorant comes in, certain receptors bind to that odorant and change their shape.

What happens next is a whole cascade of what we call "downstream events." The cell notices the shape change, and more shape changes are stimulated. Finally, there's an adaptive response. If an organism has smelled something, it gets the response to either go toward the thing (if it decides that it is good and wants to eat it), or to move away from it (if it's the smell of, say, a predator or some toxic substance). Such changes and responses occur even in bacteria, which happen to be very aware of their environment.

Neurons And Brains

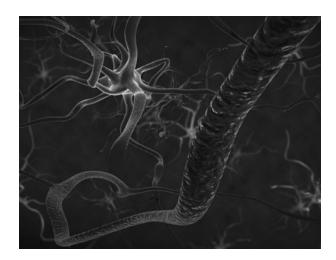
You can see the evolution of awareness throughout the single-celled world, but animals took the whole awareness idea to another level by inventing particular kinds of cells called "neurons." Many neurons tell muscles whether to contract or not. They're called motor neurons. Another group of important neurons, called sensory neurons, have sensory receptors.

In animals, sensory neurons are almost always hooked up to the brain. The brain is a collection of additional neurons that interacts with the input pouring in from the sensory neurons and integrates the signals. A brain makes things multichanneled and allows for multitasking. You can see a signal. You can smell a signal. You can touch a signal. You can taste a signal. All of these inputs come into the brain, and the neurons in the brain hook all of that information together and figure out the most appropriate response. Are you in the presence of predator or prey?

Learning And Memory

Another wondrous trait is the brain's ability to learn and remember. We once believed only highly developed animals could store information, but recent research has shown that even something rather simple, like a clam, with only about 20,000 neurons in its brain, can remember for several days stimuli it received.

Animals like mammals can have millions or even billions of neurons in their brains and any one neuron in the brain is in contact with, and can be stimulated



by, a thousand other neurons. Complicating things further, some of the neurons that relate to a given neuron stimulate it and cause it to fire, while others prevent it from firing. So whether the neuron actually fires is a result of their collective input.

Imagine that multiplied by about 100 billion, and you'll begin to see why it's hard to puzzle out how a complex mammalian brain might work. In fact, there's very little that we do understand about it. We know that because brains can remember, a mammal with a huge memory store is not only aware of what it's sensing in the moment, it's also aware of all the things that it remembers. So it's much more knowledgeable about the world than if it just had a protein receptor reacting to an outside signal, as with a single-celled organism.

Language And The Self

What about human brains? How are they different? Well, they don't look very different than other mammalian brains, and they control most of the same activities, like breathing and body temperature. But they do other things as well. The most important and interesting new feature is our unique mode of communication, called "symbolic language." We have a way of thinking that generates abstract ideas, and we can remember these abstract ideas and put them together in spoken and written language. We also use language to teach one another, rather than learning only from experience and imitation, and to transmit and evolve our ideas from generation to generation via the social system we call "culture." Another crucial feature is our storytelling ability — we are narrative creatures, and each of us has a self-narrative. Our "I-self" wakes up in the morning, goes to bed at night, and remembers things about its life. This I-self is crucial to our experience, and it probably distinguishes us from all of the other animals on the planet.

Quiz

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- Which of the following statements BEST expresses the article's central ideas?
 - (A) Living organisms share the trait of awareness. In animals, sensory neurons allow the brain to process complex messages from multiple signals.
 - (B) Living organisms share the trait of awareness. They also have thousand of different protein shapes that allow them to self-organize.
 - (C) All living creatures possess awareness. Awareness is just one example of the great variety of traits possessed by all living creatures.
 - (D) All living creatures possess awareness. Even small animals such as a clams, with only about 20,000 neurons in their brains, still have the trait of awareness.
- Which of the excerpts below would be MOST important to address in a summary of the article?
 - (A) So blood circulation is a trait. Human-style motility is a trait, and there are countless others.
 - (B) First, some sort of an outside signal exists for an organism to be aware of. Then, the organism must have a receptor looking for that signal.
 - (C) Many neurons tell muscles whether to contract or not. They're called motor neurons.
 - (D) Imagine that multiplied by about 100 billion, and you'll begin to see why it's hard to puzzle out how a complex mammalian brain might work.
- Based on information in the article, which statement ACCURATELY describes the reason all organisms have awareness?
 - (A) Awareness was selected because it was beneficial to organisms in particular environments.
 - (B) Awareness is so common because the specific proteins passed easily from generation to generation.
 - (C) Awareness was chosen by natural selection because it was recognized as a good trait for creatures to possess.
 - (D) Awareness is so common because DNA frequently copied that trait, while eliminating useless traits.

Human awareness differs from the awareness of other organisms in all of the following ways EXCEPT:

- (A) Human awareness includes symbolic communication.
- (B) Human awareness helps to transmit ideas across generations.
- (C) Human awareness enables people to construct an "I-self."
- (D) Human awareness is an adaptive trait.



Name:

Class:

<u>l'm Happiest When Most Away</u>

By Emily Brontë 1838

Emily Brontë (1818-1848) was an English poet and author best known for her novel Wuthering Heights. *Brontë had shy, solitary nature and made few friends outside of her family. As you read, take notes on how the speaker views herself and the world around her.*

- [1] I'm happiest when most away I can bear my soul from its home of clay On a windy night when the moon is bright And the eye can wander through worlds of light
- [5] When I am not and none beside —
 Nor earth nor sea nor cloudless sky —
 But only spirit wandering wide
 Through infinite immensity.



<u>"Untitled"</u> by Myles Tan is licensed under CC0.

"I'm Happiest When Most Away" by Emily Brontë (1838) 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 express a theme in the poem?
 - A. Daydreaming is a nice escape from one's problems, but it is not a permanent solution.
 - B. One's soul can only truly be at peace after it has left one's body in death.
 - C. People should embrace being alone and the peace it can bring.
 - D. People shouldn't feel ashamed for being different, as there are many ways of being happy.
- 2. PART B: Which of the following phrases best supports the answer to Part A?
 - A. "I'm happiest when most away / I can bear my soul from its home of clay" (Lines 1-2)
 - B. "On a windy night when the moon is bright / And the eye can wander through worlds of light " (Lines 3-4)
 - C. "When I am not and none beside / Nor earth nor sea nor cloudless sky " (Lines 5-6)
 - D. "But only spirit wandering wide / Through infinite immensity" (Lines 7-8)
- 3. What does the phrase "home of clay" mean as used in line 2?
 - A. The phrase suggests that the speaker feels trapped while indoors and would prefer to be outside.
 - B. The phrase refers to a society that restricts the speaker's freedoms because of her gender.
 - C. The phrase suggests that the speaker feels limited by boring reality and so she uses her studies as a means of escape.
 - D. The phrase refers to the speaker's body as she imagines herself free of her body's physical confinement.
- 4. How does the poet's use of dashes in lines 4-6 contribute to the meaning of the poem?
 - A. The dashes suggest contemplative pauses that reflect how the speaker's thoughts expand as her soul expands "away" into the universe.
 - B. The dashes suggest that everything in the universe is connected, just as the lines are connected by the dashes.
 - C. The dashes suggest that the universe is actually empty and meaningless, just as the dashes are silent and represent nothing.
 - D. The dashes suggest that the speaker can only speak in short phrases because she is dying, and the dashes represent her labored breathing.

5. How does the speaker view herself and how she interacts with the world in the poem? Cite evidence from the poem 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. Literacy critics have interpreted "I'm Happiest When Most Away" as a poem about death. Because Brontë relies mostly on figurative language in this poem, the theme is left open to debate. Do you agree that the poem is about death? Look carefully at the author's word choice before you make your case.

2. In the context of this poem, how do we achieve happiness? Do you agree with the speaker's form of happiness? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

3. In the context of this poem, what does it mean to feel alone? Do you think solitude is always a bad thing? Why or why not? How does the speaker feel about being alone? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

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Don't despair if you ate the marshmallow right away

By Richard Adams, The Guardian, adapted by Newsela staff on 06.21.18 Word Count 829 Level 1260L



The latest research suggests people could be wasting their time if they use Walter Mischel's marshmallow test to coach children to resist sweet treats. Photo by: igorr1/Getty Images

The "marshmallow test" has intrigued a generation of parents and education experts with its promise that a young child's willpower and self-control holds a key to their success in later life.

However, the latest research suggests that the marshmallow test is not very accurate after all.

The results, according to the researchers who carried out the new study, mean that parents, schools and nurseries could be wasting time if they try to coach their children to delay gratification by resisting the tasty confection.

Psychologist Walter Mischel carried out the original marshmallow test research in the 1960s and 1970s at Stanford University in California. Children between 3 and 5 years old were given a marshmallow that they could eat immediately, but were told that if they resisted eating it for 10 minutes, they would be rewarded with two marshmallows.

According to Mischel and co-workers in a follow-up study in 1990, the results were profound for children who had the willpower to wait for the extra marshmallow. More than a decade later, in their late teens, those children exhibited advanced traits of intelligence and behavior far above those who succumbed to temptation.

Results Not As Significant In Second Research Study

Now, though, there is relief for the parents of the many children who would gobble down a marshmallow before the lab door was closed. Researchers from New York University (NYU) and the University of California-Irvine tried and largely failed to re-create the earlier research, in a paper published in May.

The new research by Tyler Watts, Greg Duncan and Hoanan Quen was published in the journal Psychological Science. The research found that there were still benefits for the children who were able to hold out for a larger reward, but the effects were nowhere near as significant as those found by Mischel. Even those effects largely disappeared at age 15 once family and parental education were accounted for.

Watts said that the new results take into account the background characteristics of the child and their environment. Once those factors were accounted for, the marshmallow test made less of a difference. "Differences in the ability to delay gratification do not necessarily translate into meaningful differences later in life," Watts said.

"So, if you looked at our results, you probably would decide that you should not put too much stock in a child's ability to delay at an early age," Watts said.

In the decades since Mischel's work the marshmallow test has become common in parenting advice and among experts studying education and the mind. Its message is that improving a child's own ability to delay gratification would have tangible benefits.

The ones with willpower "yielded less to temptation; were less distractible when trying to concentrate; were more intelligent, self-reliant, and confident; and trusted their own judgment," Mischel later wrote.

Don't Take Results Too Seriously

However, Watts, a scholar at the Steinhardt school of culture, education and human development at NYU, says the test results are no longer so straightforward.

"I think the test is still a very illuminating measure of children's ability to delay gratification," Watts said. Watts added that Mischel's work undeniably influenced how we think about young children and their development.

"But our study suggests that the predictive ability of the test should probably not be overstated," he said. "In other words, if you are the parent of a 4 year old, and they reach for the marshmallow without waiting, you should not be too concerned."

The updated version of the marshmallow test allowed children to choose their own treats, including chocolate. The test studied 900 children. The group of children was selected to be more reflective of U.S. society. For example, 500 children in the study had mothers who had not attended college.

Mischel's original research used children of Stanford University staff. The follow-up study, on the other hand, included fewer than 50 children from which Mischel and co-workers formed their conclusions.

Not Predictive Of Teen Behavior

Most surprising, according to Watts, was that the revisited test failed to replicate the links with behavior that Mischel's work found. This means that a child's ability to resist a sweet treat at age 4 or 5 didn't necessarily lead to a well-adjusted teenager a decade later.

"We found virtually no correlation between performance on the marshmallow test and a host of adolescent behavioral outcomes. I thought that this was the most surprising finding of the paper," Watts said.

"It suggests that the ability to delay gratification, and possibly self-control, may not be a stable trait. It certainly opens up new avenues for inquiry," Watts said.

Robert Coe is a professor of education at Durham University in England. He said the marshmallow test had become so well known because it was a simple experiment with a powerful result.

"It will never die, despite being debunked, that's the problem. Parenting books 10 or 20 years from now will still be quoting it, and not the evidence against it," Coe said.

1 Read the following paragraphs from the section "Not Predictive Of Teen Behavior."

Robert Coe is a professor of education at Durham University in England. He said the marshmallow test had become so well known because it was a simple experiment with a powerful result.

"It will never die, despite being debunked, that's the problem. Parenting books 10 or 20 years from now will still be quoting it, and not the evidence against it," Coe said.

Which of the following can be inferred from the paragraphs above?

- (A) Coe thinks that new research is pointless because people will choose to believe the results of old research.
- (B) Coe thinks that people are convinced by simple experiments with powerful results, even if the results are not reliable.
- (C) Coe thinks that the marshmallow experiment was quite harmful because it has convinced people of lies.
- (D) Coe thinks that parenting books are generally unhelpful because they rely on bad evidence.
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Read the following statement.

The new study was better-designed than Mischel's original study.

Which selection from the article BEST supports the statement above?

- (A) "So, if you looked at our results, you probably would decide that you should not put too much stock in a child's ability to delay at an early age," Watts said.
- (B) The test studied 900 children. The group of children was selected to be more reflective of U.S. society.
- (C) Most surprising, according to Watts, was that the revisited test failed to replicate the links with behavior that Mischel's work found.
- (D) "It suggests that the ability to delay gratification, and possibly self-control, may not be a stable trait. It certainly opens up new avenues for inquiry," Watts said.
- Which statement BEST reflects one of Tyler Watt's beliefs?
 - (A) Even though Mischel's conclusions have been somewhat debunked, studying gratification in children was still useful research.
 - (B) Even though Mischel's conclusions have been somewhat debunked, they still provide valuable advice that parents should follow.
 - (C) Young children with the ability to delay gratification are most likely to be more intelligent and successful as teenagers and young adults.
 - (D) Young children with the ability to delay gratification will not be more intelligent and successful as older children in any circumstance.
- Which answer choice BEST explains why the author wrote this article?
 - (A) to prove to parents that there are better ways to raise intelligent children than delaying gratification
 - (B) to prove to parents that they should not teach young children to delay gratification
 - (C) to explain recent research that greatly revises ideas about older well-known research
 - (D) to explain recent research that completely reverses the relationship between two variables in older wellknown research

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Texting can be a positive and powerful force, experts say

By Washington Post, adapted by Newsla staff on 08.21.18 Word Count **1,157** Level **1130L**



Three teenagers are lost in their phones while in Trafalgar Square in London, England. Photo by: In Pictures Ltd./Corbis via Getty Images

When texting tends to be in the news, people aren't usually singing its praises.

It often gets blamed for fostering social isolation or decreasing teens' attention spans. Other days, it's driving down self-esteem or damaging the spine — a phenomenon known as "text neck."

Still, some technological and medical experts say the negativity is unfair. Texting can and should be a positive force in people's lives, both in terms of emotional and physical health, they say — so long as it's used correctly.

Massachusetts Institute of Technology (MIT) psychologist Sherry Turkle wrote the book "Reclaiming Conversation: The Power of Talk in a Digital Age," which analyzes how we communicate. She says "the problem really isn't that people have this new, interesting, intimate way of touching base ... the trouble is what happens to face-to-face conversation if your phone is always there." If done well, Turkle and other experts said, texting can improve interpersonal relationships. It can also help people deal with traumatic events and connect different generations of people.

Medical Uses Of Texting

There are also medical uses. Texting eases the difficulty of communication with doctors, advances research as an easy and accurate way of gathering patient information in scientific studies, and can offer support to at-risk or suicidal individuals via instant-response crisis text lines.

Eric Topol is digital health expert at the Scripps Research Institute in La Jolla, California. He admitted he's not a huge fan of texting — but said even he has been forced to acknowledge its benefits.

It all comes down to when and how you text, according to Turkle and Tchiki Davis, who studies, writes and consults on well-being technology. Both said there's one key rule of texting: Don't do it when you're around other people.

A No-No: Don't Bring Phones To The Dinner Table

If you're out to dinner with friends, put your phone away and keep it out of sight, Turkle said. Even leaving the turned-off phone visible on the table will make conversations more trivial and will reduce the possibility of "empathetic communication," Turkle said. She warned some people use texting to avoid difficult face-to-face interactions.

We should ask, "'Is texting keeping me away from a necessary conversation?' If not, enjoy."

It's better to refrain from texting even around total strangers, Davis said. She mentioned that when commuting home from work at the end of a long day, people whip out their phones and disappear into their screens, ignoring their fellow passengers on the bus or the subway.

"A whole body of research shows we can improve your well-being even through just tiny interactions with strangers," Davis said.

Reaching Out In Time Of Need

Once you're truly alone, go ahead and break out your phone, Turkle and Davis said — but be thoughtful about who and what you text. Think of texting friends and family and consider who might be feeling lonely or confronting a difficult situation.

If you yourself are struggling, texting a loved one is a great way to handle it, Davis said.

"Studies have shown that people who text and reach out to others experience less pain," Davis said. "It can be used to cope and just kind of deal with challenging situations."

Try not to gossip via text, Davis says. Write longer, fuller messages to reduce the chance the receiver misreads something you've sent. Text your friends memes or videos you think they'd find amusing. Use more exclamation points.

Keeping Parents In The Loop

Turkle said texting is an especially good way for parents to connect with their adult children. Turkle's daughter recently went shopping for a wedding dress without Turkle, so she sent her mom pictures of different dresses.

Turkle said the messages made her feel close to her daughter.

More and more doctors, scientific researchers and mental-health advocates are using texting in their everyday work and are realizing its benefits, Topol said.

For physicians and their patients, texting offers a quick and non-intrusive way of getting in touch. Turkle remembered one night recently when she noticed a rash on her leg. It would have been a "big deal" to call her doctor past 9 p.m. at night — so instead, she texted him a picture of the rash and asked whether she needed to visit the emergency room.

He quickly replied, "You ate something, don't worry," Turkle said. She thinks "sending photographs is going to be a big part of the future of medicine."

The ease, speed, and universality of texting also makes it powerful for research, Topol said. Over the course of the past five years, texting has been used to collect information in dozens of important health studies.

It Allows Immediate Feedback, Help

It's easy to gather data because 70 percent of the world likely has cellphones, which makes it easier for participants to get involved and respond to researchers.

It allows for immediate feedback. People are also more likely to reply to a text than an email.

Texting is also affecting the mental-health world. In recent years, suicide and mental-health support lines have been launched that exclusively offer text-based support.

Suicides usually result when a combination of events and circumstances make life temporarily unbearable. Mental health disorders or substance abuse are associated with most suicides. Often, family and friends do not recognize the warning signs or underlying mental health issues leading to a suicide.

Lean On Me offers an all-hours support service specifically targeted to help college students. The organization, launched in 2016 by current and former MIT students, connects texters with volunteer peer supporters. Since its founding, Lean On Me has expanded to seven college campuses, including MIT's.

"Sometimes students need a quick outlet to vent about their day, talk about a frustration, or simply hold a conversation," Lean On Me staffer Shaye Carver wrote in an email. "I don't think vulnerability necessarily requires face-to-face interaction. Texting allows users to respond in a minute or an hour and take as much time as they want to reflect on how they feel."

Texting Link With Art Museum

Others are using text lines in more whimsical ways. The San Francisco Museum of Modern Art in summer 2017 kicked off a program called "Send Me" that allows anyone to text the museum a request to see a particular item. In return, a computer algorithm sends the texter a piece of SFMOMA art that matches the requested item.

At the height of the craziness, the museum handled about **70,000** texts per hour, according to Jay Mollica, the museum's creative technologist.

He attributes Send Me's success to the "personal" nature of texting, a medium used mostly to stay in touch with close friends and family.

"In the morning people will say, 'Send me coffee,'" Mollica says. "And late at night they'll say things like 'Send me friends."

As of July 2018, the top requested items on Send Me included the terms "love," "hearts," "cats," "dogs," "purple" and "happiness."

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- Which statement would be MOST important to include in an objective summary of the article?
 - (A) Texting should be a mandatory service that all college campuses provide for their students' mental health.
 - (B) Texting is a better way for people to share their feelings and fears than talking to someone they love face-to-face.
 - (C) Experts are examining the way texting can benefit their research in a variety of fields by allowing immediate feedback.
 - (D) Experts agree the ease and personal nature of texting can provide benefits for both physical and mental health.
- 2 What is the relationship between the following selections from the article?

Even leaving the turned-off phone visible on the table will make conversations more trivial and will reduce the possibility of "empathetic communication," Turkle said.

Write longer, fuller messages to reduce the chance the receiver misreads something you've sent. Text your friends memes or videos you think they'd find amusing.

It would have been a "big deal" to call her doctor past 9 p.m. at night — so instead, she texted him a picture of the rash and asked whether she needed to visit the emergency room.

- (A) They support the main idea that being thoughtful about how and when you text will determine its benefits.
- (B) They support the main idea that texting is being used by doctors to provide physical health benefits.
- (C) They develop the main idea that texting can help people deal with traumatic events and experiences.
- (D) They develop the main idea that experts believe there are still more drawbacks than benefits to texting.

Which answer choice BEST explains why the author wrote this article?

- (A) The author is arguing that the ease of texting is keeping many people from interacting with others.
- (B) The author is persuading readers to participate in research that incorporates texting to help experts.
- (C) The author is explaining experts' views on the new ways that texting is being used to positively affect people's lives.
- (D) The author is providing evidence that more people now use texting more than traditional visits for health services.
- 4 Read the following list of people from the article.
 - 1. Eric Topol
 - 2. Tchiki Davis
 - 3. Shaye Carver
 - 4. Jay Mollica

Which two have perspectives that are MOST in AGREEMENT with each other?

- (A) 1 and 3
- (B) 2 and 3
- (C) 1 and 4
- (D) 2 and 4

🗋 newsela

More people are using fluoride-free toothpaste; dentists are worried

By Associated Press, adapted by Newsela staff on 08.23.18 Word Count **972** Level **1220L**



Dental health experts worry that more people are using toothpaste that skips the most important ingredient - the fluoride - and leaves them at a greater risk of cavities. Photo by: KidStock/Getty Images

Dental health experts worry that more people are using toothpaste that does not include fluoride, the most important ingredient. Toothpaste without fluoride, a mineral which strengthens the enamel of teeth, leaves people at a greater risk of cavities.

Most toothpastes already contain fluoride. While health authorities recognize fluoride as a cavity blocker, the Internet is dotted with claims, often from "natural" toothpaste marketers and alternative medicine advocates, that fluoride-free toothpaste also prevents cavities.

Dental authorities disagree.

Arguing With The Internet

Damien Walmsley is a scientific adviser to the British Dental Association and dentistry professor at the University of Birmingham in England. "It's really important to debunk this idea that brushing your teeth stops decay. You need to have the fluoride," he said. That view was affirmed on August 6 by an article in the dental journal Gerodontology that reviewed scientific studies on cavities. Its primary conclusion is that, without fluoride, oral hygiene efforts have "no impact" on cavity rates.

The idea that just brushing teeth doesn't stop cavities has largely been accepted among individual researchers for decades, but not always by the public. Dentists generally recommend fluoride for cavity fighting, but even some of them continue to believe that the mechanics of wiping your teeth clean of plaque also reduces cavities. The review findings, published on August 6, gave pause to at least one dentist.

What The Scientific Studies Show

Richard Niederman is a dentist and professor at New York University (NYU) who saw the study and found the findings credible. "It violates certain principles we've been taught and that we teach and that we believe," he said. "What it says to me is that the toothbrush is just a delivery system."

Few studies of the question have been carried out in recent years because the value of fluoride has been widely accepted for decades. In the review, University of Washington researchers looked for high-quality studies since 1950 and found just three. They were carried out in the U.S. and Great Britain and published from 1977 to 1981. They involved a total of 743 children 10 to 13 years old who flossed and brushed for up to three years.

When the studies were evaluated statistically as a whole, there was no significant cavity reduction from simply brushing or flossing without fluoride.

Proof That Fluoride Fights Cavities

Dentist J. Leslie Winston is the oral care director for Crest-toothpaste maker Procter & Gamble. Winston said the review "serves as an important reminder."

"Despite a large body of scientific evidence, there are growing numbers of consumers who believe that all toothpastes are the same," he said in a statement. The new research proves otherwise.

Industry sources estimate that fluoride-free toothpaste makes up no more than 5 percent of all toothpaste sold, but with projected growth of over 5 percent annually. On August 6, Tom's of Maine antiplaque and whitening toothpaste, which is fluoride-free, was listed as the second-best selling toothpaste on Amazon's online buying platform.

Fluoride-Free Toothpaste: No Promises

Paul Jessen, a brand manager at Tom's of Maine, said "the products that don't contain fluoride that we offer do not promise that benefit" to fight cavities. He said his company's customers generally understand this.

Yet customer comments on Amazon's website sometimes indicate otherwise, with many reviews insisting that the company's fluoride-free toothpaste does fight cavities. "If you brush regularly with or without fluoride, you reduce the risk of cavities," one customer insists.

Oral care companies themselves also stray into such claims. The website of Revitin non-fluoride toothpaste says it "strengthens your teeth against tooth decay."

Gerald Curatola, the dentist who founded Revitin and now serves as chief science officer, called the review "misleading." He said that the latest science suggests that a healthy mix of oral bacteria is key to dental health. "I don't think fluoride makes a difference at all," he said.

Other Benefits Of Brushing

Jeff Davis, the CEO of Sheffield Pharmaceuticals that sells toothpaste with and without fluoride, said it's "pretty established" that fluoride is what helps reduce cavities. He said some people worry about the harmful effect of too much fluoride, though, and so choose fluoride-free toothpaste.

Even without fluoride, dentists say there's some value in brushing. Philippe Hujoel is the dentist and University of Washington professor who led the dental review. He said oral hygiene without fluoride might produce real cavity-fighting effects too small to detect in a study, or adults might conceivably benefit where the children in the studies did not.

And toothbrushing did reduce swollen gums in Hujoel's review. Brushing the teeth may also dislodge stuck food and help patients recover from oral surgery.

What About Flossing?

The review also cited a 2009 analysis of studies involving 60,000 people that found fluoride rinse prevents cavities about as well as fluoride toothpaste.

In 2016, The Associated Press reported on the poor scientific evidence for the benefits of flossing. As a result, the federal government removed its long-standing flossing recommendation from Dietary Guidelines for Americans.

The review raises questions about how cavities form. Cavities have long been thought to develop in a poorly cleaned mouth when acids left by food start to wear away tooth enamel. The idea is that clean teeth do not decay. This review, though, argues for an alternate model: cavities grow in tiny crevices in the enamel that can't easily be reached with a toothbrush or dental floss alone.

Watch Your Sugar!

Despite the clear benefit of fluoride, some studies have also challenged the belief that fluoridated drinking water stops dental decay as well as fluoride toothpaste or rinses. In any event, it makes sense to combine fluoridated water and dental products for amplified protection, said Niederman, the NYU dentist.

Some dentists also said the most effective way to prevent cavities is simply to reduce sugars in the diet.

Quiz

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- Which of the following sentences from the article BEST develops a central idea of the article?
 - (A) Dental health experts worry that more people are using toothpaste that does not include fluoride, the most important ingredient.
 - (B) Dentists generally recommend fluoride for cavity fighting, but even some of them continue to believe that the mechanics of wiping your teeth clean of plaque also reduces cavities.
 - (C) Industry sources estimate that fluoride-free toothpaste makes up no more than 5 percent of all toothpaste sold, but with projected growth of over 5 percent annually.
 - (D) This review, though, argues for an alternate model: cavities grow in tiny crevices in the enamel that can't easily be reached with a toothbrush or dental floss alone.
- 2 Which answer choice provides an accurate and objective summary of the article?
 - (A) New research has revealed that fluoride is a mineral that can significantly strengthen tooth enamel.
 Dentists feel confident that the use of fluoridated toothpaste, rinses and drinking water is the only factor that affects whether cavities will develop.
 - (B) Dental experts have published a review of companies that produce dental products without fluoride, such as Tom's of Maine and Revitin. The review warns consumers of the dangers of these products and debunks the false claims published about them online.
 - (C) A review of scientific studies on cavities highly recommends the use of fluoride toothpaste to prevent the risk of cavities. However, some dentists and consumers believe that brushing and flossing is a more important factor in fighting tooth decay.
 - (D) Dentists have long been baffled by the development of cavities in patients with good dental hygiene. Scientists conducted a case study of 743 children to determine whether sugar, fluoride or brushing and flossing habits was most directly related to cavities.
 - Which of the following is the STRONGEST evidence to support the author's central claim that fluoride plays a bigger role than other forms of dental care in preventing cavities?
 - (A) The idea that just brushing teeth does not stop cavities has largely been accepted among individual researchers for decades, but not always by the public.
 - (B) When the studies were evaluated statistically as a whole, there was no significant cavity reduction from simply brushing or flossing without fluoride.
 - (C) Jeff Davis, the CEO of Sheffield Pharmaceuticals that sells toothpaste with and without fluoride, said it's "pretty established" that fluoride is what helps reduce cavities.
 - (D) As a result, the federal government removed its long-standing flossing recommendation from Dietary Guidelines for Americans.
- 4 The author provides the following evidence in the section "Fluoride-Free Toothpaste: No Promises" to support consumers' claim that fluoride-free toothpaste is just as beneficial as toothpaste with fluoride.

Yet customer comments on Amazon's website sometimes indicate otherwise, with many reviews insisting that the company's fluoride-free toothpaste does fight cavities. "If you brush regularly with or without fluoride, you reduce the risk of cavities," one customer insists.

Is this evidence factual? How do you know?

- (A) Yes; this evidence is statistical and is pulled directly from non-fluoride toothpaste sellers.
- (B) No; this evidence is a customer's testimonial and is not supported by research.
- (C) Yes; this evidence is anecdotal and reflects the actual experience of one individual.
- (D) No; this evidence is argumentative and fails to establish support of either type of toothpaste.

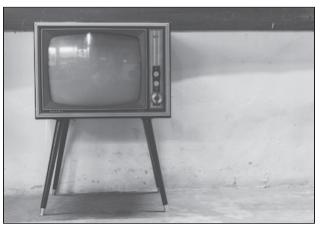


Can Television Be Considered Literature and Taught in English Classes?

By Shelby Ostergaard 2017

Movie days in the classroom are infrequent and far between, but what if teachers used television as a means of teaching? Shelby Ostergaard discusses whether or not television can be considered a form of literature and the benefits and disadvantages of teaching it in the classroom. As you read, take notes on the benefits and disadvantages of teaching in the classroom.

[1] We have always had stories. They were first told orally as fairy tales, folklore, and epic poems, and were eventually written down. And for as long as we have had stories, we've had literature. Stories are usually considered literature when they have long-lasting artistic or social value. Epic poems like *The Odyssey* or novels like *To Kill a Mockingbird* are considered literature because they have deeper meanings that go beyond the story. Both stories are meant to do more than just amuse the reader. A pop novel, like a James Patterson book you can buy at the airport, would not traditionally be considered literature because it is not meant to do much more than entertain the reader.



"Untitled" by Sven Scheuermeier is licensed under CCO.

As we've transitioned from hearing stories to reading them, our ideas have changed about what kinds of stories have merit. We have always made a point to pass on the stories we value to next generation, regardless of their form. Therefore, it should not be so outrageous to declare that a new form of literature has been forged and needs to be passed on: television shows.

Television shows can be as complex as novels and can provide students with opportunities to learn that novels do not. Yet, there are legitimate concerns about using classroom time to dissect¹ television. One issue is that complex television shows tend to have adult or graphic themes not suitable for the classroom. Another concern involves how much time students spend on television. Plenty of students already watch and discuss television in their own time, so is television needed in the classroom, too? Finally, the written word teaches cognitive² skills that television cannot.

The idea of television as a form of literature that should be taught in classrooms remains controversial.³ How many times have you heard the phrase "television rots your brain"? If television is literature, should it be taught in English class the same way traditional literature is taught?

^{1.} Dissect (verb): to analyze something

^{2.} Cognitive (adjective): relating to mental processes

^{3.} Controversial (adjective): giving rise or likely to give rise to public disagreement

The Golden Era of Television

[5] We are now living in the golden era of television. The term "golden era" is what television and media critics call the collection of TV shows from the late 1990s to present day. Commercial television shows have existed since the early 20th century, but as Jason Mitchell notes in his book *Complex TV*, technological development in the late 1990s led to three drastic changes in television. First, TV shows started to look better and showcase more interesting camera work. Second, the growth of more available channels led to an increase in the number of shows being produced. And third, technology allowed users to record, pause, and rewind the shows they were watching. Together, these three changes ushered in the golden era of television, allowing TV shows to tell more complex stories.

There isn't a clear-cut division between a complex plot and a simple one, but in general, simple plots exist in shows where every episode begins as if the one before it hasn't happened (known as standalone episodes). Complex plots, on the other hand, exist in shows where each episode depends on what happens before (known as serialized episodes). Stories with plots that are artistically and socially relevant are considered complex and literary by scholars, critics, and fans alike. A television show that uses social, political, or highly-personal issues in its plots is complex.

Until the golden era of television shows, TV plots and characters tended to be simple. They had to be; television shows were designed to appeal to as broad an audience as possible and to be easy to catch up on. Technology changed all of that. Now, television shows have as many complex characters and plotlines as novels do. As Thomas Doherty put it in the *Chronicle of Higher Education*, golden era television shows are ones "like *Mad Men*, *Breaking Bad*, *Downton Abbey*, *Homeland*, *Dexter*, *Boardwalk Empire*, and *Game of Thrones*... where the talent, the prestige,⁴ and the cultural buzz now swirl."

Talent, prestige, and cultural buzz are all pretty good reasons to study a work of art, but the shows Doherty listed are adult entertainment that deal with sexual and violent themes. When novels deal with similar themes, they are not visual. TV shows place those themes directly before the viewer.

Movies and plays also have visual elements, and plays with adult themes like *Hamlet* and *Romeo and Juliet* are frequently taught in schools. But whereas plays and cinema are visual, they do not tend to be as graphic as golden era TV shows. Propriety⁵ and censorship⁶ laws prevented Shakespeare from showing overtly visual elements related to his mature themes. Trying to teach a "golden era" television show in an English class ushers in the possibility that students will be exposed to overtly mature themes and images no one would be comfortable discussing in a classroom.

Closing Cultural Divides

[10] Nevertheless, cultural buzz is why studying television shows in English class might be unavoidable.

^{4.} **Prestige** (noun): widespread respect gained through success or excellence

^{5.} the state or quality of conforming to accepted standards of behavior or morals

^{6.} the system or practice of examining writings or movies and taking out things considered offensive or immoral

Books used to be one of the major ways to bind a culture together. Classic American novels, such as *The Scarlet Letter*, helped shed light on American culture and values. In the later half of the twentieth century, television and movies began to fill that role. TV shows like *Seinfeld* and *Friends* have come to define American culture far more than any novel has been able to do in recent years. Both sitcoms have been dubbed and translated around the world, making the characters and their lives synonymous with the American experience to people everywhere. Unless students begin to study television in school, some younger Americans may never see the TV shows that other cultures find quintessentially⁷ American.

Across the country, Americans watch different television shows. For example, the TV shows *Girls* and *Duck Dynasty* both premiered in 2009. *Girls* was a critical darling, producing reviews and discussions across the web. It averaged just over a million viewers per episode, most of whom lived in cities. *Duck Dynasty*, on the other hand, had record-breaking numbers of viewers for many episodes, largely from rural areas. Critics and reviewers ignored it. Both shows were hits in different ways, and both say something relevant about the U.S. today.

These trends in television exemplify a cultural, urban-rural divide in the U.S. According to research gathered in 2016 by *The New York Times*, shows like *NCIS* and *Duck Dynasty* have nearly all of their viewership in rural areas, while shows like *Girls* and *The Daily Show* have viewership in urban areas. Americans are no longer watching and discussing the same things. Teaching television shows in school can help to bridge that gap by providing a common cultural ground in the way novels once did.

The Importance of Reading

Bridging that gap is important. Luckily, the conversations needed to bridge that gap — about television and the way it functions for Americans — are already happening. Notably, they are happening everywhere outside of the classroom. Websites like the A.V. Club recap TV shows daily, and conversations about current TV fill popular websites like Reddit and Tumblr.

[15] As this discussion of TV surges, enthusiasm for traditional, written literature wanes. The National Endowment for the Arts found that in 1982, 56.9% of adults reported having read a work of literature in the past year. In 2015, only 43.1% of adults had. And further research by the National Endowment for the Arts found that literary reading has dropped across age, race, and educational levels among adults. As literary reading rates drop, one might argue that traditional literary reading needs to be preserved in the classroom, not to be replaced by conversations about television that are happening everywhere else in the U.S. It may be important to unite what rural and urban Americans watch; it may be more important for schools to keep young Americans reading.

Novels teach writing skills. Although a TV show comes from a script, it is watched, not read. A TV show doesn't offer students the chance to diagram sentences or to dig deeply into how paragraphs function. A 2013 study done at Tohoku University in Japan found that the more TV children watched, the lower their verbal test scores became. In the same year, a study at Emory University found that college students had increased connectivity in the parts of the brain associated with language while reading a novel.

Conclusion

Should television shows be taught in schools? Maybe. There are merits to the idea — namely that TV has reached a golden era of wonderful, complex stories — but there are also challenges, such the graphic content of current TV shows and the communication skills that television fails to teach students. At the end of the day, teachers and principals will have to decide for themselves.

There is a middle ground. Television shows are becoming increasingly culturally relevant, and this is not just because more people are watching them. More people are also writing about them. The Internet is filled with recaps, reviews, and thousands of cultural critics discussing how relevant themes in television shows interact with our society today. Using these written materials, television can be taught in schools without sacrificing reading and writing skills or exposing students to graphic images. Reading about television can help preserve the best parts of English classes while ensuring they are not permanently stuck in yesterday. When it comes to television in class, it might be possible for teachers to have their cake and eat it too.

"Can Television Be Considered Literature and Taught in English Classes?" by Shelby Ostergaard. Copyright © 2017 by text is licensed under CC BY-NC-SA 2.0.

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 the author's main claim in the text?
 - A. Schools can use written materials about television to explore its place in today's culture and to teach reading, writing, and thinking skills.
 - B. Even though watching television provides students with the same advantages as reading literature, it should not be considered as a legitimate school subject.
 - C. English curriculums should incorporate watching television because it benefits students more than reading pop novels and literature.
 - D. Watching television does not meet the requirements that determine if something is literature, but it's likely to develop more comprehensively in the future.
- 2. PART B: Which detail from the text best supports the answer to Part A?
 - A. "The idea of television as a form of literature that should be taught in classrooms remains controversial." (Paragraph 4)
 - B. "Together, these three changes ushered in the golden era of television, allowing TV shows to tell more complex stories." (Paragraph 5)
 - C. "When novels deal with similar themes, they are not visual. TV shows place those themes directly before the viewer." (Paragraph 8)
 - "Using these written materials, television can be taught in schools without sacrificing reading and writing skills or exposing students to graphic images." (Paragraph 18)
- 3. PART A: How do the benefits of television compare to reading literature?
 - A. Television engages students more directly, while reading literature helps develop students' imaginations.
 - B. Television can expose students to different types of stories and cultures, while reading literature develops their mental processes.
 - C. Television teaches students more modern and relevant storylines, while reading literature allows students to better understand the past.
 - D. Television more quickly develops students' mental processes, while reading literature teaches students patience and hard work.

- 4. PART B: Which TWO sections from the text best support the answer to Part A?
 - A. "They were first told orally as fairy tales, folklore, and epic poems, and were eventually written down." (Paragraph 1)
 - B. "First, TV shows started to look better and showcase more interesting camera work." (Paragraph 5)
 - C. "the shows Doherty listed are adult entertainment that deal with sexual and violent themes." (Paragraph 8)
 - D. "Teaching television shows in school can help to bridge that gap by providing a common cultural ground in the way novels once did." (Paragraph 13)
 - E. "As this discussion of TV surges, enthusiasm for traditional, written literature wanes." (Paragraph 15)
 - F. "a study at Emory University found that college students had increased connectivity in the parts of the brain associated with language while reading a novel." (Paragraph 16)
- 5. How does the author introduce the debate surrounding teaching televisions in the classroom?

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. What are the costs and benefits of teaching television as a form of literature in classrooms? Do you think that potential benefits outweigh the costs? Why or why not? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

2. Do you think if television was taught in the future, teachers would be able to provide students with the same mental stimulation that comes from reading literature? Why or why not?

3. In the context of this article, what is the goal of education? Does studying television help students accomplish what they should be achieving in school? Why or why not? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Name:

Class:

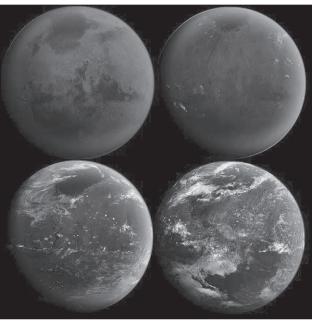
Should We Terraform Mars?

By Paul Scott Anderson 2016

Forming colonies on Mars has been the subject of books and movies for a long while now, but how possible is it? In this opinion piece, Paul Scott Anderson discusses the process by which Mars could be altered to be inhabitable by humans. Anderson ponders whether humans should inhabit a new planet just because they can. As you read, take notes on the risks that Anderson identifies with terraforming Mars.

[1] As we continue to explore farther out into our solar system and beyond, the question of habitation or colonization¹ inevitably comes up. Manned bases on the Moon or Mars for example, have long been a dream of many. There is a natural desire to explore as far as we can go, and also to extend humanity's presence on a permanent or at least semi-permanent basis. In order to do this, however, it is necessary to adapt to different extreme environments. On the Moon for example, a colony must be self-sustaining and protect its inhabitants from the airless, harsh environment outside.

> Mars, though, is different. While future bases could adapt to the Martian environment as well, there is also the possibility of modifying the surrounding environment instead of just coexisting with it. This is the process of terraforming



<u>"MarsTransitionV"</u> by Daein Ballard is licensed under CC BY-SA 3.0

— essentially trying to tinker with Mars' atmosphere and environment to make it more Earth-like. Although still a long ways off technologically, terraforming the Red Planet is seen as a future possibility. Perhaps the bigger question is, should we?

One of the main issues is whether Mars has any indigenous life or not — how does this affect the question of colonization or terraforming?



If Mars does have any kind of biosphere,² it should be preserved as much as possible. We still don't know yet if any such biosphere exists, but the possibility, which has only increased based on recent discoveries, must be taken into account. Such a precious discovery, which could teach us immensely about how life arose on both worlds, should be completely off-limits. Small colonies might be fine, but living on Mars should not be at the expense of any native habitats, if they exist. The most likely place to find life on Mars is underground. If the surface is truly as sterile and barren as it seems to be, then colonies there shouldn't be too much of a problem. It has also been suggested that Martian caves would make ideal human habitats, serving as natural protection from the harsh conditions on the surface. True, but if it turned out that something else was already taking up residence in them, then we should leave them alone. If Mars is home to any indigenous life, then terraforming should be a non-issue.

[5] What if Mars is lifeless? Even if no life otherwise exists there, that pristine³ and unique alien environment, so far barely scratched by humans, needs to be preserved as is as much as possible. We've already done too much damage here on our own planet. By studying Mars and other planets and moons in their current natural state, we can learn so much about their history and also learn more about our own world in that context. We should appreciate the differences in and variety of worlds instead of just transforming them to suit our own ambitions.

There is also the more current but related problem of contamination. There has been a long-standing protocol, via the 1967 Outer Space Treaty, to have all spacecraft going to the Moon or Mars sterilized as much as possible. If bacteria from Earth made it to the Martian surface and survived, it would complicate the search for life there; if a lander or rover was to later identify living organisms in the soil, it might be difficult to determine whether they were just contamination or true native life forms. From both a scientific and ethical perspective, it would seem prudent⁴ to try to protect Mars as much as we can from earthly intruders. This applies equally whether Mars is already inhabited or not. Fortunately, for almost any kind of bacteria or other microorganisms from Earth, it would be very difficult if not impossible to survive on the Martian surface, never mind flourish. The risk of planet-wide contamination is very negligible,⁵ but it is still better to take strict preventive measures than to play with chance.

"Should We Terraform Mars?" from Universe Today by Paul Scott Anderson is in the public domain.

^{2.} the parts of the land, sea, and atmosphere in which organisms are able to live

^{3.} **Pristine** (*adjective*): in its original condition

^{4.} Prudent (adjective): acting with or showing care for the future

^{5.} **Negligible** (*adjective*): so small it's not worth considering

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 the word "indigenous" as it is used in paragraph 4?
 - A. strong and vigorous
 - B. possessing higher mental capacity
 - C. threatened with extinction
 - D. originating in a particular place
- 2. PART B: Which phrase form paragraph 4 clarifies the meaning of "indigenous?"
 - A. "small colonies"
 - B. "native habitats"
 - C. "natural protection"
 - D. "harsh conditions"
- 3. PART A: What is the central argument contained within paragraph 6?
 - A. The danger of bacterial contamination from Earth could make it difficult to determine whether there is native life on Mars.
 - B. The 1967 Outer Space Treaty guarantees that Mars should not be terraformed in any way.
 - C. It is almost impossible that any life could survive on the surface of Mars.
 - D. Landers and rovers are routinely being sent to Mars in order to investigate if there is any native life on the surface of Mars.
- 4. PART B: Which excerpt from paragraph 6 directly undermines that argument?
 - A. "it would seem prudent to try to protect Mars as much as we can."
 - B. "it would complicate the search for life there"
 - C. "it would be very difficult if not impossible to survive on the Martian surface."
 - D. "all spacecraft going to the Moon or Mars sterilized as much as possible."
- 5. PART A: How does the author develop the primary claim of the article in paragraph 5?
 - A. He allows for an important exception to the general applicability of the argument.
 - B. He affirms the validity of the argument despite information that might seem to challenge it.
 - C. He suggests that future research will reveal how critical the argument is for humanity's survival.
 - D. He criticizes the way many people in the past have ignored the persuasiveness of the argument.

- 6. PART B: In which quotation does the author make an argument using the same technique as in Part A?
 - A. "There is a natural desire to explore as far as we can go, and also to extend humanity's presence on a permanent or at least semi-permanent basis. In order to do this, however, it is necessary to adapt to different extreme environments." (Paragraph 1)
 - B. "Although still a long ways off technologically, terraforming the Red Planet is seen as a future possibility. Perhaps the bigger question is, should we?" (Paragraph 2)
 - C. "It has also been suggested that Martian caves would make ideal human habitats, serving as natural protection from the harsh conditions on the surface. True, but if it turned out that something else was already taking up residence in them, then we should leave them alone." (Paragraph 4)
 - D. "If bacteria from Earth made it to the Martian surface and survived, it would complicate the search for life there; if a lander or rover was to later identify living organisms in the soil, it might be difficult to determine whether they were just contamination or true native life forms. From both a scientific and ethical perspective, it would seem prudent to try to protect Mars as much as we can from earthly intruders." (Paragraph 6)

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 agree with the author's beliefs that it is too risky to terraform another planet? Why or why not?

2. How does this text explore the relationship between humans and nature? In what ways do humans attempt to control nature? Do you think they are successful in this? Why or why not? Cite examples from the text, your own experience, and other literature, art, or history in your answer.

3. The author believes that observing the natural state of other planets can teach us more about our own: why do you think this is? Do you think humans can learn anything from terraforming other planets? Why or why not? Cite examples from the text, your own experience, and other literature, art, or history in your answer.

4. How could the development of terraforming technology be both beneficial to humans and potentially dangerous to other life forms? Do you think terraforming could pose any risks to humans? Cite examples from the text, your own experience, and other literature, art, or history in your answer.



From 'A Time for Choosing' Speech

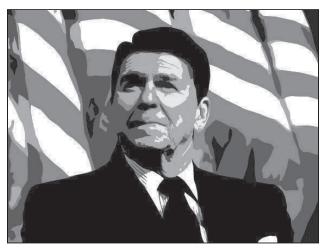
By Ronald Reagan 1964

"A Time for Choosing," also known simply as "The Speech," was presented by Hollywood actor and motivational speaker Ronald Reagan during the 1964 U.S. presidential election in favor of Republican candidate Barry Goldwater. The speech raised \$1 million for Goldwater's campaign, and is considered the event that launched Reagan's political career. Soon afterwards, Reagan was asked to run for Governor of California, and in 1980 he was elected the 40th president of the United States. As you read an excerpt of the speech below, take note of the rhetorical devices Reagan uses to make his points about freedom in America.

[1] I am going to talk of controversial things. I make no apology for this.

It's time we asked ourselves if we still know the freedoms intended for us by the Founding Fathers.¹ James Madison said, "We base all our experiments on the capacity of mankind for self-government."

This idea – that government was beholden to the people, that it had no other source of power is still the newest, most unique idea in all the long history of man's relation to man. This is the issue of this election: Whether we believe in our capacity for self-government or whether we abandon the American Revolution and confess



"Posterised Vector of Ronald Reagan" by Iain Forbes is licensed under CC BY 2.0

that a little intellectual elite in a far-distant capital can plan our lives for us better than we can plan them ourselves.

You and I are told we must choose between a left or right,² but I suggest there is no such thing as a left or right. There is only an up or down. Up to man's age-old dream – the maximum of individual freedom consistent with order or down to the ant heap of totalitarianism.³ Regardless of their sincerity, their humanitarian motives, those who would sacrifice freedom for security have embarked on this downward path. Plutarch warned, "The real destroyer of the liberties of the people is he who spreads among them bounties, donations and benefits."

The term Founding Fathers refers broadly to those individuals of the Thirteen British Colonies in North America who led the American Revolution against the authority of the British Crown and established the United States of America. Historian Richard B. Morris in 1973 identified the following seven figures as the key Founding Fathers: John Adams, Benjamin Franklin, Alexander Hamilton, John Jay, Thomas Jefferson, James Madison, and George Washington.

^{2.} Refers to the "left-right political spectrum" in which the left is considered more liberal and the right more conservative.

^{3.} a political system in which the state holds total control over the society and seeks to control all aspects of public and private life wherever possible

[5] The Founding Fathers knew a government can't control the economy without controlling people. And they knew when a government sets out to do that, it must use force and coercion to achieve its purpose. So we have come to a time for choosing.

Public servants say, always with the best of intentions, "What greater service we could render if only we had a little more money and a little more power." But the truth is that outside of its legitimate function, government does nothing as well or as economically as the private sector.⁴

Yet any time you and I question the schemes of the do-gooders,⁵ we're denounced as being opposed to their humanitarian goals. It seems impossible to legitimately debate their solutions with the assumption that all of us share the desire to help the less fortunate. They tell us we're always "against," never "for" anything.

We are for a provision that destitution⁶ should not follow unemployment by reason of old age, and to that end we have accepted Social Security as a step toward meeting the problem. However, we are against those entrusted with this program when they practice deception regarding its fiscal⁷ shortcomings, when they charge that any criticism of the program means that we want to end payments....

We are for aiding our allies by sharing our material blessings with nations which share our fundamental beliefs, but we are against doling out money government to government, creating bureaucracy,⁸ if not socialism,⁹ all over the world.

[10] We need true tax reform that will at least make a start toward restoring for our children the American Dream that wealth is denied to no one, that each individual has the right to fly as high as his strength and ability will take him.... But we cannot have such reform while our tax policy is engineered by people who view the tax as a means of achieving changes in our social structure....

Are you willing to spend time studying the issues, making yourself aware, and then conveying that information to family and friends? Will you resist the temptation to get a government handout for your community? Realize that the doctor's fight against socialized medicine is your fight. We can't socialize the doctors without socializing the patients. Recognize that government invasion of public power is eventually an assault upon your own business. If some among you fear taking a stand because you are afraid of reprisals from customers, clients, or even government, recognize that you are just feeding the crocodile hoping he'll eat you last.

If all of this seems like a great deal of trouble, think what's at stake. We are faced with the most evil enemy mankind has known in his long climb from the swamp to the stars. There can be no security anywhere in the free world if there is no fiscal and economic stability within the United States. Those who ask us to trade our freedom for the soup kitchen of the welfare¹⁰ state are architects of a policy of accommodation.

- 4. the part of a country's economic system run by individuals and companies, rather than the government
- 5. This is a reference to political liberals who generally believe the government should spend more money on social programs.
- 6. Destitution (noun): extreme poverty
- 7. Fiscal (adjective): of or relating to government revenue
- 8. a system of government in which most of the important decisions are made by state officials rather than by elected representatives
- 9. a social and economic system in which major industries are owned and controlled by the government rather than by individual people and companies

They say the world has become too complex for simple answers. They are wrong. There are no easy answers, but there are simple answers. We must have the courage to do what we know is morally right. Winston Churchill said that "the destiny of man is not measured by material computation.¹¹ When great forces are on the move in the world, we learn we are spirits – not animals." And he said, "There is something going on in time and space, and beyond time and space, which, whether we like it or not, spells duty."

You and I have a rendezvous¹² with destiny. We will preserve for our children this, the last best hope of man on earth, or we will sentence them to take the first step into a thousand years of darkness. If we fail, at least let our children and our children's children say of us we justified our brief moment here. We did all that could be done.

From 'A Time for Choosing' Speech by Ronald Reagan is in the public domain.

^{10.} a social program, often criticized by the political right as a system that encourages people not to work, in which the government provides financial or other assistance to individuals or families who are in need

^{11.} the action of mathematical calculation

^{12.} a meeting, date, or appointment at an agreed time and place

Text-Dependent Questions

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

1. Summarize the central ideas of Reagan's speech.

- 2. What effect does the first sentence have on the overall piece?
 - A. It captures the listener's attention by suggesting the speaker will make bold statements.
 - B. It suggests that the arguments in the speech are common to most political debates.
 - C. It admits bias, allowing the listener to make up his or her own mind about the arguments to be made.
 - D. It sets the listener up to potentially disagree with the points being made.
- 3. PART A: As it is used in paragraph 12, the word "accommodation" most nearly means:
 - A. Endless generosity for those in need
 - B. Supporting the undeserving
 - C. Foolishness and ignorance
 - D. Systematic greed
- 4. PART B: Which of the following phrases best supports the answer to Part A?
 - A. "no fiscal and economic stability"
 - B. "soup kitchen"
 - C. "the welfare state"
 - D. "architects of a policy"

5. How does Reagan use figurative language throughout the speech to make his argument?

97

Name:

Class:

'Day of Infamy' Speech

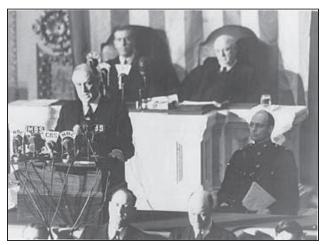
By President Franklin D. Roosevelt From Records Of The United States Senate; Record Group 46 • 1941

On December 7, 1941 the Japanese bombed Pearl Harbor, a United States naval base in Hawaii. This attack drew America into World War II. Franklin D. Roosevelt or "FDR" delivered this speech to a Joint Session of Congress on December 8, 1941, a day after the attack. As you read, consider the rhetorical methods FDR employs to convey his message to Congress and the American people.

[1] Mr. Vice President, Mr. Speaker, Members of the Senate, and of the House of Representatives:

Yesterday, December 7th, 1941 — a date which will live in infamy¹ — the United States of America was suddenly and deliberately attacked by naval and air forces of the Empire of Japan.

The United States was at peace with that nation and, at the solicitation² of Japan, was still in conversation with its government and its emperor looking toward the maintenance of peace in the Pacific.



"FDR Delivers Speech" is licensed under .

Indeed, one hour after Japanese air squadrons

had commenced bombing in the American island of Oahu³, the Japanese ambassador to the United States and his colleague delivered to our Secretary of State a formal reply to a recent American message. And while this reply stated that it seemed useless to continue the existing diplomatic negotiations, it contained no threat or hint of war or of armed attack.

[5] It will be recorded that the distance of Hawaii from Japan makes it obvious that the attack was deliberately planned many days or even weeks ago. During the intervening time, the Japanese government has deliberately sought to deceive the United States by false statements and expressions of hope for continued peace.

The attack yesterday on the Hawaiian islands has caused severe damage to American naval and military forces. I regret to tell you that very many American lives have been lost. In addition, American ships have been reported torpedoed on the high seas between San Francisco and Honolulu.

Yesterday, the Japanese government also launched an attack against Malaya⁴.

Last night, Japanese forces attacked Hong Kong.

1. Infamy (noun): the state of being well known for some bad quality or act

^{2.} Solicitation (noun): a request; the act or process of asking for something

^{3.} One of the Hawaiian islands.

^{4.} A set of states on the Malay Peninsula and the island of Singapore under British control

Last night, Japanese forces attacked Guam⁵.

[10] Last night, Japanese forces attacked the Philippine Islands.

Last night, the Japanese attacked Wake Island.⁶

And this morning, the Japanese attacked Midway Island.⁷

Japan has, therefore, undertaken a surprise offensive extending throughout the Pacific area. The facts of yesterday and today speak for themselves. The people of the United States have already formed their opinions and well understand the implications to the very life and safety of our nation.

As Commander in Chief of the Army and Navy, I have directed that all measures be taken for our defense. But always will our whole nation remember the character of the onslaught against us.

[15] No matter how long it may take us to overcome this premeditated invasion, the American people in their righteous might will win through to absolute victory.

I believe that I interpret the will of the Congress and of the people when I assert that we will not only defend ourselves to the uttermost, but will make it very certain that this form of treachery shall never again endanger us.

Hostilities exist. There is no blinking at the fact that our people, our territory, and our interests are in grave danger.

With confidence in our armed forces, with the unbounding determination of our people, we will gain the inevitable triumph — so help us God.

I ask that the Congress declare that since the unprovoked and dastardly attack by Japan on Sunday, December 7th, 1941, a state of war has existed between the United States and the Japanese empire.

'Day of Infamy' Speech by President Franklin D. Roosevelt is in the public domain.

^{5.} A U.S. island territory in Micronesia, in the Western Pacific

^{6.} A U.S. island territory located in the Western Pacific

^{7.} Also known as "Midway Atoll," a U.S. territory located in the North Pacific Ocean

Text-Dependent Questions

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

Summarize the central ideas of Roosevelt's speech in one sentence.

1.

PART A: Roosevelt begins paragraphs 8-11 with little variation of the words "Last 2. night, Japanese forces..." Why is this structure effective in helping Roosevelt make his argument? Α. It emphasizes the brazenness of Japan's multiple attacks against the U.S. and its allies. It allows the reader to determine which of Japan's offenses was most Β. destructive. C. It contrasts Japan's behavior with that of the United States. It presents a clear plan of response to the Japanese attacks. D. 3. PART B: Which aspect of the speech provides support for the answer to Part A? A. the descriptions of the damage done from the attacks (paragraph 6) the repetition of the word "deliberately" throughout the speech Β. the reference to the "righteous might" of American people and military C. (paragraph 15) D. the religious appeal to "God" (paragraph 18) PART A: What is Roosevelt's overall purpose in his speech? 4. to inform Japan that the U.S. will take any means necessary to enact revenge Α. Β. to notify the American people of the losses suffered in the Japanese attacks C. to warn of impending danger in the form of more attacks from Japan and its allies D. to reassure the American people that actions are being taken to protect the country

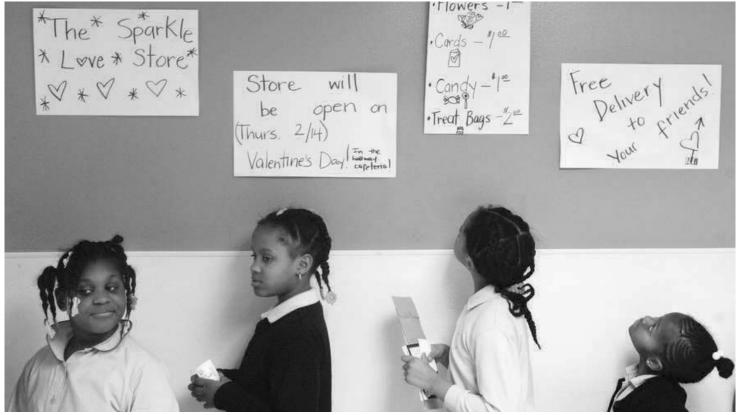
- 5. PART B: Which paragraph from the speech most directly supports the answer to Part A?
 - A. Paragraph 3
 - B. Paragraph 6
 - C. Paragraph 16
 - D. Paragraph 17

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PRO/CON: Should all high schoolers take courses in personal finance?

By K. Alexander Ashe and Wayne Madsen, Tribune News Service, adapted by Newsela staff on 06.13.17 Word Count **1,279**

Level 1240L



Students line up for lunch at the Ariel Community Academy in Chicago, Illinois, February 12, 2008. The one-of-a-kind public elementary school was established in 1996 by the Chicago-based money management firm Ariel Capital Management. It promotes financial literacy and gives students money to invest. Photo by: AP Photo/Charles Rex Arbogast

PRO: Yes. Education system overhaul should include new emphasis on financial literacy

As Secretary of Education Betsy DeVos sets out to reform America's underperforming public schools, let's hope she makes their shocking lack of personal finance instruction a top priority. Our nation's high schools are flunking badly when it comes to teaching their students the key elements of financial literacy.

A 2016 study by the Council for Economic Education found that only 17 states require high school students to take courses in personal finance.

Teach Kids The Basics In Money Management

That's particularly distressing when you consider that the final year of high school is, for many young people, a last opportunity to acquire financial literacy. Soon they will enter today's costly, complex and rapidly changing world.

Personal finance courses don't require teachers with advanced degrees. Almost any teacher who can balance a checkbook can follow some already successful course guidelines to impart financial basics to graduating seniors.

To be successful, most kids don't need to learn about advanced ideas like collateralized debt instruments, said Nan J. Morrison. She is president and CEO of the Council for Economic Education. Still, kids need to understand the basics, she says. "They do need to know how to open a bank account, how much they need to save each month to reach their goals and, if they borrow this amount of money, how much money they will need to earn to pay it back."

"Everyday Economics"

Morrison and other personal finance advocates are responsible for many of the recent gains made in the establishment of what some call "everyday economics" in high school classrooms. In 1998, only 14 states required that high schools give their seniors a basic knowledge of personal finance. Now 37 states do, meaning more students are receiving finance lessons in their civics and math classes.

And over the last few years, more populated states like New York and Illinois have toughened standards. Washington state has new legislation doing the same.

So more states are implementing personal finance standards. But the number of states that require high school students to take an actual course in personal finance -17 – has remained unchanged since 2014, according to the study.

That's truly unfortunate. The states with the toughest personal finance requirements send their students on to college and into the real world with a measurable head start.

Benefits Students In The Real World

Data recently released by the Investor Education Foundation, or IEF, show that high school students benefit from the classes. Those who passed required personal finance courses have better-than-average credit scores and are less likely to be in debt as young adults.

The IEF study found "notable improvements" in credit outcomes for young adults ages 18 to 22 in Idaho, Georgia, and Texas, three states where financial education mandates are considered strict by the Council for Economic Education.

Personal finance courses provide an important leg-up to students in low-income areas with lagging schools.

Young people in economically challenged areas are often unemployed or underemployed. They find themselves at the mercy of loan sharks and payday loans who take advantage of people who need to borrow money quickly. These lenders target poor people with unethical and even illegal practices, charging very high interest rates. These factors can be key drivers of ongoing poverty.

Recent graduates in these communities find themselves struggling to pay bills and manage what little money they have.

As Morrison said, "Exposure is everything. When you learn good habits, you tend to have better outcomes."

ABOUT THE WRITER: K. Alexander Ashe is the CEO and founder of Spendcast, a tech firm that develops finance-focused apps. Readers may email him at kashe@spendology.net. This essay is available to Tribune News Service subscribers. TNS did not subsidize the writing of this column; the opinions are those of the writer and do not necessarily represent the views of TNS or its editors.

CON: No. Better we get back to basics

Today, basic classroom subjects like writing, reading, mathematics, science and history are being discarded or underfunded by state public education authorities. Making tougher requirements on the teaching of personal finance would be a waste of time and money.

Politicians and school board members pushing such an agenda should be required to take and pass courses in public finance before making such demands.

All 50 states plus the District of Columbia already require, as part of their standard kindergartento-high-school curriculums, the teaching of basic economics. Forty-five require that personal finance be taught in their basic economics courses.

That's sufficient when you consider the education basics getting little attention.

Students Lagging In Education Basics

Students who finish high school without a baseline education in science, math, English comprehension and at least one foreign language wind up competing for low-wage jobs that don't require special skills.

In science, as measured by the Programme for International Student Assessment, U.S. students now rank behind those of Vietnam, Slovenia, Portugal, South Korea and 19 other nations.

In reading skills, American students rank 24th, behind Ireland, Estonia, Macao and France.

America's report card in math is awful, as it is 39th, behind Russia, Spain, Poland and Macao.

With these results, the United States cannot hope to compete in a globalized world. Jobs demand a workforce with expertise in engineering, medical research, computer science, robotics and environmental technology.

In the same ranking, Singapore topped all others in all three categories. Hong Kong came in second in math and reading, while Japan took second place, barely ahead of Estonia, in science.

With this in mind, Americans and their elected representatives have only themselves to blame when Singaporean, Japanese and Estonian workers are favored for employment over people from the United States.

Low Percentage in Math and Science

In 2015, the U.S. Department of Education found that only 25 percent of 12th-graders were either accomplished or advanced in math. The same study found that a mere 22 percent of high school seniors were either accomplished or advanced in science.

The only nation in history to land 12 astronauts on the moon would be hard-pressed to repeat that amazing feat today with the failure of its education system.

And besides the need for our schools to refocus on the fundamentals, there's another big problem with states requiring courses in personal finance.

There is the possibility that teachers and school administrators, already stretched thin, would be lured into allowing outsiders in the classroom to provide finance instruction.

Watch Out For Outside Influences In The Classroom

What pushers of quickie college loans or high-interest credit cards would not jump at the chance to prey upon high school seniors? These students are about to enter college or the job market.

Educational leaders should be insulating their students from such ilk, not opening their school doors to them.

America would not be the great nation it is today without its history of quality public education. Abigail Adams, the second first lady of the United States, lived in a time when women were denied equality in employment and foresaw what was required of the young country: "Learning is not attained by chance; it must be sought for with ardor and attended to with diligence."

ABOUT THE WRITER: Wayne Madsen is a longtime progressive commentator whose articles have appeared in leading newspapers throughout the U.S. and Europe. Readers may write him at 415 Choo Choo Lane, Valrico, FL, 33594. This essay is available to Tribune News Service subscribers. TNS did not subsidize the writing of this column; the opinions are those of the writer and do not necessarily represent the views of TNS or its editors. 1

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Read the selection from the section "Benefits Students In The Real World" in the PRO article.

These lenders target poor people with unethical and even illegal practices, charging very high interest rates. These factors can be key drivers of ongoing poverty.

In which of the following sentences does the word "driver" have the SAME meaning as used in this selection?

- (A) After swinging, the golfer handed his driver to the caddy.
- (B) She was impatient while waiting for her driver to bring the car out of the garage.
- (C) The computer's driver spun to life when the power button was pressed.
- (D) The strong economic forecast was one of the key drivers of job creation.

Which of the following phrases from the article is NOT used to describe people who manage their money well?

- (A) toughest personal finance requirements
- (B) a measurable head start
- (C) better-than-average credit scores
- (D) notable improvements
- 3 Read the sentence from the CON article.

Students who finish high school without a baseline education in science, math, English comprehension and at least one foreign language wind up competing for low-wage jobs that don't require special skills.

Which paragraph from the section "Students Lagging In Education Basics" helps to SUPPORT the author's claim above?

- (A) In science, as measured by the Programme for International Student Assessment, U.S. students now rank behind those of Vietnam, Slovenia, Portugal, South Korea and 19 other nations.
- (B) With these results, the United States cannot hope to compete in a globalized world. Jobs demand a workforce with expertise in engineering, medical research, computer science, robotics and environmental technology.
- (C) In the same ranking, Singapore topped all others in all three categories. Hong Kong came in second in math and reading, while Japan took second place, barely ahead of Estonia, in science.
- (D) With this in mind, Americans and their elected representatives have only themselves to blame when Singaporean, Japanese and Estonian workers are favored for employment over people from the United States.
- Which of the following does NOT support the author of the PRO article's argument?
 - (A) That's particularly distressing when you consider that the final year of high school is, for many young people, a last opportunity to acquire financial literacy.
 - (B) "They do need to know how to open a bank account, how much they need to save each month to reach their goals and, if they borrow this amount of money, how much money they will need to earn to pay it back."
 - (C) Now 37 states do, meaning more students are receiving finance lessons in their civics and math classes.
 - (D) Those who passed required personal finance courses have better-than-average credit scores and are less likely to be in debt as young adults.



Name:

Class:

The Value of Being Confused

By Barrett Smith 2018

No one likes to feel confused, but could there actually be benefits to confusion? In this informational text, Barrett Smith explores why feeling confused is actually a good thing. As you read, take notes on how people respond to confusion.

[1] We've all felt confused before, and it can be one of the most frustrating feelings to deal with. Students might be confused about how to do a math problem or finish a project. Young people might be confused about who they are and what to do in the future. No matter what is making us confused, the feeling of not knowing what the answers or solutions are can make us feel useless, stupid, and cause us to worry.

> A lot of people are hard on themselves and others when there's a lack of understanding. People often tend to think the person who has all of the answers is smarter than the one who asks



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a lot of questions. Because of the negative judgment that surrounds confusion, people often try to hide their confusion in a variety of ways. Instead of admitting or accepting that they don't have the solution, people sometimes try to pretend they have the answers. At other times, people make educated guesses or create an answer even if they know it isn't right.

Students are often guilty of hiding their lack of understanding. If confused about a topic in school, they might pretend to know the answers. They can sometimes be embarrassed to ask questions. As young individuals, they can be confused about who they are, and might try harder to behave in a particular way. They can be too embarrassed to explore other groups or identities, afraid perhaps of being called a "wanna-be". They can be afraid people will know they're confused.

But confusion might actually be a good thing. When we jump to an answer, we don't have time to explore and understand the thing we're confused about. Fighting confusion ends up making us more confused. Instead of fighting or trying to ignore your confusion, accepting it and taking the opportunity to analyze what's confusing can benefit our learning. In fact, scientific studies show that confusion actually leads to deeper understanding. A 2004 study explored six moods that people feel while learning, including frustrated, bored, and confused. They found that students who spent more of the lesson confused learned the most. In another study, published in 2014, scientists tried to confuse students by giving them contradicting¹ information. Students who expressed confusion during the lesson did better on the final test. Based on these studies, scientists believe being confused is a step to learning. Not knowing the answer to a problem gives us space to look at different ways to solve it. The feeling of confusion also motivates us to look more deeply into the problem. In the end, this helps us understand the topic on a deeper level.

[5] Confusion isn't just an important step to learning in school, it's also important for learning who you are. Psychologists call that sense of who you are identity. Your identity can involve being part of groups like race, gender, subcultures.² Identity is also made up of your values and goals. People figure out their identity in two steps. The first step is exploration, where you try out different groups and values and see what fits. The next step is commitment, when you decide firmly about some parts of your identity. Exploring your identity can feel very confusing. You might be afraid that people will judge you for going through different phases or not committing to a group. But phases are completely natural. A study published in the International Journal of Behavioral Development found that people who do the most exploring about who they are have better outcomes such as higher self-esteem later in life. Confusion gives us the space to try new things and be creative. Allowing ourselves to be confused and ask questions leads to deeper understanding, more learning, and higher self-confidence. So, try not to be embarrassed when you're confused about something. Instead of trying to hide or fight your confusion, try to resolve it by trying new things. Embrace the confusion and explore different solutions to your problem. Sometimes being confused is hard, not just because we judge ourselves, but because it can be frustrating. When we try over and over to understand something without making any progress, we can feel defeated and stop caring, and eventually give up. Trying a new method, asking for help, or researching different ways to approach the problem online can all be great resources to work through your confusion. Before you give up, make sure you have someone to help you and the resources you need to resolve your confusion.

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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 central ideas of the text?
 - A. Allowing yourself to feel confused is a necessary part of developing your brain and understanding yourself.
 - B. Confusion is more important to intellectual growth than it is to understanding your identity.
 - C. It takes a certain degree of self-confidence and maturity to admit that you don't have all the answers.
 - D. Feeling confused is something that will fade with time and experience as you acquire all of the answers.
- 2. PART B: Which detail from the text best supports the answer to Part A?
 - A. "No matter what is making us confused, the feeling of not knowing what the answers or solutions are can make us feel useless, stupid, and cause us to worry." (Paragraph 1)
 - B. "Instead of admitting or accepting that they don't have the solution, people sometimes try to pretend they have the answers." (Paragraph 2)
 - C. "Students are often guilty of hiding their lack of understanding. If confused about a topic in school, they might pretend to know the answers." (Paragraph 3)
 - D. "Confusion isn't just an important step to learning in school, it's also important for learning who you are." (Paragraph 5)
- 3. PART A: Which of the following describes the author's main purpose in the text?
 - A. to provide readers with tools to overcome their confusion
 - B. to reassure readers that it's completely normal to feel confused
 - C. to encourage readers to work through their confusion, rather than avoid it
 - D. to explore why teenagers are more susceptible to confusion than adults
- 4. PART B: Which quote from the text best supports the answer to Part A?
 - A. "We've all felt confused before, and it can be one of the most frustrating feelings to deal with." (Paragraph 1)
 - B. "As young individuals they can be confused about who they are, and might try harder to behave in a particular way." (Paragraph 3)
 - C. "A 2004 study explored six moods that people feel while learning, including frustrated, bored, and confused." (Paragraph 4)
 - D. "Instead of trying to hide or fight your confusion, try to resolve it by trying new things." (Paragraph 5)

5. Explain the relationship between confusion and growth in the text. 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. According to the text, confusion is an important part of growth. Why do people resist it? How do you feel when you are confused?

2. Psychologists found that struggling through multiple phases in your life helps you decide who you are. What makes you who you are? Have you ever been confused by your identity or gone through a phase that didn't seem true to yourself? Has a friend? Describe the experience.

3. Smith claims that working through confusion leads to deeper understanding. How do we understand the world around us? Describe a time when you worked through your confusion to learn something new.

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The difference between empathy and sympathy

By ThoughtCo., adapted by Newsela staff on 12.20.17 Word Count **829**

Level 1210L



Image 1. A woman gives food to a homeless man in New York City. Photo by: Ed Yourdon/WIkimedia.

Is that "empathy" or "sympathy" you're showing? These two words are often incorrectly used interchangeably, but their difference is important. Sympathy is a simple expression of concern for another person's misfortune while empathy, however, goes beyond that. Empathy is the ability to actually feel what another person is feeling, like the saying "to walk a mile in their shoes." Taken to extremes, deep or extended feelings of empathy can actually be harmful to one's emotional health.

Sympathy

Sympathy is a feeling and expression of concern for someone, often accompanied by a wish for them to be happier or better off. An example of sympathy is feeling concerned after finding out someone has cancer and hoping the treatment goes well for him or her.

In general, sympathy implies a deeper, more personal level of concern than pity, which a simple expression of sorrow.

However, sympathy does not imply that someone's feelings for another person are based on shared experiences or emotions. That is what we call empathy.

Empathy

Empathy is the ability to recognize and share another person's emotions.

Empathy requires the ability to recognize the suffering of another person from his or her point of view. It also means openly sharing another person's emotions, including painful distress.

Empathy is often confused with sympathy, pity and compassion, which are feelings that just simply recognize another person's distress.

Pity typically implies that the person who is suffering does not deserve what has happened to him or her. Pity also implies the person suffering is powerless to do anything about it.

Pity shows a lower degree of understanding and engagement with the suffering person's situation.

Compassion is a deeper level of empathy, demonstrating an actual desire to help the suffering person.

Empathy requires shared experiences, so people generally feel empathy only for other people, not for animals or objects. While people may be able to sympathize with a horse, for example, they cannot truly empathize with it.

The Three Types Of Empathy

Paul Ekman is a psychologist specialized in the field of emotions who has identified three types of empathy.

• Cognitive empathy: Also called "perspective taking," cognitive empathy is the ability to understand and predict the feelings and thoughts of others by imagining one's self in their situation.

• Emotional empathy: This is the ability to actually feel what people feel, or at least feel emotions similar to theirs, so there is always some level of shared feelings. Emotional empathy can be a trait among persons diagnosed with Asperger syndrome.

• Compassionate empathy: Driven by their deep understanding of the other people's feelings based on shared experiences, compassionately empathic people make actual efforts to help.

Having empathy can give meaning to our lives, though Ekman warns that empathy can also go terribly wrong in some cases.

Empathy Can Lead To Misplaced Anger

Empathy can make people angry - perhaps dangerously so - if they mistakenly perceive that another person is threatening a person they care for.

Danish family therapist Jesper Juul believes empathy and aggression are related.

Empathy Can Drain Your Wallet

Psychologists report cases of overly empathetic patients endangering their own well-being. One example is an overly empathetic person giving away his or her life savings to random, needy

individuals. Such overly empathetic people who feel they are somehow responsible for the distress of others have developed an empathy-based guilt.

There is a better-known condition called "survivor guilt," which is a form of empathy-based guilt in which an empathic person incorrectly feels that his or her own happiness has come at the cost of someone else's.

Psychologist Lynn O'Connor believes people who regularly have empathy-based guilt may develop mild depression later.

Empathy Can Harm Relationships

Psychologists warn that empathy should never be confused with love because, essentially, love can cure, but empathy cannot. While love can make any relationship — good or bad — better, empathy cannot do this. Empathy can even hasten the end of a strained relationship.

A scene from the animated comedy TV series "The Simpsons" is an example of how empathy can damage a relationship. In the scene, Bart is bemoaning the failing grades on his report card and says, "This is the worst semester of my life." His dad, Homer, based on his own school experience, tries to comfort his son by telling him, it is "your worst semester so far."

Empathy Can Lead To Fatigue

Counselor Mark Stebnicki coined the term "empathy fatigue." This refers to a state of physical exhaustion resulting from repeated or prolonged personal involvement in the illness, disability, pain, grief and loss of others.

Any overly empathetic person can experience empathy fatigue leading to health problems, which is common among mental health counselors, doctors, nurses, lawyers and teachers.

Paul Bloom is a professor of psychology and cognitive science at Yale University and goes so far as to suggest that due to its inherent dangers, people need to have less empathy, rather than more.

Quiz

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- Is the author of the article suggesting that empathy can be a dangerous emotion? Which selection from the article BEST supports your answer?
 - (A) No, the author does not suggest empathy can be dangerous; Empathy is often confused with sympathy, pity and compassion, which are feelings that just simply recognize another person's distress.
 - (B) No, the author does not suggest empathy can be dangerous; It also means openly sharing another person's emotions, including painful distress.
 - (C) Yes, the author does suggest empathy can be dangerous; Empathy requires shared experiences, so people generally feel empathy only for other people, not for animals or objects.
 - (D) Yes, the author does suggest empathy can be dangerous; Psychologists report cases of overly empathetic patients endangering their own well-being.
 - Which option would counselor Mark Stebnicki MOST LIKELY agree with? Which line from the article supports your answer?
 - (A) Empathy has both positive and negative effects; Empathy can make people angry perhaps dangerously so — if they mistakenly perceive that another person is threatening a person they care for.
 - (B) Over-empathy causes mild depression later in life; Psychologists report cases of overly empathetic patients endangering their own well-being.
 - (C) Sometimes empathy makes people in certain professions exhausted; This refers to a state of physical exhaustion resulting from repeated or prolonged personal involvement in the illness, disability, pain, grief and loss of others.
 - (D) Over-empathy hurts relationships; A scene from the animated comedy TV series "The Simpsons" is an example of how empathy can damage a relationship.
- Which of the following sentences from the section "The Three Types Of Empathy" BEST develops a CENTRAL idea of the article?
 - (A) Paul Ekman is a psychologist specialized in the field of emotions who has identified three types of empathy.
 - (B) This is the ability to actually feel what people feel, or at least feel emotions similar to theirs, so there is always some level of shared feelings.
 - (C) Emotional empathy can be a trait among persons diagnosed with Asperger syndrome.
 - (D) Having empathy can give meaning to our lives, though Ekman warns that empathy can also go terribly wrong in some cases.
 - Which option provides an accurate and objective summary of the article?
 - (A) It is vital for people to express a certain level of empathy for healthy relationships. Teachers and doctors should be aware of the potential danger of empathy fatigue.
 - (B) Empathy is the ability to recognize when someone else is suffering. Empathy is dangerous when it leads to anger and empathy fatigue.
 - (C) Although commonly used interchangeably, sympathy and empathy are unique from one another. Overempathy can cause health problems.
 - (D) People should watch out for symptoms of anger and empathy fatigue, and discuss any concerns with their doctor. Some professions have an increased risk of "empathy fatigue."

115

What is economics?

By ThoughtCo.com, adapted by Newsela staff on 08.20.19 Word Count **930**

Level 1140L



Economics is a broad field. Economists hold positions in business, government and academia. Photo by: Rawpixel/Getty Images

All humans have wants and needs. All humans make choices every day. These are among the topics that interest economists.

Economics is the study of the production, distribution and consumption of wealth in human society. However, this perspective is only one among many different definitions. Economics is also the study of people (as consumers) making choices about which **goods** and **services** to buy.

Indiana University says that economics is a social science that studies human behavior. It has a unique method for analyzing and predicting individual behavior. The field also studies the effects of institutions such as firms and governments, clubs and even religions.

Definition Of Economics: The Study Of Resource Use

Economics is the study of choices. Some believe that economics is driven purely by money or capital, such as owned property or investments. However, choice is much more expansive. If the study of economics is the study of how people choose to use their **resources**, it requires looking at all possible resources. Money is just one of these.

In practice, resources can encompass everything from time to knowledge and property to tools. In response, economics helps illustrate how people interact within **markets** to realize their varied goals. In economics, a market does not have to be a physical place. It is understood as any situation that allows buyers and sellers to exchange any type of goods, services and information.

Beyond defining what these resources are, the concept of **scarcity** is also an important consideration. Resources — no matter how broad the category — are limited. This is the source of tension in the choices people and society make: Their decisions are a result of the constant tug of war between unlimited wants and desires and limited resources.

Many people break down the study of economics into two broad categories: **microeconomics** and **macroeconomics**.

Microeconomics

The Dictionary of Economics defines microeconomics as "the study of economics at the level of individual consumers, groups of consumers, or firms." Microeconomics is the analysis of the decisions made by individuals and groups. It also observes the factors that affect those decisions, and how those decisions affect others.

The prefix "micro-" means small. Not surprisingly, microeconomics is the study of small economic units. Microeconomics deals with economic decisions



made at a low, or micro, level. From this standpoint, microeconomics is sometimes considered the starting point for the study of macroeconomics. That's because microeconomics takes a more bottom-up approach to analyzing and understanding the economy.

The field of microeconomics is concerned with:

Consumer decision-making and maximizing the **utility**, or usefulness, of that decision

Firm production and profit maximization

Individual market equilibrium

Effects of government regulation on individual markets

Externalities and other market side effects

Microeconomics concerns itself with the behavior of individual markets. Some examples would be the markets for oranges, cable television, or skilled workers. Microeconomics generally does not cover overall markets for produce, electronics, or the entire workforce.

Microeconomics is essential for local governance, business, personal finance, or research of stocks and other investments.

Macroeconomics

In contrast to microeconomics, macroeconomics considers similar questions, but at a larger scale. The study of macroeconomics deals with the sum total of the decisions made by individuals in a society or nation such as, "How does a change in interest rates influence national savings?" It looks at the way nations divide up resources such as labor, land and capital.

Macroeconomics can be thought of as the big-picture version of economics. Rather than analyzing



individual markets, macroeconomics focuses on aggregate, or overall, production and consumption in an economy. Topics that macroeconomists study include:

Effects of taxes, such as income and sales taxes, on output and prices

Causes of economic upswings and downturns

Effects of monetary and fiscal policy on economic health, such as how governments manage their own currency

Effects of and process for determining interest rates

Causes for the pace of economic growth

To study economics at this level, researchers must be able to combine different goods and services produced in a way that shows their relative contributions to aggregate output. This is generally done using the concept of the gross domestic product (GDP). That is where goods and services are weighted by their market prices.

What Do Economists Do?

Economists do many things, such as:

Conduct research

Monitor economic trends

Collect and analyze data

Study, develop or apply economic theory

Economists hold positions in business, government and universities. An economist's focus may be on a particular topic, like inflation or interest rates. Or her approach might be broader. Using their understanding of economic relationships, economists might be employed to advise businesses, nonprofits, labor unions or government agencies. Many economists are involved in the practical application of economic policy. This could include a focus on several areas, from finance to labor or energy to health care.

Some economists are primarily theoreticians. They may spend a majority of their days deep in mathematical models. They develop new economic theories and discover new economic

relationships. Others may devote their time equally to research and teaching. Some hold positions as professors to mentor the next generation of economists and economic thinkers.

So perhaps when it comes to economists, a more fitting question might be: What don't economists do?

Quiz

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- 1 Which section from the article BEST explains that economics is interested in the tension between what people want and what is available to them?
 - (A) "Definition Of Economics: The Study Of Resource Use"
 - (B) "Microeconomics"
 - (C) "Macroeconomics"
 - (D) "What Do Economists Do?"
 - Which piece of evidence from the article BEST explains the concept of scarcity?
 - (A) It has a unique method for analyzing and predicting individual behavior.
 - (B) Resources no matter how broad the category are limited.
 - (C) It looks at the way nations divide up resources such as labor, land and capital.
 - (D) That is where goods and services are weighted by their market prices.
 - How are the sections organized overall to help develop understanding?
 - (A) by field; to help readers understand the different tasks economists undertake
 - (B) by problem and solution; to highlight how different economic fields tackle problems
 - (C) by key idea; to provide specific information about various aspects of economics
 - (D) by compare and contrast; to demonstrate the key differences between economic fields

Out of the following, what is the MOST likely reason the author includes the section "What Do Economists Do?"

- (A) to convince the student reader to take economics in college and pursue it as a career
- (B) to highlight that most economists spend more time studying than analyzing money
- (C) to provide evidence that microeconomics and macroeconomics are very similar in practice
- (D) to support the idea that economists are involved with many parts of society in different ways

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What's in your wallet? Uh, I mean, what apps are on your smartphone?

By USA Today, adapted by Newsela staff on 03.21.19 Word Count **1,004** Level **1200L**



Jennifer Bailey, vice president of Internet software and services at Apple, presents the Apple Pay contactless payment service. Apple has launched it in Germany. Photo by: Lino Mirgeler/dpa (Photo by Lino Mirgeler/picture alliance via Getty Images

Most people think to grab their keys, smartphone and wallet when they leave the house. Would it be such a disaster if they left that last one behind?

In the not-too-distant future, it may not be. Physical wallets may be on the decline.

Think of why people carry an overstuffed billfold in the first place. They have pictures in it, credit and ATM cards, cash, a driver's license or other ID, lists and notes, etc. Increasingly, though, most of these are being kept in digital format on a smartphone instead.

At the airport, you can hand over your iPhone or Android handset instead of a paper ticket to the TSA agent. Your digital boarding pass gets inspected and scanned.

You can scan your phone entering ballparks, movie theaters and concert halls, too.

Most states will accept an electronic copy of your automobile's insurance ID card during a traffic stop.

Catching On At Colleges

Students at Duke, University of Alabama, University of Oklahoma, Temple, Johns Hopkins and Santa Clara can or will soon be able to use the Wallet app inside iPhones as contactless student IDs. Other colleges are presumably to follow.

Employees may soon be able to use their phone as their corporate ID as well, as Apple employees currently do.

Indeed, more and more people are letting their smartphone substitute for cash, and ATM and credit cards. It's easy doing contactless payment with such apps as Apple Pay, Google Pay, Samsung Pay, Cash App, Venmo and PayPal.

Nevertheless, the physical wallet isn't in any immediate danger of vanishing since shopping habits are tough to break. For all the talk of a cashless society, physical currency isn't going away anytime soon, either.

Still, 68 percent of 1,218 smartphone owners surveyed say it is likely that smartphones will eventually replace the need for wallets entirely. These consumers were questioned by SurveyMonkey Audience and USA Today last month. Nearly half (45 percent) of them believe wallets will no longer be useful in five years time or less.

Such an eventuality remains a ways off for Seth Buchwalter, a PR manager at Sparkloft Media in Portland, Oregon. Buchwalter uses Venmo and Apple Pay on his iPhone, but he also epitomizes the consumer who remains reluctant to send the wallet out to pasture.

Backup Plan May Still Be Needed

"People are very accustomed to losing or breaking their phone or running out of battery," he says. "Having that backup plan with cash or cards in their wallet is kind of a safety net."

Pervasive concerns about security are one key reason people don't feel comfortable ditching their wallets. Fifty-eight percent of SurveyMonkey respondents want better phone security before they stop using their physical wallet altogether.

Laura Wronski, the senior research scientist at SurveyMonkey who conducted the survey, observes that although smartphones have the advantage of convenience, they do indeed have a perceived weakness of security. "Consumers clearly see a tradeoff between the two," she argues.

Of course, this concern about smartphone security may well be a matter of perception that is without foundation.

"If I hand you my phone, and you hand me your physical credit card, who is going to have better luck running up some charges?" says Elias Guerra. He is CEO of Popwallet, a mobile wallet company in New York. "You're not going to unlock my phone and go make payments with it. But if I have physical possession of your credit card, until you actually call and cancel that, I'm running rampant."

Longer Battery Life Advocated

There's other resistance to retiring the wallet. Forty-three percent of the smartphone owners in the SurveyMonkey survey want to see longer battery life before they stop using their physical wallet altogether.

Nearly half of the smartphone owners in the survey said they wanted the ability to digitally store their passports, driver's license or other forms of ID on the phone.

The early stages of making this happen are underway, though challenges remain. The company IDEMIA began testing a Mobile Driver's License (mDL) with the state of Iowa in 2015, followed by Delaware and soon, Oklahoma.

In 2016, the global digital security company Gemalto received a two-year grant from the U.S. National Institute of Standards and Technology (NIST) to pilot smartphone-based digital driver's licenses in Colorado, Idaho, Maryland, Wyoming and Washington, D.C.

Among the benefits of Gemalto's digital driver's license, or DDL, is the fact that they can more easily and quickly be updated with address changes. Gemalto says such credentials are more resistant to fraud and hacking.

What's more, consumers with a DDL can choose to share only the personalized ID data needed for the situation at hand, without having to show everything. Moreover, if you are pulled over by law enforcement on the highway, you'll remain in possession of the phone. The officer would be able to access your credentials wirelessly via Bluetooth Low Energy.

Of course, because of interstate travel, any digital license issued would have to ultimately work interchangeably in every state, and how to manage the technology to make this feasible is still being hammered out.

Transit cards present another opportunity for the digital wallet, but it is slow going so far in the U.S. For now, you can use Apple Pay, Google Pay and Samsung Pay on your phone to ride buses and trains in Portland, Oregon, and Chicago, Illinois, and soon on New York City's MTA system.

However, last spring, the UTA public transit system in Utah pulled support for Apple Pay and Google Pay, as well as contactless credit cards. The UTA was concerned over how few people used contactless pay there, in light of the cost of upgrading the system.

No doubt about it, smartphones increasingly have impressive utility as wallet substitutes. Leaving the house without a wallet might soon not be such a big deal, after all. Considering that some smartphones now can even unlock your front door and your car, maybe there's no reason to panic if you happen to leave your keys behind, too.

Quiz

1

- Which of the following sentences from the section "Catching On At Colleges" BEST develops a central idea of the article?
 - (A) Students at Duke, University of Alabama, University of Oklahoma, Temple, Johns Hopkins and Santa
 Clara can or will soon be able to use the Wallet app inside iPhones as contactless student IDs.
 - (B) Nevertheless, the physical wallet isn't in any immediate danger of vanishing since shopping habits are tough to break.
 - (C) Still, 68 percent of 1,218 smartphone owners surveyed say it is likely that smartphones will eventually replace the need for wallets entirely.
 - (D) Buchwalter uses Venmo and Apple Pay on his iPhone, but he also epitomizes the consumer who remains reluctant to send the wallet out to pasture.
- 2 How does the central idea that smartphones provide sufficient security emerge in the article?
 - (A) through a comparison of different brands of smartphones
 - (B) through a discussion of the risks of owning and using a smartphone
 - (C) through an explanation of security software available for smartphones
 - (D) through a description of how smartphones resist hacking and theft
- 3 What are the reasons why consumers are reluctant to make the transition to a completely digital wallet?
 - 1. Smartphones are already being used to access public transportation and entertainment venues.
 - 2. Smartphones can break and batteries can die, cutting off access to the information on the phone.
 - 3. Smartphones are perceived to be a less secure means for financial transactions than credit cards.
 - 4. Smartphones can be used to gain access to an individual's home or their personal car.
 - (A) 1 and 4
 - (B) 2 and 3
 - (C) 1, 2 and 3
 - (D) 2, 3 and 4

4

Why does the author begin and conclude the article by suggesting that people may not need to panic if they forget their wallets?

- (A) to predict that consumers will always want to have a physical wallet as a backup option
- (B) to point out the connection between storing identification, payment information and keys digitally
- (C) to emphasize the likelihood that smartphones will replace traditional wallets in the near future
- (D) to indicate that smartphones can assist people in remembering important items like wallets

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Creating a personal budget

By Gale, Cengage Learning, adapted by Newsela staff on 09.18.19 Word Count **587** Level **1230L**



Photo by: Getty Images/Hero Images.

People use personal budgets to fill two needs. First, budgets measure or report, allowing people to assess how much they are spending and what they are spending money on. Second, budgets forecast or predict, allowing people to evaluate where their finances are headed and make changes if necessary. A budget is much like an annual checkup for finances and can be simple or complex. The simplest budget consists of two columns labeled "In" and "Out."

"In" And "Out" Columns

The first step to making a budget is filling the "in" column with all sources of income. Such items include wages, bonuses, interest and miscellaneous income. In some cases, income is received more frequently, such as weekly paychecks. In other cases, the income is less frequent, such as a quarterly bonus. One must convert the income to a monthly basis for budget purposes, with quarterly items being divided by three and weekly items multiplied by four. In the case of semiannual items, such as auto insurance premiums, the amount is divided by six.

Next, in the "out" column, list all identifiable outflows or expenses. Such expenses include mortgage or rent payments, utilities like electricity, gas or water, car payments and gasoline,

interest expenses like credit card charges, health care, charitable donations, groceries, and entertainment, like movie tickets. The details of this list will vary from person to person. However, an effort should be made to include all expenditures. In particular, pay attention to seemingly small purchases, such as soft drinks and snacks, cigarettes, and small items bought with cash. For accuracy, any purchase costing over \$1 should be included.

The third step is to add up each column and find the difference between them. In simplest terms, if the "out" column is larger than the "in" column, then more money is flowing out than in, the budget is out of balance, and the family's money reserves are being depleted. If more money is flowing in than out, the family's budget is working and attention should be paid to maintaining this state.

The fourth step in this process is evaluating the specific spending categories to determine whether each one is consuming a reasonable proportion of the spendable income. For instance, each individual category can be divided by the total amount to determine the percentage spent. A family spending \$700 of their monthly \$2,000 on car payments, gas and insurance should probably conclude that this expenditure, 700/2000 = 35 percent, is excessive and needs to be adjusted. In many cases, families creating a first-time budget find that they are spending far more than they realized at restaurants. By cooking more of their own meals, they can almost painlessly reduce their monthly deficits.

Setting Goals

The previous four steps of this process ask "What are you spending money on?" The fifth and final step asks, "What should be spent?" or "What is the spending goal?" At a minimum, efforts should be made to bring the entire budget into balance by adjusting specific categories of spending. Ideally, goals can be set for each category and re-evaluated at the end of the month. A budget provides a simple, inexpensive tool to begin taking control of one's personal finances. W. Edwards Deming, the genius who transformed the Japanese from makers of cheap trinkets into the worldwide experts on quality manufacturing, is often paraphrased as saying, "You can't change what you can't measure." A simple three-column budget provides the basic tool to begin measuring one's saving and spending habits and changing one's future.

Quiz

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

- (A) They both emphasize the purpose of personal budgeting.
- (B) They both explain how to itemize budget expenditures.
- (C) They both reference influential economists.
- (D) They both describe how to adjust spending categories.
- Read the following sentences from the section "In And Out Columns."

In many cases, families creating a first-time budget find that they are spending far more than they realized at restaurants.

By cooking more of their own meals, they can almost painlessly reduce their monthly deficits.

Which answer choice BEST describes the relationship between the two sentences?

- (A) The first sentence describes a hypothetical problem, and the second sentence offers a realistic solution.
- (B) The second sentence describes a a hypothetical cause, and the second sentence describes its expected effect.
- (C) The first sentence states an argument, and the second sentence provides a counterargument.
- (D) The second sentence highlights a contrast, while the first sentence provides a comparison.
- 3 Read the following statement.

The goal in personal budgeting is to have income exceed spending.

Which sentence from the article BEST supports the statement above?

- (A) First, budgets measure or report, allowing people to assess how much they are spending and what they are spending money on.
- (B) One must convert the income to a monthly basis for budget purposes, with quarterly items being divided by three and weekly items multiplied by four.
- (C) In particular, pay attention to seemingly small purchases, such as soft drinks and snacks, cigarettes, and small items bought with cash.
- (D) If more money is flowing in than out, the family's budget is working and attention should be paid to maintaining this state.

Is the author of the article suggesting that people review and update their budgets frequently? Which selection from the article BEST supports your answer?

4

- (A) No; "Second, budgets forecast or predict, allowing people to evaluate where their finances are headed and make changes if necessary. A budget is much like an annual checkup for finances and can be simple or complex. The simplest budget consists of two columns labeled 'In' and 'Out.'"
- (B) Yes; "The first step to making a budget is filling the 'in' column with all sources of income. Such items include wages, bonuses, interest and miscellaneous income. In some cases, income is received more frequently, such as weekly paychecks. In other cases, the income is less frequent, such as a quarterly bonus."
- (C) Yes; "At a minimum, efforts should be made to bring the entire budget into balance by adjusting specific categories of spending. Ideally, goals can be set for each category and re-evaluated at the end of the month. A budget provides a simple, inexpensive tool to begin taking control of one's personal finances."
- (D) No; "W. Edwards Deming, the genius who transformed the Japanese from makers of cheap trinkets into the worldwide experts on quality manufacturing, is often paraphrased as saying, 'You can't change what you can't measure.' A simple three-column budget provides the basic tool to begin measuring one's saving and spending habits and changing one's future."

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Study shows one brain's electrical pulses can influence those of another

By Los Angeles Times, adapted by Newsela staff on 05.03.17 Word Count **819** Level **1170L**



Edgewood Middle School students extract strawberry DNA during the Technology Needs Teens program at Harford Community College in Bel Air, Maryland. A new study has detected similarities in brain-wave patterns when students work together. Photo: U.S. Army photo by Conrad Johnson

Thanks to scientists who have gone outside the laboratory, we have learned that interacting with others changes us. For instance, research shows that good friendships are connected to good health. Women who spend a lot of time together can start to experience synchronized menstrual periods, and couples who stay together long enough can even begin to look alike.

In the wilds of a New York City biology classroom, a new study has captured another group phenomenon known to exist in labs but never before in humans' natural habitat: group brain synchrony. Group brain synchrony is when people's brains work in very similar ways at the same time.

Neurons, the cells in our brains, process and transmit information through electrical and chemical signals. The human brain has about 100 billion neurons, and everything we think, feel and do is a result of communication between them. When a mass of neurons communicate with each other,

synchronized electrical pulses are produced. These are called brain waves, and scientists measure them to learn more about how our brains work.

"Theta" Waves And "Beta" Waves

Waves are measured in frequency, which is the number of pulses in a certain amount of time. Scientists generally use the unit hertz (Hz), which is equal to one pulse per second. Different brain-wave patterns have different names based on their frequency. "Theta" waves, for example, are 4-7 Hz, or pulses per second. This pattern is associated with daydreaming or feeling sleepy, while the "Beta" wave pattern, with a range of 12-30 Hz, is the most common frequency when we're awake.

Scientists can measure brain-wave patterns using a machine called an electroencephalograph or EEG. In group brain synchrony, the brain-wave patterns inside two or more brains, as seen on EEG readings, will look very similar.

Psychology researchers at New York University gave 12 high school seniors a portable EEG machine to gather the students' brain-wave readings. They observed the students' brain-wave patterns over an entire semester's worth of biology classes. The researchers reported that when students were most engaged with each other and deeply involved in group learning, the readings on their EEGs tended to show very similar brain-wave patterns.

Strong Connections

The group brain synchrony was most pronounced when students liked their teacher. Individual students who reported feeling connected to their classmates, as well as those who showed high levels of empathy, were most likely to fall into synchrony with classmates during group learning.

The new research suggests that neural synchrony may also reflect something more than just shared attention. According to neuroscientist Suzanne Dikker, who worked on the study, it was evident in social dynamics among classmates as well. This is notable since the give-and-take of group learning might have made for a less uniform experience, Dikker said.

"Brain-to-brain synchrony is a possible neural marker for dynamic social interactions, likely driven by shared attention mechanisms," the team of researchers wrote.

Using what we know about brain waves, we can actually change how our brains work. Through a process called brain-wave "entrainment," audio or visual stimulation can train our brains to follow a certain wave pattern. For instance, brainwaves of 2Hz usually happen when we're sleeping. If someone is having trouble sleeping, special audio recordings of the 2Hz frequency can nudge the brain to follow along.

Brain Waves In Sync

When two or more people are engaged socially with one another, that, too, appears to involve something resembling "entrainment." It seems that when everyone in a room is paying attention to the same thing, their brain waves will start to be in sync. The similar type of brain activity shows up on EEGs as neural synchrony. In other words, the electrical pulses in one brain can influence those of another.

Dikker noted that the project itself was explicitly designed as an effort to gather data in a natural setting. The researchers first gave the students a crash course in neuroscience. After enlisting their support in designing the experiment, the researchers helped the students craft a few of their own.

"They loved it — at least they said they did," Dikker said. Except during lack of student attention around college-application time and the appearance of "senioritis" toward the end of the semester, "they really owned the project," she said.

Researchers Design Larger Projects

The idea that neural entrainment in groups can be detected and measured with portable EEGs — and then analyzed to perceive patterns — opens new avenues for research, Dikker added.

The researchers are now designing larger projects in which they'll be able to record brain data from up to 45 people at once.

Among the questions they hope to answer: What are the optimal conditions for an audience to experience a performance or movie? Is there an ideal group size? Does having some joint interaction right before a performance improve the experience? How does the audience affect the performer, and vice versa?

Quiz

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2

4

- Which of the following sentences from the article BEST develops a central idea?
 - In the wilds of a New York City biology classroom, a new study has captured another group phenomenon known to exist in labs but never before in humans' natural habitat: group brain synchrony.
 - (B) The researchers reported that when students were most engaged with each other and deeply involved in group learning, the readings on their EEGs tended to show very similar brain-wave patterns.
 - (C) Through a process called brain-wave "entrainment," audio or visual stimulation can train our brains to follow a certain wave pattern.
 - (D) The idea that neural entrainment in groups can be detected and measured with portable EEGs and then analyzed to perceive patterns opens new avenues for research, Dikker added.
- Which option provides the BEST summary of the article?
 - (A) New research shows that the frequency of brain waves indicates two basic patterns, which can be activated or changed among groups of participating test subjects.
 - (B) Researchers found that students were most engaged in learning when they liked their teacher, and were deeply involved in group learning.
 - (C) New research suggests that brain-wave entrainment can enhance how we learn patterns, and may lead to more optimal learning conditions in the classroom.
 - (D) Researchers measured the brain-wave frequency of a student group, and found the highest levels of synchrony when students liked their teacher and were engaged in group learning.
- 3 Read the selection from the section "Strong Connections."

"Brain-to-brain synchrony is a possible neural marker for dynamic social interactions, likely driven by shared attention mechanisms," the team of researchers wrote.

Which of the following is the BEST replacement for the word "mechanisms"?

- (A) talents
- (B) processes
- (C) building blocks
- (D) machinery

Read the selection from the section "Strong Connections."

The new research suggests that neural synchrony may also reflect something more than just shared attention. According to neuroscientist Suzanne Dikker, who worked on the study, it was evident in social dynamics among classmates as well. This is notable since the give-and-take of group learning might have made for a less uniform experience, Dikker said.

Which of the following phrases from the selection provides context clues to the meaning of the phrase "social dynamics"?

- (A) neural synchrony
- (B) more than just shared attention
- (C) give-and-take of group learning
- (D) a less uniform experience

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Native American Activism in the 1960s and 1970s

By Native American Almanac (Visible Ink Press), adapted by Newsela staff on 10.31.17 Word Count **1,092** Level **1220L**



About 50 Native Americans took over an abandoned Nike site after the U.S.government ended their 19-month occupation of Alcatraz Island. In this June 14, 1971, photo, young Native Americans sleep on the road and rest on a car used as a roadblock to the abandoned residential area. A sign reads "Indian People of All Tribes." Photo by: Bettmann/Getty Images

A nationwide Native American conference was held at the University of Chicago in June 1961. More than 500 Native Americans from more than 90 tribes and bands participated and created a "Declaration of Indian Purpose," which supported the right of a tribal community to maintain itself and develop with government money and assistance. The conference helped mobilize a generation of Native American activists.

Native American organizations founded

After the conference, there was a widespread organizational and activist response in native communities. The National Indian Youth Council, founded in 1961, and the American Indian Movement (AIM), founded in 1968, were part of a great proliferation of organizations on reservations and in cities. In addition, dozens of native newspapers and magazines were established during the late 1960s and 1970s.

Important legal, political and economic national organizations were also established: the National Indian Education Association, founded in 1969, the Native American Rights Fund, founded in 1970, the National Tribal Chairmen's Association, founded in 1971, and the Council of Energy Resource Tribes, founded in 1975. These organizations represented Indian interests at various levels of government. They contributed to a growing awareness of the shared interests and common problems of all Native Americans.

The growth of a Native American population in various U.S. cities contributed to the emergence of a national Native American activist movement. This came to be known as the Red Power movement.

During the 1960s, Native Americans began uniting to take control of their own future. A generation of Native American activists forced the public and the federal government to look at problems confronting reservation tribes. The fish-in movement was launched in response to court and law-enforcement restrictions on North Pacific tribes' access to fishing, which had been guaranteed by treaties, but which had been stripped away during the 19th century. The fish-in movement provided a training ground for future activism in other parts of the U.S.

Alcatraz Island claimed by the "right of discovery"

On November 20, 1969, 89 "Indians of all tribes" landed on Alcatraz Island, off of San Francisco, California, the former site of a federal prison. The group claimed the island by the "right of discovery," in the same way white settlers justified taking over native lands in earlier centuries. The group wanted the U.S. government to give money to turn it into a Native American cultural center and university. Over the next 19 months, they negotiated with the federal government.

The negotiations did not result in any plan for the future of Alcatraz Island. However, the occupation itself, which ended on June 11, 1971, marked the beginning of a period of greatly increased Native American activism in cities and on reservations. Occupations became a tactic designed to draw attention to the historical and contemporary grievances of North American Indians. Most didn't last long.

"Trail of Broken Treaties"

During the 1970s, government buildings also became the sites of protests. Among them were regional Bureau of Indian Affairs (BIA) offices in Cleveland and Denver, as well as the main BIA headquarters in Washington, D.C., in 1972. The BIA is the department of the government that is in charge of all Native American tribal lands. It also provides health care and education to Native Americans. Many Native Americans felt then that the BIA was just controlling Native American land for the government's purposes, breaking its treaties and providing poor education.

The unplanned occupation of the Washington BIA occurred at the end of a protest known as the "Trail of Broken Treaties." This protest involved caravans that traveled across the U.S. to meet in Washington, in order to present Native American concerns at the national BIA offices. When protesters found their planned camping ground was no longer available, they took over BIA offices for a week.

"Wounded Knee II"

No single event of the Red Power era more clearly illustrated the combination of Native American grievances and community tensions than the events on South Dakota's Pine Ridge Reservation in the spring of 1973. The 10-week-long siege came to be known as "Wounded Knee II." It was named after the Wounded Knee massacre in 1890. In that first conflict, Native Americans had been protesting their treatment by the U.S. government at Wounded Knee on the Pine Ridge. The U.S. Army killed 146 Sioux during a standoff.

"Wounded Knee II" involved a dispute within the Oglala Lakota Tribe. Reservation traditionalists asked AIM to assist them in their struggle against the elected chairman Richard Wilson, whose administration they charged was corrupt.

Federal marshals and FBI agents surrounded the hamlet, creating a standoff that drew national and worldwide media attention. Native militants, who were armed, made clear their intention to fight rather than surrender. The standoff finally ended with a negotiated settlement and withdrawal of both sides.

International Indian Treaty Council

Following the stand at Wounded Knee, AIM brought together thousands of native representatives in a 10-day gathering that founded the International Indian Treaty Council (IITC). In 1975, the council applied for and received United Nations recognition. By the mid-1980s, it was attracting representatives from indigenous, or native, communities from around the world. The IITC reached a milestone in 2007 when the United Nations General Assembly passed the Declaration on the Rights of Indigenous Peoples.

"The Longest Walk"

The last major event of the Red Power era occurred in July 1978 when several hundred native people marched into Washington, D.C., at the end of a protest known as "The Longest Walk." The peaceful protest march had begun five months earlier in San Francisco. It was intended to symbolize the forced removal of native people from their homelands and draw attention to continuing problems they faced.

Land and water rights

During the 1970s, Native American activism shifted to the courts as well. Tribes went to federal and state courts to claim land and protect their treaty rights. In the eastern United States, Native American groups claimed lands taken illegally during the late 1790s. Based on a section of the Indian Trade and Intercourse Act of 1790, Native Americans in Maine, Rhode Island and Connecticut succeeded in reclaiming some state lands illegally taken in violation of the 1790 law.

In the 1970s, Native American activists demanded that water rights be protected, especially in the Southwest, where water is scarce. During this same period, Native Americans in the Great Lakes and northern Pacific coast region used the courts to try to win back their treaty rights to fish at "accustomed" places. The fish-in movement sought to lift restrictions on tribal access to fishing.

Quiz

1

Read the paragraph from the section "Alcatraz Island claimed by the right of discovery."

On November 20, 1969, 89 "Indians of all tribes" landed on Alcatraz Island, off of San Francisco, California, the former site of a federal prison. The group claimed the island by the "right of discovery," in the same way white settlers justified taking over native lands in earlier centuries. The group wanted the U.S. government to give money to turn it into a Native American cultural center and university. Over the next 19 months, they negotiated with the federal government.

Which conclusion is BEST supported by the paragraph?

- (A) The Native Americans who claimed Alcatraz Island had the right to turn the island into a cultural center and university.
- (B) The Native Americans who claimed Alcatraz Island were dependent on the U.S. government to help them achieve their goals.
- (C) Native Americans wanted their own university because they were barred from attending other universities.
- (D) Native Americans had to negotiate with the federal government to get land in the same way that white settlers had to negotiate for land.
- 2 Read the details below from the article.

The fish-in movement was launched in response to court and law-enforcement restrictions on North Pacific tribes' access to fishing, which had been guaranteed by treaties, but which had been stripped away during the 19th century.

During the 1970s, government buildings also became the sites of protests.

This protest involved caravans that traveled across the U.S. to meet in Washington, in order to present Native American concerns at the national BIA offices.

Each of these details is evidence of activist actions that _

- (A) were taken by the Red Power movement.
- (B) failed to get the attention of the federal government.
- (C) led to the formation of the Red Power movement.
- (D) involved a violent response from the federal government.

Read the paragraph below from the section "International Indian Treaty Council."

Following the stand at Wounded Knee, AIM brought together thousands of native representatives in a 10-day gathering that founded the International Indian Treaty Council (IITC). In 1975, the council applied for and received United Nations recognition. By the mid-1980s, it was attracting representatives from indigenous, or native, communities from around the world. The IITC reached a milestone in 2007 when the United Nations General Assembly passed the Declaration on the Rights of Indigenous Peoples.

Which sentence in the paragraph has a subjective tone?

- (A) Following the stand at Wounded Knee, AIM brought together thousands of native representatives in a 10-day gathering that founded the International Indian Treaty Council (IITC).
- (B) In 1975, the council applied for and received United Nations recognition.
- (C) By the mid-1980s, it was attracting representatives from indigenous, or native, communities from around the world.
- (D) The IITC reached a milestone in 2007 when the United Nations General Assembly passed the Declaration on the Rights of Indigenous Peoples.

Read the sentence from the section "Alcatraz Island claimed by the 'right of discovery."

Occupations became a tactic designed to draw attention to the historical and contemporary grievances of North American Indians.

Which two words could replace "tactic" and "contemporary" WITHOUT changing the meaning the of the sentence?

- (A) goal, current
- (B) test, enduring
- (C) strategy, modern
- (D) maneuver, complex

4

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Mexicans set social structure aside to provide earthquake relief

By Washington Post, adapted by Newsela staff on 09.25.17 Word Count **865** Level **1220L**



Volunteers pass buckets filled with water bottles in Mexico City, Mexico, to help earthquake victims on September 20, 2017. Photo for The Washington Post by Alejandro Cegarra

MEXICO CITY, Mexico - On one of Mexico City's trendiest streets, lined with art galleries, cafes and gourmet restaurants, taco vendor Luis Miguel Osorio, his wife and daughter worked rapidly Wednesday to serve food to the victims. Volunteers and emergency workers crowded around a nearby apartment building that collapsed during Mexico's deadliest earthquake in 32 years.

The site remained one of several crisis points around the capital as authorities and volunteers worked to locate the missing and rescue those still trapped beneath rubble the day after the earthquake. Authorities have reported a death toll of 230 in central and southern Mexico. Mexico City has the largest number of these fatalities, where the death toll is 100 people.

Yet in the space of 24 hours, a sense of terror shifted to a spirit of solidarity. Friends, neighbors, relatives and even complete strangers came to each other's aid, transcending Mexico's usually strict class divisions.

Pitching In

With many businesses closed, Osorio and his family came out to support the rescue efforts with food, water and other supplies. Osorio has run a taco stand on Álvaro Óbregon street in the Roma neighborhood for 17 years.

"The whole city was affected, and we're part of the city, so we're here to help," he said. "What else were we going to do?"

The 7.1-magnitude earthquake, whose epicenter was southeast of Mexico City in Puebla state, occurred 32 years to the day after the country's worst earthquake. That quake killed thousands in 1985. The quake Tuesday also happened only 12 days after an 8.1-magnitude quake rattled the capital and killed 98 people in southern Mexico.

Donors Become Victims

Last week, the well-heeled residents of Roma, located close to the city's downtown, were depositing supplies for the previous earthquake's victims. They brought canned food, blankets, and water to drop-off points for people in some of Mexico's poorest, most rural areas. Yet as Álvaro Obregón street filled with dust and debris, with one building toppled and many others damaged, these residents became victims too.

"It felt like the world was ending," says Amanda Ramírez, 22, who lives close to a collapsed apartment building. At least 13 people were still trapped in the building beneath rubble. Following emergency protocols, she abandoned her third-floor apartment when the quake hit, leaving behind everything except her keys, and descended a staircase that veered and contorted beneath her feet.

"There were moments as I went down the stairs in which I thought, 'Will I make it out?' " she said.

Forced To Leave

Elsewhere in the neighborhood, windows were shattered, and buildings were damaged to the point where people could not stay there. Many were forced to seek shelter elsewhere.

Ramírez, a pharmacist, was able to escape her building unscathed and returned only to pack an overnight bag before traveling to her mother's house across the city. With scores of people still trapped and rescue operations underway in various parts of the capital, many others were not so lucky.

Rescue efforts have been led by joint teams of federal, state and local officials, along with the military. But ordinary citizens have also come forward to help, sometimes producing unlikely friendships.

First-Aid Volunteer

University student Amelia Lara, 21, comes from Gustavo A. Madero, one of Mexico City's poorest districts. However, Wednesday she found herself bandaging the wounds of lawyers and workers from Mexico's financial district as she volunteered to provide first-aid.

"The conversations were interesting," she said. "People were in shock, many were shaking and crying, so you just tried to take their minds off things, ask them about silly things."

Mexico's capital is one of the world's largest cities and reflects the country's huge disparity between rich and poor. While residents of Roma enjoy leafy green parks, European-style cafes and well-kept streets, many of the city's less fortunate citizens live in dusty slums on the edge of the city. The poor often commute to informal jobs in the wealthier neighborhoods.

As authorities barred many residents from returning to their homes because of structural damage, nearby Parque Mexico became a makeshift campsite where people grouped together, aware of the possibility of aftershocks that might cause further destruction. By Wednesday morning last week, the park was also a drop-off point for people wishing to donate blankets, water and other supplies.

Time To Come Together

The strong sense of solidarity in a city known for its aggressive drivers and rough edges -- not to mention its social snobbiness -- reflects Mexicans' resilient sense of humor.

"These kinds of events bring the best out of Mexicans," said Álvaro Jiménez, a middle-aged engineer who was volunteering in the rescue efforts. "We can fight each other like dogs when things are going well, but when somebody needs help, we band together."

Just hours before the latest disaster occurred, the city had undergone a drill in recognition of the capital's far more destructive 1985 earthquake. By afternoon the following day, there were fears another building, six stories high, could topple in the Roma neighborhood.

"It's mysterious and it's tragic," Jiménez said. "But you can't do anything to stop it. You just do everything you can to help the people affected."

Quiz

1

3

4

- Which of the following sentences from the introduction [paragraphs 1-3] BEST develops a central idea of the article?
 - (A) Volunteers and emergency workers crowded around a nearby apartment building that collapsed during Mexico's deadliest earthquake in 32 years.
 - (B) Authorities have reported a death toll of 230 in central and southern Mexico.
 - (C) Mexico City has the largest number of these fatalities, where the death toll is 100 people.
 - (D) Friends, neighbors, relatives and even complete strangers came to each other's aid, transcending Mexico's usually strict class divisions.
- 2 Which answer choice provides an accurate and objective summary of the article?
 - (A) A devastating earthquake struck Mexico on the 32nd anniversary of the country's worst earthquake.
 Citizens, volunteers and emergency workers joined together on the day after the earthquake to provide help and supplies to those in need. Their solidarity crossed the usual divide between rich and poor in Mexico City.
 - (B) A devastating earthquake struck Mexico on the 32nd anniversary of the country's worst earthquake. In the aftermath of the earthquake, many brave citizens stepped out of their homes to help those who were less fortunate. It was especially inspiring to see the city's wealthiest residents help the poorest.
 - (C) An earthquake struck Mexico City one week after an even larger earthquake hit the city and caused historic destruction. Wealthy residents were surprised to find that their homes were destroyed by the quake. The emergency brought together rich and poor who were seeking hard-to-find food and shelter.
 - (D) An earthquake struck Mexico City one week after an even larger earthquake hit the city and caused historic destruction. Many residents were lucky enough to escape with their lives but lost their homes. It is important for people to come together in situations like this regardless of class.
 - Which answer choice BEST represents Amanda Ramírez's reaction to the earthquake?
 - (A) Ramírez was terrified and could not find her way out of her apartment without the help of friends and neighbors.
 - (B) Ramírez was terrified, but remained calm enough to follow emergency procedures and get out of her apartment safely.
 - (C) Ramírez was calm and collected, and was able to help many people in her neighborhood who were in danger.
 - (D) Ramírez was calm and collected and quickly joined rescue teams working to bring others to safety.
 - Why did the author conclude the article with the observations of Álvaro Jiménez?
 - (A) to indicate that Jiménez's skills as an engineer were especially helpful after the earthquake
 - (B) to illustrate the similarities between the most recent earthquake and the one in 1985
 - (C) to elaborate on the idea that there are usually much stricter class divisions in Mexico City
 - (D) to emphasize the solidarity the people of Mexico feel with one another after a disaster

Class:

The Last Class: The Story of a Little Alsatian

By Alphonse Daudet 1917

Alphonse Daudet (1840-1897) was a French writer. This story takes place in Alsace, a region of France that borders Germany. In 1870, France lost a war with Prussia, a region in northern Europe that included part of Germany. After this war, France had to give Prussia some mainly German-speaking regions previously under French control. These were the provinces of Alsace and Lorraine. Today, the overall culture of Alsace is generally more German than French. In this story, a young Alsatian boy is met with a surprising announcement when he arrives at his French class. As you read the story, take notes on the story's mood and the ways the author portrays the character's reactions to change.

[1] I was very late for school that morning, and I was terribly afraid of being scolded, especially as Monsieur¹ Hamel had told us that he should examine us on participles, and I did not know the first thing about them. For a moment I thought of staying away from school and wandering about the fields. It was such a warm, lovely day. I could hear the blackbirds whistling on the edge of the wood, and in the Rippert field, behind the sawmill, the Prussians going through their drill. All that was much more tempting to me than the rules concerning participles; but I had the strength to resist, and I ran as fast as I could to school.



"Image from The New York Times publication of 'The Last Class: The Story of the Little Alsatian'" by Unknown is in the public domain.

As I passed the mayor's office, I saw that there were people gathered about the little board on which notices were posted. For two years all our bad news had come from that board—battles lost, conscriptions,² orders from headquarters; and I thought without stopping:

"What can it be now?"

Then, as I ran across the square, Wachter the blacksmith, who stood there with his apprentice, reading the placard, called out to me:

[5] "Don't hurry so, my boy; you'll get to your school soon enough!"

I thought that he was making fun of me, and I ran into Monsieur Hamel's little yard all out of breath.

Usually, at the beginning of school, there was a great uproar which could be heard in the street, desks opening and closing, lessons repeated aloud in unison, with our ears stuffed in order to learn quicker, and the teacher's stout ruler beating on the desk:

"A little more quiet!"

^{1.} the French word for mister

^{2.} conscription is when a nation forces a person to join the military

I counted on all this noise to reach my bench unnoticed; but as it happened, that day everything was quiet, like a Sunday morning. Through the open window I saw my comrades³ already in their places, and Monsieur Hamel walking back and forth with the terrible iron ruler under his arm. I had to open the door and enter, in the midst of that perfect silence. You can imagine whether I blushed and whether I was afraid!

^[10] But no! Monsieur Hamel looked at me with no sign of anger and said very gently:

"Go at once to your seat, my little Frantz; we were going to begin without you."

I stepped over the bench and sat down at once at my desk. Not until then, when I had partly recovered from my fright, did I notice that our teacher had on his handsome blue coat, his plaited ruff, and the black silk embroidered breeches, which he wore only on days of inspection or of distribution of prizes. Moreover, there was something extraordinary, something solemn⁴ about the whole class. But what surprised me most was to see at the back of the room, on the benches which were usually empty, some people from the village sitting, as silent as we were: old Hauser with his three-cornered hat, the ex-mayor, the ex-postman, and others besides. They all seemed depressed; and Hauser had brought an old spelling-book with gnawed edges, which he held wide-open on his knee, with his great spectacles askew.

While I was wondering at all this, Monsieur Hamel had mounted his platform, and in the same gentle and serious voice with which he had welcomed me, he said to us:

"My children, this is the last time that I shall teach you. Orders have come from Berlin to teach nothing but German in the schools of Alsace and Lorraine. The new teacher arrives tomorrow. This is the last class in French, so I beg you to be very attentive."

[15] Those few words overwhelmed me. Ah! the villains! that was what they had posted at the mayor's office.

My last class in French!

And I barely knew how to write! So I should never learn! I must stop short where I was! How angry I was with myself because of the time I had wasted, the lessons I had missed, running about after nests, or sliding on the Saar!⁵ My books, which only a moment before I thought so tiresome, so heavy to carry—my grammar, my sacred history—seemed to me now like old friends, from whom I should be terribly grieved to part. And it was the same about Monsieur Hamel. The thought that he was going away, that I should never see him again, made me forget the punishments, the blows with the ruler.

Poor man! It was in honour of that last lesson that he had put on his fine Sunday clothes; and I understood now why those old fellows from the village were sitting at the end of the room. It seemed to mean that they regretted not having come oftener to the school. It was also a way of thanking our teacher for his forty years of faithful service, and of paying their respects to the fatherland which was vanishing.

^{3.} Comrade (noun): a friend, especially one who shares the same interests or is a fellow member of an organization

^{4.} Solemn (adjective): very serious or formal in manner, behavior, or expression

^{5.} a region along the German-French border

I was at that point in my reflections, when I heard my name called. It was my turn to recite. What would I not have given to be able to say from beginning to end that famous rule about participles, in a loud, distinct voice, without a slip! But I got mixed up at the first words, and I stood there swaying against my bench, with a full heart, afraid to raise my head. I heard Monsieur Hamel speaking to me:

^[20] "I will not scold you, my little Frantz; you must be punished enough; that is the way it goes; every day we say to ourselves: 'Pshaw! I have time enough. I will learn tomorrow.' And then you see what happens. Ah! it has been the great misfortune of our Alsace always to postpone its lessons until tomorrow. Now those people are entitled to say to us: 'What! you claim to be French, and you can neither speak nor write your language!' In all this, my poor Frantz, you are not the guiltiest one. We all have our fair share of reproaches⁶ to address to ourselves.

"Your parents have not been careful enough to see that you were educated. They preferred to send you to work in the fields or in the factories, in order to have a few more sous.⁷ And have I nothing to reproach myself for? Have I not often made you water my garden instead of studying? And when I wanted to go fishing for trout, have I ever hesitated to dismiss you?"

Then, passing from one thing to another, Monsieur Hamel began to talk to us about the French language, saying that it was the most beautiful language in the world, the most clear, the most substantial; that we must always retain it among ourselves, and never forget it, because when a people falls into servitude,⁸ "so long as it clings to its language, it is as if it held the key to its prison." Then he took the grammar and read us our lesson. I was amazed to see how readily I understood. Everything that he said seemed so easy to me, so easy. I believed, too, that I had never listened so closely, and that he, for his part, had never been so patient with his explanations. One would have said that, before going away, the poor man desired to give us all his knowledge, to force it all into our heads at a single blow.

When the lesson was at an end, we passed to writing. For that day Monsieur Hamel had prepared some entirely new examples, on which was written in a fine, round hand: "France, Alsace, France, Alsace." They were like little flags, waving all about the class, hanging from the rods of our desks. You should have seen how hard we all worked and how silent it was! Nothing could be heard save the grinding of the pens over the paper. At one time some beetles flew in; but no one paid any attention to them, not even the little fellows who were struggling with their straight lines, with a will and conscientious⁹ application, as if even the lines were French. On the roof of the schoolhouse, pigeons cooed in low tones, and I said to myself as I listened to them:

"I wonder if they are going to compel¹⁰ them to sing in German too!"

^{6.} Reproach (verb): an act of blame or scolding

^{7.} a unit of French currency

^{8.} being completely under the control of or serving someone else

^{9.} Conscientious (adjective): careful, diligent

^{10.} Compel (verb): to force

^[25] From time to time, when I raised my eyes from my paper. I saw Monsieur Hamel sitting motionless in his chair and staring at the objects about him as if he wished to carry away in his glance the whole of his little schoolhouse. Think of it! For forty years he had been there in the same place, with his yard in front of him and his class just as it was! But the benches and desks were polished and rubbed by use; the walnuts in the yard had grown, and the hop-vine which he himself had planted now festooned¹¹ the windows even to the roof. What a heart-rending thing it must have been for that poor man to leave all those things, and to hear his sister walking back and forth in the room overhead, packing their trunks! For they were to go away the next day—to leave the province¹² forever.

However, he had the courage to keep the class to the end. After the writing, we had the lesson in history; then the little ones sang all together the ba, be, bi, bo, bu. Yonder, at the back of the room, old Hauser had put on his spectacles, and, holding his spelling-book in both hands, he spelled out the letters with them. I could see that he too was applying himself. His voice shook with emotion, and it was so funny to hear him, that we all longed to laugh and to cry. Ah! I shall remember that last class.

Suddenly the church clock struck twelve, then the Angelus¹³ rang. At the same moment, the bugles of the Prussians returning from drill blared under our windows. Monsieur Hamel rose, pale as death, from his chair. Never had he seemed to me so tall.

"My friends," he said, "my friends, I—I—"

But something suffocated him. He could not finish the sentence.

[30] Thereupon he turned to the blackboard, took a piece of chalk, and, bearing on with all his might, he wrote in the largest letters he could:

"VIVE LA FRANCE!"¹⁴

Then he stood there, with his head resting against the wall, and without speaking, he motioned to us with his hand:

"That is all; go."

The Last Class: The Story of a Little Alsatian by Alphonse Daudet is in the public domain.

^{11.} an ornamental chain of flowers

^{12.} a governed region

^{13.} a prayer recited in Roman Catholic churches, convents, and monasteries three times daily: 6:00 a.m., noon, and 6:00 p.m.

^{14.} a French patriotic expression meaning "long live France"

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 story?
 - A. Sometimes you don't fully appreciate something until it is too late.
 - B. Always embrace change, or you will live with bitterness.
 - C. Hold strong to your traditions and stand up for them.
 - D. War only brings pain and loss.
- 2. PART B: Which paragraph from the text best supports the answer to Part A?
 - A. Paragraph 1
 - B. Paragraph 14
 - C. Paragraph 20
 - D. Paragraph 31
- 3. In paragraphs 9-12, how does the description of the setting contribute to the mood of the story? What does this tell you about the town's attitude toward the announcement?

4. Explain the figurative language in the following quotation from paragraph 23. What is the purpose of this comparison? "For that day Monsieur Hamel had prepared some entirely new examples, on which was written in a fine, round hand: 'France, Alsace, France, Alsace.' They were like little flags, waving all about the class, hanging from the rods of our desks."

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 context of this story, what are some reasons why people are resistant to change? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

2. Although the story is fiction, it is based on real events in Alsace after the Franco-Prussian War. Consider the effects of the war on the lives of the everyday people in this town. How does war change people? Is it ever for the better? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Class:

Village Schools and Traveling Soldiers

By Arthur Henderson Smith 1899

Arthur Henderson Smith (1845-1932) was an American missionary who traveled to China in the late 19th century and wrote books describing the country and its customs to foreign readers. In this excerpt, he describes traditional Chinese views on education. As you read this text, take notes on the differences between what is expected of the educated and the uneducated child.

[1] The object of Chinese education is to pump up the wisdom of the ancients into the minds of the moderns. In order to do this, however, it is necessary to keep the stream in a constant flow, at whatever cost, else much of the preceding labour is lost. According to Chinese theory, or practice, a school which should only be in session for six months of the year, would be a gross absurdity.¹ The moment a child fails to attend school, he is supposed (and with reason) to become "wild."

The territory to be traversed is so vast that the most unremitting² diligence³ is absolutely indispensable.⁴ This continues true, however advanced the pupil may be; as witness the popular saying, "Ten years a graduate (without studying), and one is a nobody." The same saying is current in regard to the second degree, and with not less reason.



"Image from page 337 of "A'Chu and Other Stories"" by Emma Maria Anderson is in the public domain.

The necessity of confining one's attention to study alone, leads to the selection of one or more of the sons of a family as the recipient of an education. The one who is chosen is clothed in the best style which his family circumstances will allow, his little cue⁵ neatly tied with a red string, and he is provided, as we have seen, with a copy of the Hundred Surnames and of the Trimetrical Classic. This young Confucianist⁶ is the bud and prototype⁷ of the adult scholar. His twin brother, who has not been chosen to this high calling, roams about the village all summer in the costume of the garden of Eden,⁸ gathering fuel, swimming in the village mud-hole, busy when he must be busy, idle when he can be idle. He may be incomparably more useful to his family than the other, but so far as education goes he is only a "wild" lad.

- 1. Here, the word "gross" means "in every way" or "from every point of view."
- 2. Unremitting (adjective): not stopping
- 3. **Diligence** *(noun):* careful and persistent work or effort
- 4. Indispensable (adjective): absolutely necessary
- 5. a required hairstyle for men during the Qing dynasty, consisting of a low braid or ponytail at the back of the head (also spelled "queue")
- 6. Confucianism is a Chinese philosophy that emphasizes family relationships and ethical living.
- 7. a standard or typical example

If the student is quick and bright, and gives good promise of distinguishing himself, he stands an excellent chance of being spoiled through thoughtless praises. "That boy," remarks a bystander to a stranger, and in the lad's hearing, "is only thirteen years old, but he has read all the Four Books, and all of the Book of Poetry, etc. By the time he is twenty, he is sure to graduate." When questioned as to his attainments,⁹ the lad replies without any of that pertness¹⁰ and forwardness which too often characterizes Western youth, but as he has been taught to do, in a bashful and modest manner, and in a way to win at once the good opinion of the stranger. His manner leaves nothing to be desired, but in reality he is the victim of the most dangerous of all flatteries, the inferiority¹¹ of what is around him. In order to hold his relative position, it is necessary, as already pointed out to bestow the most unwearied attention on his books. His brothers are all day in the fields, or learning a trade, or are assistants to some one engaged in business, as the case may be, but *he* is doing nothing, absolutely and literally nothing, but study.

^[5] So much confinement, and such close application from the very earliest years, can scarcely fail to show their effects in his physical constitution.¹² His brother hoes the ground, bareheaded throughout the blistering heats of July, but such exposure to the sun would soon give him the headache. His brother works with more or less energy all day long (with intermittent¹³ sequence), but were *he* compelled to do the same the result would not improbably be that he would soon begin to spit blood. That he is physically by no means so strong as he once was, is undeniable. He has very little opportunity to learn anything of practical affairs, and still less disposition.¹⁴ The fact that a student has no time to devote to ordinary affairs is not so much the reason of his ignorance,¹⁵ as is the fact that for him to do common things is not respectable. Among the four classes of mankind, scholars rank first, farmers, labourers, and merchants being at a great remove.

The two things that a pupil is sure to learn in a Chinese school are obedience, and the habit of concentrating his attention upon whatever he is reading, to the entire disregard of surrounding distractions. So far as they go these are valuable acquirements, although they can scarcely be termed an education.

Village Schools and Traveling Soldiers by Arthur Henderson Smith is in the public domain.

8. According to the Bible, people in the Garden of Eden were naked until they decided to cover themselves with leaves.

- 10. confidence and a lack of respect
- 11. Inferiority (noun): the state of not being as good as somebody/something else
- 12. a person's physical condition and health
- 13. Intermittent (*adjective*): coming and going at intervals; not continuous
- 14. a natural tendency or desire to do something
- 15. Ignorance (noun): a lack of knowledge or awareness in general

^{9.} achievements

Text-Dependent Questions

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

1. Compare and contrast the lives of the twins described in paragraphs 3-6. Cite evidence from the text in your response.

- 2. PART A: Which TWO of the following best identify the central ideas of this text?
 - A. Traditional Chinese education requires constant study.
 - B. Education in China is superior to education elsewhere.
 - C. Without traditional Chinese education, children will become arrogant.
 - D. The goal of education is to master many skills, both practical and intellectual.
 - E. Education is only for some—others become "wild" laborers.
 - F. With a good education, a "wild" child can become more useful to his family.
- 3. PART B: Which TWO phrases from the text best support the answers to Part A?
 - A. "The object of Chinese education is to pump up the wisdom of the ancients into the minds of the moderns" (Paragraph 1)
 - B. "According to Chinese theory, or practice, a school which should only be in session for six months of the year, would be a gross absurdity" (Paragraph 1)
 - C. "The same saying is current in regard to the second degree, and with not less reason" (Paragraph 2)
 - D. "He may be incomparably more useful to his family than the other, but so far as education goes he is only a 'wild' lad" (Paragraph 3)
 - E. "He has very little opportunity to learn anything of practical affairs, and still less disposition" (Paragraph 5)
 - F. "So far as they go these are valuable acquirements, although they can scarcely be termed an education" (Paragraph 6)
- 4. PART A: What does the word "gross" most closely mean as it is used in Paragraph 1?
 - A. Largely unacceptable
 - B. Muddy or dirty
 - C. Nauseating
 - D. Undiscovered

- 5. PART B: Which phrase from the text best supports the answer to Part A?
 - A. "The object of Chinese education is to pump up the wisdom of the ancients into the minds of the moderns." (Paragraph 1)
 - B. "a school which should only be in session for six months of the year" (Paragraph 1)
 - C. "The moment a child fails to attend school, he is supposed (and with reason) to become 'wild." (Paragraph 1)
 - D. "The territory to be traversed is so vast" (Paragraph 2)

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 the lives of the twins described in the text compare to your own? Is there one that more closely resembles the system of education where you live? Explain.

2. According to this text, one brother is educated and the other must do hard labor. Is this fair, or, if not, who gets the better deal? How might a system like this impact society?

3. The author writes that this "can scarcely be termed an education" (Paragraph 6). Why do you think he says so? What should an education be and do? Should all people be educated in the same way?

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International lifestyle concepts are catching on in the U.S.

By Washington Post, adapted by Newsela staff on 01.13.19 Word Count **918** Level **1130L**



Image 1. Hygge is a Danish word for a mood of coziness and comfortability with feelings of wellness and contentment. Photo by: John Fedele/Getty Images

Hygge, the Danish lifestyle concept of cozy, comfortable and quality living, has bloomed over the past three years into a full-blown social and cultural trend. Pronounced "HOO-ga," it was listed as one of the Oxford English Dictionary's most important words of 2016. Hygge quickly became a marketing buzzword to sell cool Scandinavian items, such as tea-light candles, fluffy throw blankets and woven hats.

"Hygge to the Danes seems to be what freedom is to Americans," says Meik Wiking, chief executive of the Happiness Research Institute and author of "The Little Book of Hygge." "It's ingrained in our cultural DNA."

Hype over hygge doesn't appear to be decreasing. There are more than 3.4 million posts on Instagram bearing the #hygge hashtag. Wiking's "The Little Book of Hygge" has become an international bestseller that has been translated into more than 30 languages. In mid-April, Denmark applied to have the word added to the United Nations Education, Scientific and Cultural Organization's list of "cultural heritage" trademarks, alongside flamenco from Spain, yoga from India and Neapolitan pizza from Italy.

Its international success has book publishers scurrying to find authors in various parts of the world willing to contribute their country's cultural pearls of wisdom. A slew of pocket-size lifestyle guides has resulted, offering a wide range of mindfulness ideas and feel-good advice.

Why would Americans be looking across the Atlantic Ocean to find prescriptions for happiness? Truthfully, Americans could use the advice. The U.S. recently ranked No. 18 on the World Happiness Report, which is much lower than comparably wealthy nations and down four spots from last year's report. In fact, the U.S. has never cracked the top 10. Denmark, on the other hand, ranks consistently in the top three.

"A lot of people feel that they have gotten richer without getting happier and are looking abroad for new sources of inspiration," Wiking says.

Here are four imported lifestyle concepts that have the potential to reach hygge level in the U.S.

Lagom

The Swedish term, pronounced "Lah-GOM," roughly translates as "not too much and not too little."

This natural, less-is-more mentality is all about living simply, harmoniously and sustainably, which is making products last, and striking a happy work-life balance. It is closely tied to the Swedish cultural and social ideology of fairness, moderation and balance, and places an emphasis on collectiveness over individualism.

How can you incorporate it into your life? Niki Brantmark is the author of "Lagom: The Swedish Art of Living a Balanced, Happy Life," and recommends taking a fika (a break involving a hot beverage or a treat) to recharge your batteries during the day. She also recommends decluttering and creating a section in your closet or dresser of only essential clothes — the ones you wear the most — at home to reduce stress and boost productivity.

For instance, if you live somewhere with cold winters and hot summers, you might store away your winter clothes during the summer. Make the things you use most often the easiest to find.

lkigai

Ikigai, pronounced "ee-key-guy," which comes from Japan, roughly translates as one's "reason for being."

Forget about slowing down and cozying up by the fire, hygge-style. This age-old Japanese tradition is all about movement, specifically uncovering your life's purpose and going after it. In the West, it is often associated with a Venn diagram with four overlapping qualities: What you love, what you are good at, what the world needs and what you can be paid for. Within the intersection of these four spheres lies your ikigai and recognizing it will help you become more satisfied with your life.

Bring a little ikigai into your life. Do a little soul-searching and think about different careers you might be interested in. What things bring you joy and purpose? How do those things translate to a job or career? What kind of schooling will you need for that career?

Ikigai is about thinking of the things that give you a reason to jump out of bed in the morning. It's never too early to start thinking about a career path that will bring you joy.

Gezellig

Pronounced "heh-SELL-ick," this word, which comes from the Netherlands, derives from "gezel," which means "companion" or "friend."

This Dutch term praises the warm-and-fuzzy feeling of coziness and togetherness you get when you surround yourself with people, places and things that are comforting, relaxing and good for the soul. Like hygge, it exudes warmth and contentment, but at its core is more sociable and less insular.



You can add gezellig to your life by taking time to relax, unwinding and de-stressing with friends. Good food, company and conversation are sure to inspire the warm-and-fuzzies. Likewise, eliminate negative or emotionally wearing individuals from your life.

Friluftsliv

Pronounced "FREE-loofts-liv," the Norwegian term roughly translates to mean "free air life" or "open-air living."

The deeply rooted philosophical lifestyle is centered on the joy and appreciation of nature, outdoor activities and beautiful scenery. It's about embracing the outdoors, improving your relationship with nature and experiencing the pleasure of being outside, either alone or with others.

How do you incorporate friluftsliv into your life? You can camp, hike, forest-bathe (taking in a forest atmosphere through the senses) or incorporate bike rides and strolls into your routine. For kids, this can mean playing outside, developing relationships with the natural world and striking a healthy balance between screen time and green time.

1

2

3

- Read the following sentences from the article.
 - 1. Niki Brantmark is the author of "Lagom: The Swedish Art of Living a Balanced, Happy Life," and recommends taking a fika (a break involving a hot beverage or a treat) to recharge your batteries during the day.
 - 2. Ikigai is about thinking of the things that give you a reason to jump out of bed in the morning.
 - 3. You can add gezellig to your life by taking time to relax, unwinding and de-stressing with friends.
 - 4. Pronounced "FREE-loofts-liv," the Norwegian term roughly translates to mean "free air life" or "open-air living."

Which two sentences taken together provide the BEST evidence to support the idea that lifestyle concepts of other countries often involve embracing new ways to find peace and calm in one's life?

- (A) 1 and 3
- (B) 1 and 4
- (C) 2 and 3
- (D) 2 and 4

With which statement would Meik Wiking MOST LIKELY agree?

Which line from the article supports your answer?

- (A) Americans are unhappier than other people because they value money too much; The U.S. recently ranked No. 18 on the World Happiness Report, which is much lower than comparably wealthy nations and down four spots from last year's report.
- (B) Americans should let go of their love of freedom if they want to be happier; "Hygge to the Danes seems to be what freedom is to Americans," says Meik Wiking, chief executive of the Happiness Research Institute and author of "The Little Book of Hygge."
- (C) People are learning that money does not necessarily guarantee happiness; "A lot of people feel that they have gotten richer without getting happier and are looking abroad for new sources of inspiration," Wiking says.
- People are learning that hygge is the only lifestyle choice to adopt if they want to be happy; Wiking's
 "The Little Book of Hygge" has become an international bestseller that has been translated into more than 30 languages.
- Read the following paragraph from the article's introduction.

Hype over hygge doesn't appear to be decreasing. There are more than 3.4 million posts on Instagram bearing the #hygge hashtag. Wiking's "The Little Book of Hygge" has become an international bestseller that has been translated into more than 30 languages. In mid-April, Denmark applied to have the word added to the United Nations Education, Scientific and Cultural Organization's list of "cultural heritage" trademarks, alongside flamenco from Spain, yoga from India and Neapolitan pizza from Italy.

What is the MAIN reason why the author includes this paragraph in the article?

- (A) to describe the events that led up to hygge achieving popularity around the world
- (B) to establish that there is large interest in the lifestyle concept of hygge
- (C) to suggest that hygge is currently the best lifestyle concept in the world
- (D) to compare the popularity of a book about hygge with the popularity of hygge on Instagram

Read the section "Ikigai."

4

What is the MOST LIKELY reason for including the diagram in the section?

- (A) to show that ikigai is a concept that affects a person's life in numerous ways
- (B) to compare ikigai with other qualities that contribute to the purpose of a person's life
- (C) to illustrate that ikigai is equal in importance to other qualities in a person's life
- (D) to show how a person's ikigai is the result of various components in a person's life working together

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Curiosity changes the brain to boost memory and learning

By The Conversation, adapted by Newsela staff on 08.07.19 Word Count **772** Level **1200L**



Image 1. A curious child in Vietnam in 2010. Being curious means wanting to know more. People who are curious are also better at remembering things. Photo by: Wagner T. Cassimiro/Flickr

The more curious we are about a topic, the easier it is to remember information about that topic and other unrelated information shown at the same time. A study published in 2014 in Neuron shows what happens inside our brains when our curiosity is sparked.

Participants in the study were asked to rate how curious they were to find out the answer to a specific trivia question, like "What does the term 'dinosaur' actually mean?" The participants were then placed in a magnetic resonance imaging (MRI) machine, which measures brain activity.

The participants saw the trivia question again followed by the image of a person's face and were asked to make a specific decision about the person, and then they were shown the answer to the trivia question, in the dinosaur case, "terrible lizard."

After the MRI scan, the participants completed a surprise test on the answers to the trivia questions. They were also tested on their ability to recognize the faces shown during the scan.

The Curious Mind Is A Vortex For Information

The research produced three key findings that we can learn from.

The first finding is that when people are curious to learn the answer to a question they are better at learning that information. Most surprising though was that participants had greater recall of the completely unrelated information — such as the face — shown at the same time.

It seems that in the curious mind, more information is taken in no matter the subject. Amy Reichelt is a psychology researcher at the University of New South Wales, in Australia. She shared her thoughts about this finding: "This shows that when the brain is engaged more, by making a task relevant and interesting, people learn more."

The second research finding is that activity increases in the hippocampus when curiosity is stimulated. The hippocampus is the region of the brain associated with memory. The last finding is that there is increased activity in the regions of the brain associated with reward when curiosity is stimulated.

Fiona Kumfor is a researcher who focuses on how the emotions you experience during an event determine how likely you are to remember it. Kumfor said that the work in this study agrees with her findings, and that other motivational states, such as curiosity, also influence whether information is likely to be remembered.

Motivations Matter

Behavioral neuroscience is the science of how a person's brain influences their behavior. Jee Hyun Kim, a behavioral neuroscientist, said more could be done to see whether different levels of curiosity and different motivations have an impact on memory and learning.

Extrinsic motivation describes behavior that is driven by goals that come from outside a person, like when a person is motivated by the promise of a reward or the threat of being punished. Intrinsic motivation describes behavior that is driven by rewards that come from inside a person. Intrinsic motivation happens when a person does something because it is naturally satisfying to them. Curiosity is an example of intrinsic motivation.

Kim said scientists should be trying to figure out if people with low curiosity respond better to extrinsic motivation. They should also work more to see if people with high intrinsic motivation are better left to their own devices, she said.

"Finding such a relationship, and how such intrinsic vs. extrinsic motivations may change due to neurological disorders, will have more important practical implications," Kim said. Neurological disorders are diseases suffered by the brain, spinal cord and nerves that connect them. Alzheimer's and dementia are examples of neurological disorders. The diseases make it hard for people to remember things and think, and most people with the diseases are elderly.

Kumfor adds that research into extrinsic rewards on memory is an important research area. According to her, "previous research has suggested that the [benefits] of intrinsic reward and extrinsic reward are not additive." In other words, she said: "Providing additional external rewards, when an individual is already self-motivated is unlikely to have any extra benefit on memory." But external rewards could be useful to a person who is trying to learn something that isn't interesting or who doesn't have enough self-motivation.

Stimulating Curiosity

Reichelt said that "stimulating curiosity is really important across all ages, from schools to the workplace and to elderly care." She said that stimulating curiosity can help children who struggle to learn by increasing their motivation. She noted that the new research is particularly interesting when it comes to people with Alzheimer's or dementia. "Carrying out engaging tasks can help people remember things that are important, and also encourage new learning," she said.

Quiz

1

- HOW does the article develop the idea that curiosity plays an important role in learning and memory?
 - (A) by describing how participants were tested, explaining the results and examining the relationship between motivation and curiosity
 - (B) by explaining the key findings in the study, discussing how the brain influences behavior and suggesting applications
 - (C) by providing the results of the MRI scan, explaining brain anatomy and examining how motivation varies from person to person
 - (D) by outlining the steps involved in the research process, including a question used in the test and citing earlier findings
- 2 Which of the following BEST describes HOW Jee Hyun Kim sees the relationship between motivation and curiosity?
 - (A) People with low curiosity are more likely to be motivated extrinsically.
 - (B) A person's curiosity level may be related to variations in motivation.
 - (C) People with high curiosity are more likely to be motivated intrinsically.
 - (D) A person's curiosity level may indicate how motivation changes.
- 3 Read the section "Motivations Matter."

Which selection from the section BEST describes unhealthy changes in the brain?

- (A) Alzheimer's and dementia
- (B) behavioral neuroscience
- (C) neurological disorders
- (D) low curiosity
- 4 Read the sentence from the section "Motivations Matter."

They should also work more to see if people with high intrinsic motivation are better left to their own devices, she said.

What is the meaning of the phrase "left to their own devices" as used in the sentence?

- (A) allowed to make their own choices
- (B) helped to understand their actions
- (C) given permission to use devices
- (D) encouraged to find motivation

🗋 newsela

Research shows friends are good for your health

By Emily Sohn, Washington Post on 07.20.18 Word Count **1,208** Level **MAX**



(From left) actor and singer Chloe Bailey, singer Sabrina Carpenter, actor Yara Shahidi, actor and singer Halle Bailey and actor Rowan Blanchard standing together at a celebration in Hollywood, California, in 2017. Photo by: Donato Sardella/Getty Images for Coach

Overwhelmed recently by the stress of an impending move -- along with the usual demands of a busy life -- I turned to the people I love.

In small chunks of time between tasks on my to-do list, I called and texted with my sister, my parents, local friends and old friends scattered around the country. Some conversations turned my stress into laughter. Others made me cry. One friend came over to clean out my closet. Then she took our kids for four hours so we could pack without interruption.

With each hug, conversation and gesture of support, I started to feel better. As it turns out, those feelings may be paying long-term dividends, too: According to accumulating evidence, strong relationships breed better health, with benefits that include resilience against heart disease and a longer life.

It's encouraging research that's worth paying attention to. When life gets hectic, making time for friends can be a challenge. And some studies suggest that many of us have fewer friends today

than our parents did a generation ago.

Those obstacles make prioritizing relationships all the more important, experts say.

"A good friendship is a wonderful antidepressant," says psychologist Janice Kiecolt-Glaser, director of the Institute for Behavioral Medicine Research at the Ohio State University College of Medicine in Columbus. "Relationships are so powerful, we don't always appreciate the many levels at which they affect us."

Ever since researchers began to make links between loneliness and poor health about 25 years ago, the scientific literature on the value of friendship has exploded. Today, the data make a convincing case: Having people who care about us is good for us.

In a 2010 meta-analysis that combined data on more than 308,000 people across 148 studies, for example, researchers found a strong connection between social relationships and life span. The size of the effect rivaled that of better-known health-related behaviors such as smoking and exercise.

Because the studies used different methods, the analysis couldn't say exactly how many more years of life we might gain by having true pals, says lead author Julianne Holt-Lunstad, a psychologist at Brigham Young University in Provo, Utah.

But in a 2015 analysis that compiled data on more than 3.4 million people across 70 studies, she and colleagues found that the absence of social connections carried the same health risk as smoking up to 15 cigarettes a day. Loneliness led to worse outcomes than obesity. And the findings held true for people of all ages.

Early on, it seemed possible that healthier people might simply make more friends. But a growing body of research suggests instead that good relationships actually lead to better health. One clue comes from studies that begin with a large group of healthy people and follow them for decades. Experimental work on animals has also linked isolation with earlier death.

And plenty of studies have revealed biological theories that may explain what makes us healthier when we feel supported: lower blood pressure, better hormone function, stronger immune systems and possibly lower levels of inflammation.

Meanwhile, friends can influence health-related behaviors through peer pressure that values healthy eating, exercise, taking prescriptions and going to doctor's appointments, Holt-Lunstad adds. True friendships can also give us a sense of purpose, making us more motivated to take care of ourselves.

But even as evidence piles up to support the value of bonding, the nature of friendship seems to be changing, says Glenn Sparks, a communications professor at Purdue University in West Lafayette, Indiana, who studies how media affect people. One reason is that people move more frequently than they used to. And for many people, a focus on display screens has replaced a focus on faces.

Sparks remembers arriving at Purdue in 1986 and marveling at a stretch of sidewalk on campus dubbed the "Hello Walk." The point was to smile and say hello to the people you passed there, and that's what students did.

"Today, you walk down that sidewalk and people are staring at their iPhones and iPads and in some cases even their laptops," says Sparks, co-author of "Refrigerator Rights: Creating Connections and Restoring Relationships." "Their ear buds are in and they're gone into some virtual space. We think that really takes a toll on the relational health of any community."

Technology isn't necessarily all bad, he adds. Facebook and Skype can help keep people connected from afar, and science hasn't yet caught up with the nuanced ways that digital devices might alter relationships. But a confluence of factors seems to be threatening the potential for connection.

According to a long-term study published in 2006, people had an average of about three friends they felt they could discuss important things with in 1984. By 2005, the average number of confidants had dropped to about two. At the end of the study, close to 25 percent of respondents said they didn't have anyone they could truly trust, triple the proportion from two decades earlier.

More recently, a 2010 study by AARP surveyed more than 3,000 people 45 and older and found that 35 percent scored in the lonely category. Another survey, published this year by researchers at the University of Oxford in England, included more than 3,300 British people and found that, even though respondents averaged 155 Facebook connections, the number they felt they could approach in times of extreme distress was just four.

It's not necessarily important to have a lot of friends, though some studies suggest that more might be better than fewer. The AARP survey found that loneliness rates were highest in people who had fewer than three close friends, and having five or more was better than having three or four.

What is clear is that quality trumps quantity. Just as strong relationships can improve health measures, toxic or stressful relationships can lead to depression, high blood pressure and other negative outcomes.

In one recent study, Kiecolt-Glaser and colleagues asked married couples to discuss something they disagreed about. Over the next day, pairs that both included someone with a history of depression and had argued with hostility burned fewer calories than did those who talked to each other with more kindness. That suggests that relationship quality can affect metabolism.

So how can we cultivate more and stronger relationships? Science can't yet say. Studies that have randomly assigned patients in hospitals to be part of a support group or have sent visitors to sit with lonely people have produced mixed results, probably because of chemistry: There's no guarantee that two people will click.

A better strategy, Holt-Lundstad suspects, is to try volunteering or joining activities that allow for interaction with a wide variety of people. It's also worth making a conscious effort to be the kind of friend you'd like people to be for you, Kiecolt-Glaser says. That includes being supportive, being there when friends need you, having fun together and making an effort to listen, even when you're busy or stressed-out.

In my case, I'm going to try to remember how much it meant to me when friends helped us with our move. And if I can organize a closet or even show up to give a hug, I'll do my best to be there. After all, there's something in it for me, too. Quiz

1

One CENTRAL idea of the article is that the nature of our friendships can affect our health.

Which two details BEST support the idea above?

- 1. One clue comes from studies that begin with a large group of healthy people and follow them for decades.
- 2. And plenty of studies have revealed biological theories that may explain what makes us healthier when we feel supported: lower blood pressure, better hormone function, stronger immune systems and possibly lower levels of inflammation.
- 3. At the end of the study, close to 25 percent of respondents said they didn't have anyone they could truly trust, triple the proportion from two decades earlier.
- 4. Just as strong relationships can improve health measures, toxic or stressful relationships can lead to depression, high blood pressure and other negative outcomes.
- (A) 1 and 3
- (B) 2 and 3
- (C) 1 and 4
- (D) 2 and 4

2

- HOW does the CENTRAL idea that modern friendship is changing emerge in the article?
 - (A) through an opinion and anecdote about the role of technology in interactions and evidence that the number of people's close friends has shrunk in recent decades
 - (B) through an outline of the way that connections are growing as a result of Facebook and Skype and studies of improved friendships among the elderly
 - (C) through a comparison between the friendships the author developed as a young person close to home and those she has found after moving far away
 - (D) through a contrast between the ways that people made friends long ago and the ways science has proven to be most effective in recent years
- 3 According to the article, which of the following are reasons WHY researchers believe friendships lead to better health?
 - 1. Research shows married couples feel more positively about life than single people.
 - 2. Support can lead to healthier biological indicators like lower blood pressure and stronger immune systems.
 - 3. Friends can influence health-related behaviors through positive peer pressure and providing a sense of purpose.
 - 4. Studies suggest that using kindness can positively affect metabolism.
 - (A) 1 and 2 only
 - (B) 2 and 3 only
 - (C) 1, 2 and 4
 - (D) 2, 3 and 4

- WHY does the author begin the article by describing the experience of her recent move?
 - (A) to indicate that she personally wanted to take part in the new study of friendship and health
 - (B) to highlight the way her perspective on friendship was changed recently
 - (C) to provide an anecdote about the way that close friends can help relieve stress
 - (D) to explore the way that her friendships have changed since she has moved



The tipi goes modern and bright for a special museum exhibit

By Smithsonian.com, adapted by Newsela staff on 03.19.18 Word Count **987** Level **1190L**



Manifestipi, 2016 by ITWÉ Collective. Courtesy of ITWÉ and Collection Majudia. This special installation is part of the exhibition "Transformer: Native Art in Light and Sound" at the Smithsonian's National Museum of the American Indian, George Gustav Heye Center in New York City. Photo: Joshua Voda/National Museum of the American Indian

Some symbols are so familiar that even with different surroundings, colors and materials, they remain immediately recognizable. That's the case of the five neon-colored tipis that anchor an exhibit called "Manifestipi." The exhibit is on view at the Smithsonian's National Museum of the American Indian's George Gustav Heye Center in New York City.

Created by ITWÉ Collective, a trio of artists based in Winnipeg and Montreal, Canada, the 8-foottall structures are made of frosted plexiglass. They look nothing like what we think of as a traditional tipi, also spelled tepee, but are unmistakably that.

"You see the tipi, you immediately recognize it — but the artists are doing something very unconventional with the form," says Kathleen Ash-Milby, associate curator of the National Museum of the American Indian. "These are plexiglass, the colors are constantly shifting, it's not a traditional palette you might normally associate with native people."

"A Powerful Symbol Of Our Culture"

The tension between tradition and change is evoked in the exhibition's multimedia elements. A shifting soundscape, created by audio artist and musician Michel Germain, who worked with ITWÉ on the project, fills the room. On the wall, historic images and illustrations of native people, sourced from the Saint-Boniface archives in Manitoba, Canada, are played in a continuous loop with bright streaks and patches of color added by the artists. The colors of the tipis drift from pink to blue to orange and back.

"We have been evolving tremendously, and the tipi still remains a powerful symbol of our culture," explains artist Caroline Monnet, who is Algonquin North American Indian and French. She is a multimedia artist based in Montreal, Canada, and a member of the ITWÉ trio. The others are Kevin Lee Burton, of the Swampy Cree people, and Sébastien Aubin, who is Cree and Metis. "However, we cannot put all indigenous people in the same bag. ... We are challenging the tipi as a stereotypical symbol of our culture and therefore making it fun and accessible to all," Monnet said.

To Be Empowering

The title brings to mind the 19th-century belief in "Manifest Destiny." In the 1800s, white U.S. settlers believed that occupying and annexing Native American lands throughout North America was a God-given right. Today, ITWÉ aims to reframe the idea of "manifestation" into something empowering for indigenous people.

"Like, 'manifest something' or reignite something — to manifest your own reality," Burton says. "To try not to get caught up in a downward spiral or wallow in self-hatred. We're engaging in conversation from a different angle, trying to step toward another future: What is inside your heart, celebrating your culture, yourself, your identity, your nation, your history — and making a present tense."

Monnet shared a similar sentiment about the meaning of the exhibit's name.

"Manifestipi was created with the aim of opening up dialogue, taking up space as indigenous people but also inviting other nations to be part of our manifestation," she explained.

The Circle Of Open Dialogue

The artists laid out the work in a circle, in a way that resembles a gathering place. Its location is in the lower level of the museum, where the institution traditionally brings groups for education, meetings or performances. A circle is painted onto the room's floor, which evokes the sense of open dialogue that the artists hope will take place among people who visit the exhibit.

The layout also reflects the democratic approach that ITWÉ has developed for all its projects since it was formed in 2010. Each member is empowered to speak their mind and to share ideas. The three members have different backgrounds and artistic interests. Together, they create art that is distinct from their individual work.

"Kevin has a strong background in filmmaking, new media and community work, Sébastien is coming from his graphic design perspective and I bring some experience in visual arts and filmmaking," Monnet says. "Together, we weave our respective interests, expertise and cultural background to create new works."

An "Urban Indigenous" Tipi

The work itself is an evolution of form and materials. ITWÉ created the original Manifestipi in 2013 as an outdoor work set on The Forks in Winnipeg, Canada. The location is a historic gathering place where two rivers, the Red River and Assiniboine River, meet.

In the outdoor version, the video was projected onto trees, with dry ice used to imitate a fire burning inside a tipi. Made of metal poles, wires and rope, it was "less refined than the work we have now," Burton says.

In this first version, the trio created its own camp by using materials from city surroundings, making a type of a tipi as "urban indigenous," Monnet said. "We wanted to take back territories and space. We wanted to occupy space and grounds."

Burton adds that the work was meant to be a statement about occupied space, reimagining The Forks as if it were still the home of indigenous people.

"We couldn't just go and chop down trees," he explains, "but we sourced the wiring and metal rods for the tipis from local sellers, enacting that process of gathering local materials." Everyone had a hand in building it, he says.

Newly Neon And Transportable

After its exhibition at The Forks, Manifestipi went on to be shown at three galleries throughout Canada, evolving as it traveled. The design changed, the number of tipis grew from one to five, and in 2016, ITWÉ worked with engineers to manufacture the current versions of the neon-colored structures.

The exhibit was made more transportable, too. The importance of making the work easy to move was not just for convenience, but emphasized the theme of the nomadic lifestyle of those who had to migrate over the seasons.

Ash-Milby says that it aims to help viewers rethink what is meant by "tradition." Rather than something that's static or in the past, "tradition is really about things being in motion and changing."

Quiz

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Read the paragraph from the section "A Powerful Symbol Of Our Culture."

"We have been evolving tremendously, and the tipi still remains a powerful symbol of our culture," explains artist Caroline Monnet, who is Algonquin North American Indian and French. She is a multimedia artist based in Montreal, Canada, and a member of the ITWÉ trio. The others are Kevin Lee Burton, of the Swampy Cree people, and Sébastien Aubin, who is Cree and Metis. "However, we cannot put all indigenous people in the same bag. ... We are challenging the tipi as a stereotypical symbol of our culture and therefore making it fun and accessible to all," Monnet said.

What conclusion is BEST supported by this paragraph?

- (A) ITWÉ rejects the idea that the tipi is a symbol of Native American culture.
- (B) ITWÉ wants to transform the way people view the tipi as a symbol of Native American culture.
- (C) ITWÉ embraces the idea of the tipi being a stereotypical symbol of Native American culture.
- (D) ITWÉ believes the tipi symbol brings power to all people of the Native American culture.
- Read the selection from the section "The Circle Of Open Dialogue."

The artists laid out the work in a circle, in a way that resembles a gathering place. Its location is in the lower level of the museum, where the institution traditionally brings groups for education, meetings or performances. A circle is painted onto the room's floor, which evokes the sense of open dialogue that the artists hope will take place among people who visit the exhibit.

The layout also reflects the democratic approach that ITWÉ has developed for all its projects since it was formed in 2010. Each member is empowered to speak their mind and to share ideas. The three members have different backgrounds and artistic interests. Together, they create art that is distinct from their individual work.

Which sentence from the selection BEST supports the idea that ITWÉ designed the "Manifestipi" exhibit in a way that encourages a response from viewers?

- (A) The artists laid out the work in a circle, in a way that resembles a gathering place.
- (B) Its location is in the lower level of the museum, where the institution traditionally brings groups for education, meetings or performances.
- (C) A circle is painted onto the room's floor, which evokes the sense of open dialogue that the artists hope will take place among people who visit the exhibit.
- (D) The layout also reflects the democratic approach that ITWÉ has developed for all its projects since it was formed in 2010.
- What is the connection between the introduction and the conclusion of the article?
 - (A) The introduction describes some ways that the tipis in the Manifestipi exhibit are different from traditional tipis; the conclusion describes additional ways that the exhibit tipis are different from traditional tipis.
 - (B) The introduction mentions the associate curator of the museum where the Manifestipi exhibit is displayed; the conclusion explains how she became the curator of the Manifestipi exhibit.
 - (C) The introduction explains that the artists who created the Manifestipi exhibit are based in Canada; the conclusion explains why these artists first showed the exhibit in Canada.
 - (D) The introduction explains how the Manifestipi tipis have changed from traditional tipis; the conclusion describes how the meaning of "tradition" is about things changing.

Each of the following answer choices contains the first sentence of a paragraph in the article.

Which sentence marks a major shift in the article's development?

- (A) The tension between tradition and change is evoked in the exhibition's multimedia elements.
- (B) "We have been evolving tremendously, and the tipi still remains a powerful symbol of our culture," explains artist Caroline Monnet, who is Algonquin North American Indian and French.
- (C) "Kevin has a strong background in filmmaking, new media and community work, Sébastien is coming from his graphic design perspective and I bring some experience in visual arts and filmmaking," Monnet says.
- (D) After its exhibition at The Forks, Manifestipi went on to be shown at three galleries throughout Canada, evolving as it traveled.

4

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No magic wand: How J.K. Rowling became the first billionaire author

By Biography.com, adapted by Newsela staff on 03.13.19 Word Count **962** Level **1210**L



Image 1. Author J.K. Rowling attends the U.K. premiere of "Fantastic Beasts: The Crimes Of Grindelwald" at Cineworld Leicester Square on November 13, 2018, in London, England. She wrote the screenplay of the movie. Photo by: John Phillips/Getty Images

In 1990, as she waited on a delayed train bound for London, England, a young woman named Joanne Rowling began musing on the idea of an adolescent boy who attends a school for wizards. This was the very beginning of Harry Potter.

Nevertheless, it would take far more than a magic spell and the wave of a wand for the aspiring author to bring him to life.

Tragedy, And A Drastic Move

At the time Harry first popped into her head, Rowling was in a confusing place in her life. She had just finished college and wasn't sure yet what she wanted to pursue. She had worked a series of short-term jobs since earning her French degree at the University of Exeter and was looking at a move to Manchester, England, to live with her boyfriend.

Everything abruptly changed at the end of the year when her mother, Anne, lost a decade-plus battle with multiple sclerosis at age 45. Devastated, Rowling sought refuge in the thrill of a new, adventurous life, and moved to Portugal to teach English.

Settling in the coastal city of Porto, Portugal, Rowling scrawled out the beginnings of Harry Potter before spending her evenings teaching. She eventually met and fell in love with aspiring journalist Jorge Arantes.

Struggles Of A Single Mom

Rowling ignored her friends' concerns about the state of their relationship and married Arantes in October 1992. She gave birth to a baby girl, Jessica, the following July.

Meanwhile, Arantes had grown increasingly abusive. The final straw came with an ugly fight in November 1993, when Arantes harshly slapped his wife and threw her out of the home without Jessica. Rowling soon returned with the police to take her daughter, and within weeks they were on a plane back to the United Kingdom (U.K.), along with the first three chapters of Harry Potter.

After spending the holidays at the Edinburgh, Scotland, home of her sister and brother-in-law, Rowling applied for government benefits that helped her secure a small apartment and weekly money for living expenses. She grudgingly accepted a friend's loan for a deposit on a more welcoming apartment. Then Rowling began spending her days at her brother-in-law's café with Jessica by her side, as she continued the long march through her manuscript.



"As Poor As It Is Possible To Be"

Barely getting by with the help of friends and family -

"as poor as it is possible to be in modern Britain, without being homeless," she later described it – Rowling found herself increasingly in despair. She was angry over her failures and felt guilty about her inability to provide for her daughter. As a reminder of her missteps, Arantes showed up in an attempt to get back together, though he retreated after Rowling obtained a restraining order.

Finding it almost unbearable to face so many challenges in her life, Rowling struggled with thoughts of suicide. Taking her own life felt like a solution at the time but she realized she wanted to work through her problems for the sake of her daughter, if no one else. She began seeing a mental health counselor and when her outlook improved with therapy she set her sights on a one-year teaching training course. Still, there was the matter of unfinished business with the boy wizard who occasionally flew through her imagination.

Harry Potter To The Rescue

Upon completing her manuscript in 1995, Rowling followed through with the plan for teachers' certification while hunting down literary representation. A three-chapter sample of Harry Potter was enough to reel in the London agent Christopher Little. Still, publishing houses seemed largely immune to the magic of Harry, Ron, Hermione and company.

Following a dozen rejections, Little finally found a taker in London publishing house Bloomsbury, which offered a £1,500 advance. This payment, which comes before a book is published, was equal to around \$2,400 in U.S. dollars at that time. Rowling also snagged an £8,000 grant from the Scottish Arts Council, or about \$12,800 dollars. This payment helped her buy a brand-new typewriter and finish a Harry Potter sequel.

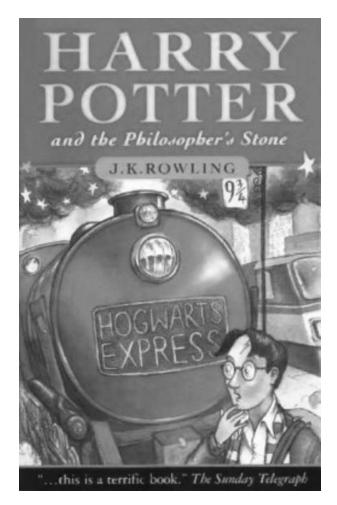
On June 26, 1997, the author saw her hard work pay off with the publication of "Harry Potter and the Philosopher's Stone" in the U.K. She was now known as J.K. Rowling because of concerns about how boys would respond to a female writer, but the name change was fitting in that her life of privacy was about to end.

Hooray For Hollywood!

Within days of Harry's debut, children's publishing powerhouse Scholastic had bid more than \$100,000 for the American publishing rights. Scholastic renamed the book "Harry Potter and the Sorcerer's Stone." The highly successful sequel, "Harry Potter and the Chamber of Secrets," followed a year later. By the fall of 1998, Warner Bros. was on board with a feature film deal.

The rest reads like a fairy tale. Rowling was a billionaire by 2004 when Hollywood was still only halfway through eight Harry Potter films and well before the launch of another cash-cow series, Fantastic Beasts. She also found love again, with Scottish doctor Neil Murray, and continued churning out bestsellers on the strength of her name and addictive stories.

Rowling's life looks charmed from the outside. However, she faced many struggles early on, and failed more than once when trying to get her first book published. Luckily for all Harry Potter fans, she never gave up.



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Read the following statement.

Few people know that Rowling's success did not come easy.

Which sentence from the article BEST supports the statement above?

- (A) Nevertheless, it would take far more than a magic spell and the wave of a wand for the aspiring author to bring him to life.
- (B) Meanwhile, Arantes had grown increasingly abusive.
- (C) Barely getting by with the help of friends and family "as poor as it is possible to be in modern Britain, without being homeless," she later described it Rowling found herself increasingly in despair.
- (D) Rowling's life looks charmed from the outside.
- 2 Read the paragraph from the section "Harry Potter To The Rescue."

On June 26, 1997, the author saw her hard work pay off with the publication of "Harry Potter and the Philosopher's Stone" in the U.K. She was now known as J.K. Rowling because of concerns about how boys would respond to a female writer, but the name change was fitting in that her life of privacy was about to end.

Which of the following can be inferred from the paragraph above?

- (A) Rowling suggested the name change because she wanted boys to understand her book.
- (B) Rowling was willing to have her name changed if it meant that boys would read her book.
- (C) Rowling agreed to the name change because she wanted to be a more private person.
- (D) Rowling agreed to the name change because she anticipated that her privacy was going to end.

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

- (A) The first paragraph describes how Rowling first had the idea of Harry Potter, and the final paragraph explains how she got ideas for subsequent Harry Potter books.
- (B) The first paragraph describes how Rowling conceived the idea of Harry Potter, and the final paragraph explains how that idea evolved over time.
- (C) The first paragraph describes how Rowling conceived the first Harry Potter book, and the final paragraph reviews what she had to endure to bring the book to fruition.
- (D) The first paragraph describes how a train problem led to Rowling musing about Harry Potter, and the final paragraph explains how that problem was eventually solved.

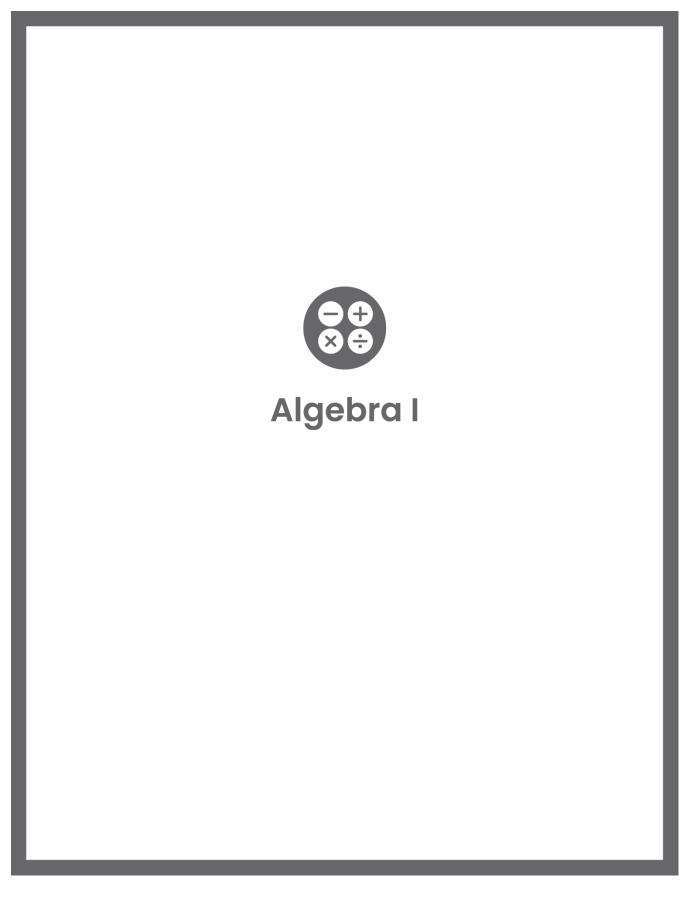
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Rowling soon returned – with a police presence – to take her daughter, and within weeks they were on a plane back to the United Kingdom (U.K.), along with the first three chapters of Harry Potter.

Then Rowling began spending her days at her brother-in-law's café with Jessica by her side, as she continued the long march through her manuscript.

Which option BEST describes how the sentences help develop a central idea of the article?

- (A) They both show that Rowling was very clever at finding ways to solve difficult problems.
- (B) They both show that Rowling was greatly affected by terrible tragedies that occurred in her life.
- (C) They both show that Rowling asked others for help so she could work on her Potter book.
- (D) They both show that Rowling worked on her Potter manuscript even during challenging times.





Ninth Grade Summer At-Home Learning

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WARM UP

Solve each equation.

- 1. 2.5x + 100 = 600
- 2. 10 = 2x 4
- 3. $\frac{1}{4}x + 5 = 30$

LEARNING GOALS

- Use strategies to solve linear equations with variables on both sides of the equals sign.
- Solve linear equations with rational number coefficients.
- Combine like terms and use the Distributive Property to solve linear equations.

You have solved equations by combining like terms and using inverse operations. How can you solve equations when there are variables on both sides of the equation?

Build It Up and Break It Down

The Properties of Equality allow you to solve equations.

Properties of Equality	For all numbers <i>a</i> , <i>b</i> , and c
Addition Property of Equality	If $a = b$, then $a + c = b + c$.
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$.
Multiplication Property of Equality	If $a = b$, then $ac = bc$.
Division Property of Equality	If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.

These properties also allow you to create more complex equations. For example, given the equation x = 2, you can use the Addition Property of Equality to create x + 1 = 2 + 1, which is the same as x + 1 = 3. Since you used the Properties of Equality, the two equations have the same solution.

1. Consider each given equation. Use the Properties of Equality to create an equivalent equation in the form ax + b = c, where *a*, *b*, and *c* can be any number. Record the Properties of Equality you used to create your new equation.

b. x = -1

a. *x* = 5

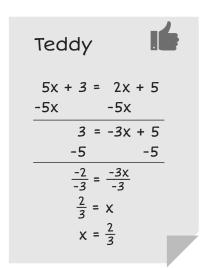
2. Give each of your equations to a partner to verify that each equation has the correct solution.

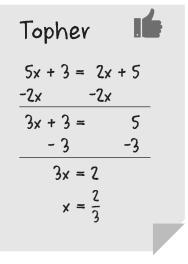
To solve a two-step equation, isolate the variable term on one side of the equation and the constant on the other side of the equation. Then multiply or divide both sides of the equation by the numeric coefficient to determine the value of the variable. **Α**CTIVITY

You have previously solved two-step equations using a variety of strategies. In this activity you will learn different strategies to solve equations with variables on both sides. Remember, to solve an equation means to determine the value of the unknown that makes the equation true.

Consider the equation 5x + 3 = 2x + 5.

Teddy and Topher each solved it in a different way. Analyze their solution strategies.



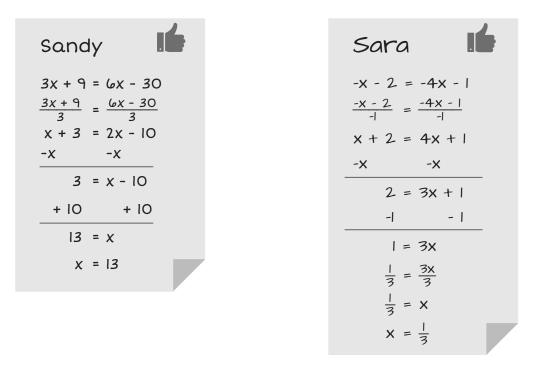


- 1. Compare the two solution strategies.
 - a. How were their solution strategies the same? How were they different?
 - b. Which strategy do you prefer? Explain your choice.
- 2. Solve each equation. Describe why you chose your solution strategy.

a. x - 6 = 5x + 10 b. 2x - 7 = -5x + 14

To begin solving an equation with variables on both sides of the equation, move all the variable terms to one side of the equation and all the constants to the other side of the equation. Consider the two different equations that Sandy and Sara solved.





- 3. Sandy and Sara each divided both sides of their equations by a factor and then solved.
 - a. Explain the reasoning used by each.

- b. Do you think this solution strategy will work for any equation? Explain your reasoning.
- 4. Solve each equation using the strategy similar to Sandy and Sara.

a. -4x + 8 = 2x + 10 b. -42x = -4x - 1

ACTIVITY **1.2**

Solving Equations with Efficiency



As you saw in the last activity, there can be more than one way to solve an equation. Sometimes an efficient strategy involves changing the numbers in the equation—in mathematically appropriate ways.

WORKED EXAMPLE

Consider the equation $\frac{1}{3}(2x + 7) + \frac{5}{6} = \frac{5}{3}x$.

You can multiply both sides of the equation by the least common denominator (LCD) of the fractions to convert the fractions to whole numbers.

 $\frac{1}{3}(2x + 7) + \frac{5}{6} = \frac{5}{3}x \quad \leftarrow \quad \text{The LCD of the fractions is 6.} \\ \text{Multiply both sides by 6.} \\ 2(2x + 7) + 5 = 10x \quad \leftarrow \quad \text{Rewrite using the Distributive Property.} \\ 4x + 14 + 5 = 10x \quad \leftarrow \quad \text{Rewrite using the Distributive Property.} \\ \end{array}$

- Explain how both sides of the equation were multiplied by 6 in the first step.
- 2. What is the solution to the equation $\frac{1}{3}(2x + 7) + \frac{5}{6} = \frac{5}{3}x$? Check your solution.

A savvy mathematician (you!) can look at an equation, see the structure of the equation, and look for the most efficient solution strategy. 3. Explain why Cody's reasoning is incorrect.

Cody $-\frac{3}{4}x = \frac{1}{2}x + \frac{5}{4}$ $4(-\frac{3}{4}x) = 4(\frac{1}{2}x + \frac{5}{4})$ -3x = 2x + 5 -5x = 5 x = -1Since I multiplied both sides by 4 to get the solution,
I have to divide the solution by 4: $x = -\frac{1}{4}$

4. Solve each equation by first multiplying both sides of the equation by the LCD. Check your solutions.

a.
$$\frac{1}{4}(x-5) + 9 = \frac{1}{2}x$$
 b. $\frac{5}{4}(x+\frac{1}{2}) + 8 = \frac{1}{8}x$



5. Mindy and David multiplied both sides of the equation 2.5x + 1.4 = 0.5x + 2 by 10 before solving the equation. The first step of each strategy is shown. Who's correct? What is the error in the other strategy?

You can multiply both sides of an equation by powers of 10 to convert all numbers to whole numbers. Mindy 25x + 14 = 5x + 2 25x + 14 = 5x + 20



Solve each equation.

1. 12.6 + 4x = 9.6 + 8x

2.
$$-12.11x - 10.5 = 75.6 - 3.5x$$

3.
$$\frac{10x+2}{2} = 4x + \frac{1}{4}$$

4.
$$\frac{3}{8}(x + 8) = \frac{1}{2}(x + 5) + \frac{1}{4}$$

5.
$$\frac{-2(5x+4)}{3} = -3(3x+2) - \frac{7}{3}$$

NOTES

TALK the TALK 📥

Building Strategically

Use each starting equation to build an equation with variables on both sides that can be solved using the given strategy. Then, give your equations to a partner to solve.

1. h = 1.6, factor out a number from both sides

2. j = 5, multiply both sides by the LCD to rewrite fractions as whole numbers

3. $k = \frac{1}{3}$, multiply both sides by a power of 10 to rewrite decimals as whole numbers

Assignment

Write

Explain the process of solving an equation with variables on both sides.

Remember

You can use Properties of Equality to rewrite equations and increase your efficiency with solving equations.

- Factor out a number from both sides.
- Multiply both sides of an equation by the least common denominator of the fractions to rewrite fractions as whole numbers.
- Multiply both sides of an equation by a power of 10 to rewrite decimals as whole numbers.
- Use the Distributive Property to rewrite expressions.

Practice

Solve each equation. 1. 5x + 15 = 75 - 25x3. 4x = 20x - 245. 9.6x - 15.4 = -4.3x + 26.3

2. $\frac{1}{4}x - 3 = \frac{1}{2}x + 12$ 4. 11.3x + 12.8 = 7.5x + 35.66. -2x - 1.4 = 6 + 3x

Stretch

You can solve an equation with two variables by trying different values. What is the solution to the equation 2x + 3y = 13?

Review

1. Rodell took a survey of his classmates. The data from the survey are shown in the two-way table.

	Lunch Options								
		Chicken Nuggets	Peanut Butter & Jelly	Pizza	Salad	Total			
Gender	Male	2	3	4	0	9			
Ű	Female	3	1	3	4	11			
	Total	5	4	7	4	20			

Student's Lunch Preference

a. Which lunch option is the most favorite of the males?

b. Which lunch option is the most favorite of the females?

2. Isabel surveyed three classes about their favorite season. The data from the survey are shown in the twoway table. Complete the relative frequencies for each row. If necessary, round decimals to the nearest thousandth.

	Seasons								
		Winter	Spring	Summer	Fall	Total			
Classes	Class A	9	2	7	6	24			
Clas	Class B	2	5	9	4	20			
	Class C	8	6	10	4	28			
	Total	19	13	26	14	72			

Student's Season Preference

Student's Season Preference

	Seasons								
		Winter	Spring	Summer	Fall	Total			
Classes	Class A	$\frac{9}{24} = 0.375$							
Clas	Class B								
	Class C								

3. Calculate the slope of the line represented by each table.

a.	х	Y	b.	Х	Y
	4	8		2	5
	10	11		4	3
	16	14		5	2
	20	16		8	-1

WARM UP

Members of a community service club are collecting pull tabs from aluminum cans to support a local hospital's initiative.

- Sadie collected the least number of pull tabs.
- Emma collected 15 more pull tabs than Sadie.
- Ricky collected 4 times as many as Emma.
- Lily collected 10 fewer than Ricky.

Define a variable to represent the number of pull tabs that Sadie collected. Then, write algebraic expressions to represent the number of pull tabs that each of the other students collected.

LEARNING GOALS

- Write and solve linear equations in one variable.
- Determine whether an equation has one solution, no solutions, or infinite solutions by successively transforming the equation into simpler forms.
- Interpret expressions in and solutions to equations in the context of problem situations.

You have learned how to use strategies to solve complex equations with variables on both sides. How can you determine when an equation has no solutions or infinite solutions?

No One Knows Exactly

Sometimes, you are asked to determine the value of unknown quantities using only information you have for a quantity.

Five friends have a certain number of DVDs.

- Dan has the fewest.
- Donna has 7 more than Dan.
- Betty has twice as many as Donna.
- Jerry has 3 times as many as Dan.
- Kenesha has 6 fewer than Donna.
- 1. Define a variable for the number of DVDs that Dan has.



2. Use your defined variable to write algebraic expressions to represent the number of DVDs each person has.

ACTIVITY **2.1**



Use the expressions you wrote in the previous activity to answer each question.

- 1. Is it possible for Jerry and Kenesha to have an equal number of DVDs? Write and solve an algebraic equation to explain why or why not.
- 2. Kim and Corinne share their own set of DVDs. Kim has 6 times as many as Dan has, and Corinne has twice as many as Jerry has. Can you write and solve an equation to determine how many DVDs each girl has? Explain your reasoning.
- 3. If the original group of friends has a total of 182 DVDs all together, then how many does each person have? Make sure to check your work.
 - a. DVDs that Dan owns: b. DVDs that Donna owns:
 - c. DVDs that Betty owns: d. DVDs that Jerry owns:
 - e. DVDs that Kenesha owns:
- 4. Write and solve an algebraic equation to show why Donna's reasoning is incorrect.

Donna

Donna says that the sum of the number of her DVDs and Kenesha's DVDs is the same as the number of DVDs that Betty owns.



Terry, Trudy, Tom, and Trevor have challenged their friends with this riddle.

ACTIVITY

- Terry said, "If you add 150 to the number of MP3 downloads Tom has, double that number, and finally divide by 3, you have the number of MP3 downloads I have."
- Trudy said, "If you take the number of MP3 downloads Tom has, subtract 30, multiply that difference by 5, and finally divide that product by 4, the result will be the number of MP3 downloads I have."
- Trevor said, "Well, if you take twice the number of MP3 downloads Tom has, add 30, multiply the sum by 4, and finally divide that product by 3, you will have the number of MP3 downloads I have."
- 1. What do you need to know to determine the number of MP3 downloads each person has?
- 2. Define a variable for the number of MP3 downloads Tom has, and then write expressions for the number of MP3 downloads each of the other people has.
 - a. The number of MP3 downloads Terry has:
 - b. The number of MP3 downloads Trudy has:
 - c. The number of MP3 downloads Trevor has:

3. Suppose Tom has 150 MP3 downloads. Determine how many MP3 downloads each person has.

Terry Trudy	Trevor
-------------	--------

4. What if Terry and Trevor have the same number of MP3 downloads? How many MP3 downloads would each person have?

Tom

Trudy

Trevor and Terry

5. What if the sum of Trudy's and Trevor's MP3 downloads is 39 more than the number Terry has? How many would each person have?

Tom	Trudy
-----	-------

Trevor

Terry

activity **2.3**

One Solution, No Solutions, or Infinite Solutions



Amy and Damon were solving an equation from their math homework. They came across the equation shown.

$$3x + 7 = 5x + 2(3 - x) + 1$$

Examine each solution strategy.

Amy 3x + 7 = 5x + 2(3 - x) + 1 3x - 5x + 7 = 5x - 5x + 2(3 - x) + 1 -2x + 7 = 2(3 - x) + 1 -2x + 7 = 6 + (-2x) + 1 -2x + 7 = 7 + (-2x) -2x + 2x + 7 = 7 + (-2x) + 2x 7 = 7



Damon

3x + 7 = 5x + 2(3 - x) + 13x + 7 = 5x + 6 + (-2x) + 13x + 7 = 5x + (-2x) + 6 + 13x + 7 = 3x + 73x + 7 + (-7) = 3x + 7 + (-7) $\frac{3x}{3} = \frac{3x}{3}$ x = x

1.	Explain why both Amy's and Damon's methods are correct but
	have different solutions.



2.	How would you interpret the final equation in each solution? Is the final equation always true, sometimes true, or never true? Explain your reasoning.	
3.	Explain whether the equation has one solution, no solution, or an infinite number of solutions.	

Consider this new equation:

What

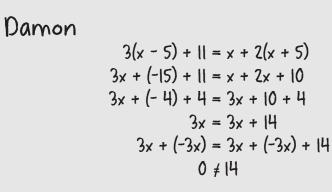
happened to

the term with the variable?

$$3(x-5) + 11 = x + 2(x + 5)$$

Examine each solution strategy.

••	Amy	3(x - 5) + = x + 2(x + 5) 3x + (-15) + = x + 2x + 0 3x + (-4) = 3x + 0 3x - 3x + (-4) = 3x - 3x + 0 $-4 \neq 0$, if the second s



4. Explain why both Amy's and Damon's methods are correct but have different solutions.

5. How would you interpret the final equation in each solution? Is the final equation always true, sometimes true, or never true? Explain your reasoning.



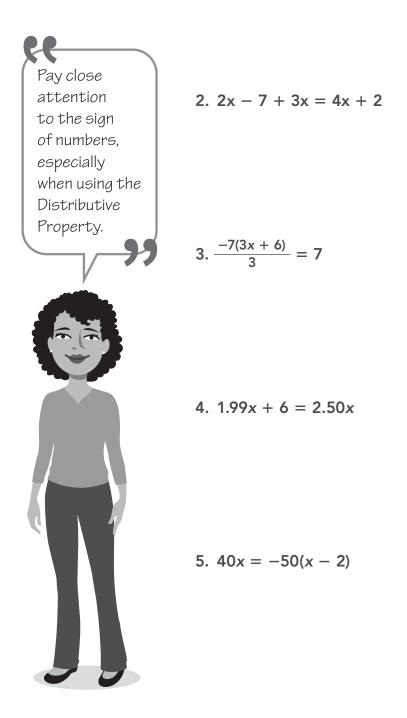
6. Explain whether the equation has one solution, no solution, or an infinite number of solutions.

^{ACTIVITY}

Practice Solving Equations with Rational Coefficients

Solve each equation shown. Make sure to check your work.

1.
$$\frac{3}{4}(2x + 5) = 14$$



6. 30(x - 10) = 15x

7.
$$3(x - 1) + x = 4(x + 2)$$

8.
$$5(2x - 1) + x + 17 = 5x + 6(x + 2)$$

9.
$$\frac{-3(-2x-5)}{4} = -5(3x+5) + \frac{5}{4}$$

10.
$$\frac{2}{3}(6x - 5) = 2 - \frac{1}{3}(3x - 2)$$



TALK the TALK 中

How Do You Know?

- 1. When you solve any equation, describe how you know when there will be:
 - a. one solution.

b. no solutions.

c. infinite solutions.

Assignment

Write

Write three equations, one that has one solution, one that has no solutions, and one that has infinite solutions.

Remember

An equation can have one solution, no solutions, or infinite solutions.

Practice

- 1. Don has four different chicken coops on his farm. He gathers eggs from each coop every day to sell at the local farmer's market each week. During one week in the summer, the production levels from the coops were compared.
 - The number of eggs from coop B can be found by subtracting 10 from coop A's production, and then multiplying this result by two-fifths.
 - The number of eggs from coop C can be found by adding 3 to coop A's production, multiplying this amount by 3, subtracting 4 from this total, and then dividing the whole result by 4.
 - The number of eggs from coop D can be found by adding 7 to coop A's production, doubling this amount and then dividing the result by 3.
 - a. Define a variable for the number of eggs produced by coop A. Then write expressions for the number of eggs produced by the other coops.
 - b. If coop A produced 125 eggs, how many did each of the other coops produce?
 - c. If the sum of the number of eggs from coop B and coop C was 24 more than the number of eggs from coop D, how many eggs did each coop produce?
- 2. Three siblings collect rare coins. To determine the number of rare coins that Samantha has, take the number of rare coins Kevin has, add 4, and then divide that sum by 2. To determine the number of rare coins Ben has, double the number of rare coins Kevin has, subtract 4, and then multiply that difference by 2. How many rare coins does each sibling have if they have a total of 49 rare coins?
- 3. Three teammates had different point totals at the girls' basketball game. To determine the number of points Effie had, multiply Toni's points by 3, subtract 8, and then multiply the difference by 2. To determine the number of points Linda had, add 9 to Toni's points and divide the sum by 3. How many points did each girl have if Effie scored 9 more than Toni and Linda combined?
- 4. Four members of the track team ran various numbers of miles last week. To determine the number of miles Manuel ran, multiply the number of miles Ewan ran by 3, subtract 15, multiply the difference by 2, and divide this quantity by 5. To determine the number of miles Violet ran, subtract 14 from the number of miles Ewan ran, and then multiply the difference by 3. To determine the number of miles Ling ran, add 30 to the number of miles Ewan ran, and then divide the sum by 5. How many miles did each team member run last week if the total number of miles run by Ewan and Manuel is equal to the total number of miles run by Violet and Ling?

Stretch

When an equation is not a linear equation, it can have more than one solution. The equation $x^2 = 9$ has two solutions, -3 and 3. What are the solutions to the equation $2x^2 + 5 = 77$?

Review

Solve each equation.

1. $\frac{2}{3}(x + 2) = \frac{1}{6}x + \frac{1}{3}$ 2. 2.5x - 1 = 10 - 7.5x

Determine whether there is likely a positive or negative association between the quantities. Explain your reasoning.

- Independent quantity: number of sunny days in Year A Dependent quantity: number of cloudy days in Year A
- 4. Independent quantity: number of miles driven Dependent quantity: amount of gas in tank

Determine the slope and y-intercept of the line represented by each equation.

- 5. 36 = 24y + 48x
- 6. y 14 = 7x + 9

DOODOOOO Tic-Tac-Bingo Creating Linear Equations

WARM UP

Solve each equation.

- 1. $\frac{2}{3}(x-4) = \frac{1}{2}$
- 2. 0.7(x + 3) = 2.1
- 3. 3(-2x + 5) = 5x 7
- 4. $\frac{3x+11}{2} = x 4$

LEARNING GOALS

- Solve linear equations with rational coefficients and variables on both sides.
- Give examples of linear equations with one solution, no solutions, or infinite solutions.
- Determine whether an equation has one solution, no solutions, or infinite solutions.

You know how to solve linear equations and determine the number of solutions. How can you create linear equations with zero, one, or infinite solutions?

The Goal

In this lesson, each person in the class will be given a different algebraic expression. Your goal is to locate a classmate and form an equation to meet each of the criteria listed.

- a. no solution
- b. a non-zero integer solution
- c. a negative rational solution
- d. a positive rational solution
- e. a solution that is neither positive nor negative
- f. infinite solutions
- 1. For each criterion, provide an example of a final line of the solved equation.





Use the Tic-Tac-Bingo board at the end of the lesson. The board has 9 spaces. Three spaces are already designated.

- 1. Fill each remaining space with one of the solution types listed. Each option must be used at least once.
 - positive rational solution
 - negative rational solution
 - non-zero integer solution

2. Your teacher will assign your expression. When you and a classmate have created an equation with one of the solution types, write your equation in the corresponding box.



Try to be the first person to get three in a row. Then, try to be the first person to completely fill your board with equations.



TALK the TALK 🖚

The Strategy

Think about the strategies you used to play Tic-Tac-Bingo.

1. Describe your general strategy.

- 2. Reflect on the equations with no solutions and infinite solutions.
 - a. How can you look at an equation and determine that there will be no solution?

b. How can you look at an equation and determine that there will be infinite solutions?

Tic-Tac-Bingo

	Solution is not positive or negative	
Equation:	Equation:	Equation:
Solution:	Solution:	Solution:
No Solution		
Equation:		Equation:
	FREE	
	SPACE	Solution:
		Infinite Solutions
Equation:	Equation:	Equation:
Solution:	Solution:	

Assignment

Write

Explain the difference between an equation with no solution and an equation with a solution of x = 0.

Remember

Linear equations can have no solution, one solution, or infinite solutions.

Practice

1. Set each given expression equal to 7(x - 2) - 4x + 14. Determine whether the equation formed has no solution, infinite solutions, or a solution of x = 0.

a. no solution	$\frac{8x+4}{2} - \frac{1}{3}(x+6)$
b. infinite solutions	2(x - 1) + x
c. solution of $x = 0$	-9x + 12 + 4(3x - 3)
2. Set each given expression equal to solution, infinite solutions, or a solution	$\frac{7}{3}x + 4 - \frac{x-6}{3}$. Determine whether the equation formed has no tion of $x = 0$.
a. no solution	$\frac{1}{3}(8x + 18) - \frac{2}{3}x$

b. infinite solutions c. solution of x = 02(3x + 5) - 4 $4(\frac{1}{2}x - 3) + 6$

Stretch

Create an equation with at least one fractional coefficient and at least one negative coefficient with solutions x = 0 and $x = \frac{4}{3}$.

Review

- 1. The Franklin Lee Middle School Glee Club is hosting a talent show competition to raise money for a community that was recently hit by a flood. All of the members are asked to go out in the community to sell tickets to the show.
 - Patrick sold 30 more tickets than Jose.
 - Gabriella sold 25 fewer than two times the number that Patrick sold.
 - Owen sold one-third the number of tickets that Patrick sold.
 - Desmond sold 15 fewer than Owen.
 - a. Define a variable for the number of tickets Jose sold. Then write expressions for the number of tickets sold by the other students.
 - b. If Jose sold 30 tickets, how many tickets did each of the others sell?
 - c. If Gabriella sold 65 tickets, how many tickets did each of the others sell?
 - d. If Patrick, Owen, and Desmond sold 175 tickets altogether, how many tickets did each of them sell?

2. Isabel surveyed three classes about their favorite season. The data from the survey are shown in the two-way table.

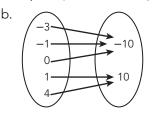
			Seasons					
		Winter	Spring	Summer	Fall	Total		
s	Class A	9	2	7	6	24		
Classes	Class B	2	5	9	4	20		
	Class C	8	6	10	4	28		
	Total	19	13	26	14	72		

Student's Season Preference

a. Compute the relative frequencies for each row. If necessary, round decimals to the nearest thousandth.

- b. What percent of students in Class A prefer winter?
- c. Which class has the largest percent of students who prefer summer?
- d. Compute the relative frequencies for each column. If necessary, round decimals to the nearest thousandth.
- e. What percent of students who prefer winter are from Class C?
- f. The smallest percentage of students who prefer summer comes from which class?
- 3. Determine whether each relation represents a function. Explain your reasoning.

a.	x	у
	1	7
	5	23
	5	35
	8	55



Topic 1 Solving Linear Equations

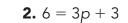
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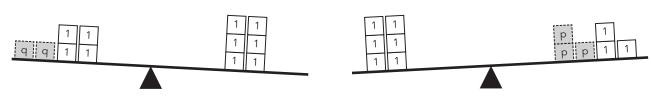
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I. Exploring Two-Step Equations

A. Use the balance tool to help you solve each equation.

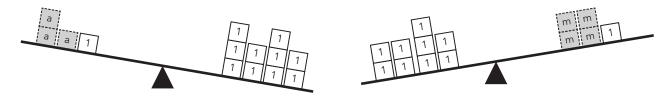
1. 2q + 4 = 6



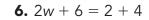


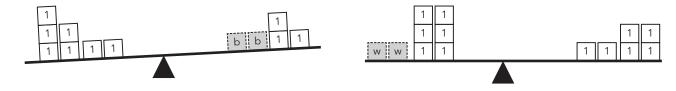
3. 3*a* + 1 = 5 + 5

4. 4 + 5 = 4m + 1



5. 5 + 2 = 2b + 3





PAGE 91

Name .

Date ____

- B. Use inverse operations to isolate the variable and solve each equation.
- **1.** 5x + 15 = 75**2.** 4x 3 = 37**3.** $\frac{t}{3} + 14 = 29$ **4.** $\frac{3}{4}x + 2 = 4\frac{2}{3}$ **5.** $-\frac{n}{5} 9 = 21$ **6.** $2 = 2.27 \frac{m}{4}$
- C. Match each equation to an equivalent equation solved for x.
- **a.** $x = \frac{9-1}{2}$ **1.** $\frac{1}{2}x + 1 = 9$ **2.** $-\frac{1}{3}x - 2 = 6$ **b.** $x = \frac{9+1}{2}$ **c.** x = 2(9 - 1)**3.** 3x - 2 = 6**4.** 2x - 1 = 9**d.** x = 2(9 + 1)**e.** $x = \frac{6+2}{-3}$ **5.** $\frac{1}{3}x - 2 = 6$ **f.** $x = \frac{6+2}{3}$ **6.** $\frac{1}{2}x - 1 = 9$ **7.** 2x + 1 = 9**g.** x = 3(6 + 2)**8.** -3x - 2 = 6**h.** x = -3(6 + 2)
- **II. Solving Multi-Step Equations**
- A. Solve for x.
- 1. 7 + 4x = 63 10x2. 9x 9 = 10x 73. 9 + 4x = -10x 54. 10 + x = -9x + 25. 3 + 4x = -3 + 6x6. 7x 9 = 3x 297. 5x 3 = 3 + 2x8. -4x + 6 = 9x 89. -10x + 2 = -3 + 8x10. 47 + 10x = -10x + 711. 5x + 1 = -3 + 10x12. 24 4x = 2x

III. Solving Equations with One Solution, Infinite, and No Solutions

A. Determine whether each equation has one solution, no solutions, or infinite solutions.

1. 5 = 0	2. 4 = y
3. 10 <i>b</i> = 10 <i>b</i>	4. <i>x</i> = 5
5. 8 = 2	6. <i>x</i> = <i>x</i>
7. 9 = <i>x</i> − 4	8. x + 3 = x + 3
9. 2 <i>x</i> = 3 <i>x</i>	10. <i>x</i> + 8 = <i>x</i>
11. <i>x</i> + 3 = 5	12. $6z = (3 + 3)z$
13. <i>x</i> − 2 = 2	14. 9 - <i>c</i> = 2 <i>c</i>
15. <i>g</i> − 0 = <i>g</i> + 1	16. 0 = 0
17. 3(<i>f</i> + 1) = 3 <i>f</i> − 3	18. 0 = <i>p</i>
19. <i>x</i> − 4 = <i>x</i> − 2 − 2	20. 9 <i>f</i> = <i>f</i> + 9
21. 1 <i>a</i> = 0	22. $\frac{q}{q} = 1$
23. $\frac{9}{s} = 3\left(\frac{3}{s}\right)$	24. $20\left(\frac{y}{5}\right) - 7 = 4y + 3$

B. Solve each equation. Tell whether the equation has one solution, no solutions, or infinite solutions.

1. 10(x - 2) + 15 = 8x + 72. x + 6(x - 1) = 7(3 + x)3. 3(3x + 4) - 2x - 5 - 7x = 204. 8x - 8 = 6x - 5 + 2(x - 1.5)5. 12x + 9 - 4x - 4 = 3x - 7 - x + 306. 5 + 5x - 3 = 5x + 97. 4x + 1 + 3x + 2 + 3x + 7 = 5(2x + 2)8. $\frac{4(x - 8)}{5} = 16$ 9. $6x - 5 - 2x + 8 = 12(\frac{1}{3}x + \frac{1}{4})$ 10. 2(-7x + 5) + 2x = 3x + 3 - 15x11. $\frac{9}{x} + 2 = 20$ 12. -5x + 4(3 + 2.5x) = 8x + 12 - 3x

Crossing Paths

Point of Intersection of Linear Graphs

WARM UP

Determine an ordered pair (x, y) that represents a solution to each equation.

1.
$$y = 2x + 5$$

2. $3x + 4y = 200$
3. $y = \frac{1}{2}x - 10$

LEARNING GOALS

- Write a system of equations to represent a problem situation.
- Analyze and solve a system of simultaneous linear equations graphically.
- Interpret the solution to a system of two linear equations in two variables as the point of intersection of two linear graphs and in terms of the original problem's context.
- Determine a point of intersection in a system of linear equations using tables.

KEY TERMS

- point of intersection
- break-even point

You have modeled different linear equations. How can you model two linear equations on the same graph? What does it mean when two linear graphs intersect?

Getting Started

Profit is the amount of money made after paying all costs. To calculate the profit made from selling T-shirts, subtract the cost of the shirts from the income, which is the money earned from sales.

Long-Sleeved T-Shirts

Your school's parent-teacher organization wants to sell long-sleeved T-shirts as a fundraiser. The business manager found a company that will charge \$4 for each long-sleeved T-shirt and a setup fee of \$160 to create the design that will be placed on each shirt. The chairman of the fundraising committee suggested selling the long-sleeved T-shirts for \$8 each. The organization has asked you to help them analyze the production costs and the amount of money that can be made by this fundraiser.

1. If the shirts are sold for \$8 each, at what point will the parent-teacher organization start making a profit? Show your work. Describe the reasoning you used to determine the answer.

астічіту **1.1**



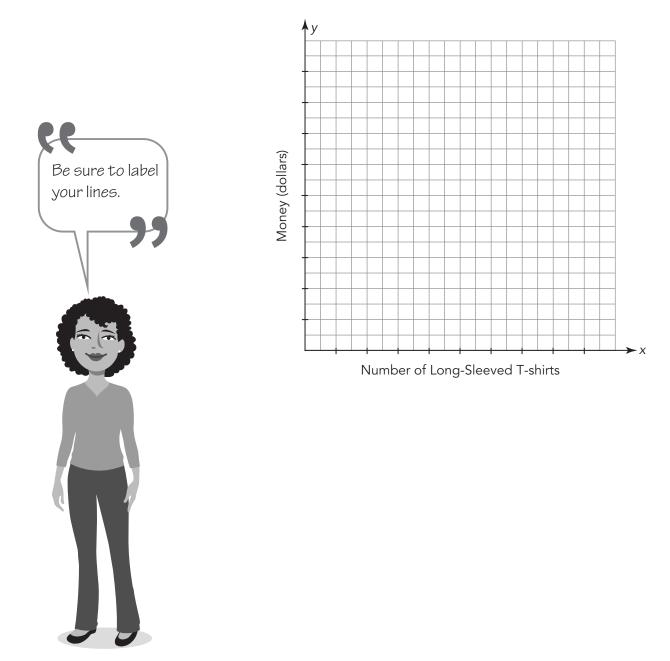
Consider the fundraiser being held by the parent-teacher organization, described in the previous activity. Shirts are sold for \$8 each and cost \$4 each to make, plus a \$160 setup fee.

- 1. Write an equation to represent the organization's cost, in dollars, to buy the long-sleeved T-shirts. Describe what your variables represent.
- 2. Write an equation to represent the organization's income from selling the long-sleeved T-shirts. Describe what your variables represent.
- 3. Complete the table to show the cost, income, and profit for different numbers of long-sleeved T-shirts sold.

Quantity Name	Number of Long-Sleeved T-shirts	Cost	Income	Profit
Unit	Long-Sleeved T-shirts	Dollars	Dollars	Dollars
Expression				
	0			
	10			
	20			
	35			
	50			
	100			

4. Create graphs to represent the cost and the income on the coordinate plane shown. Use the given bounds and intervals.

Variable Quantity	Lower Bound	Upper Bound	Interval
Number of Long-Sleeved T-shirts	0	50	2.5
Money	0	400	20



- 5. Use your graphs to answer each question and describe your reasoning in terms of the graphs.
 - a. Determine the number of long-sleeved T-shirts for which the cost is greater than the income.

b. Determine the number of long-sleeved T-shirts for which the income is greater than the cost.

c. Determine when the cost is equal to the income.

d. Verify your solution algebraically.

NOTES	 The point of intersection is the point at which two lines cross on a coordinate plane. When one line represents the cost of an item and the other line represents the income from selling the item, the point of intersection is called the break-even point. 6. What is the break-even point for making and selling the long-sleeved T-shirts?
	7. What is the profit from T-shirts at the break-even point?
	8. What are the cost and income at the break-even point?
	9. What do the coordinates of the point of intersection mean in terms of the fundraiser?
	10. State the number of long-sleeved T-shirts that must be sold for a profit to be made.

1.2 A Different Point of Intersection



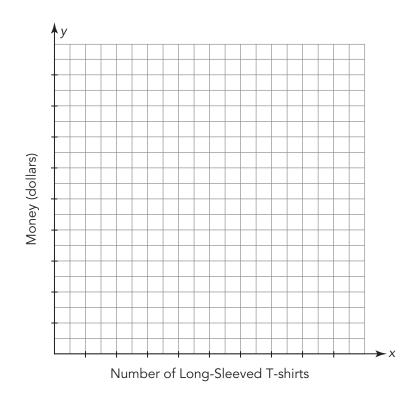
After the initial analysis, the business manager of the parent-teacher organization called the company that will be producing the shirts. The company agreed to discount the design fee to \$80, while maintaining the cost of \$4 per shirt. The committee would like you to analyze the profit potential with the new costs and a new selling price of \$12 per shirt.

- 1. Write an equation that represents the cost, in dollars, for the long-sleeved T-shirts. Describe what your variables represent.
- 2. Write an equation that represents the organization's income from selling the long-sleeved T-shirts. Describe what your variables represent.
- 3. Complete the table to show the cost, income, and profit for different numbers of long-sleeved T-shirts.

Quantity Name	Number of Long-Sleeved T-shirts	Cost	Income	Profit
Unit	Long-sleeved T-shirts	Dollars	Dollars	Dollars
Expression				
	0			
	5			
	10			
	35			
	50			
	100			

4. Create graphs to represent the cost and the income on the coordinate plane shown. Use the given bounds and intervals.

Variable Quantity	Lower Bound	Upper Bound	Interval
Number of Long-Sleeved T-shirts	0	50	2.5
Money	0	400	20



- 5. Use your graphs to answer each question and describe your reasoning in terms of the graphs.
 - a. Determine the number of long-sleeved T-shirts for which the cost is greater than the income.
 - b. Determine the number of long-sleeved T-shirts for which the income is greater than the cost.

- c. Determine when the cost is equal to the income.
- d. Verify your solution algebraically.
- 6. What is the break-even point for producing and selling the long-sleeved T-shirts?
- 7. What is the profit from T-shirts at the break-even point?
- 8. What are the production cost and income at the break-even point?
- 9. What do the coordinates of the point of intersection mean in terms of the fundraiser?
- 10. State the number of long-sleeved T-shirts that must be sold for a profit to be made.

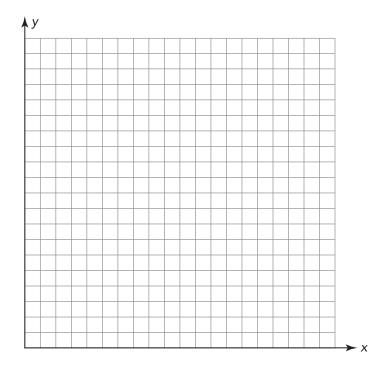
ACTIVITY

1.3



Serena is ordering lunch from Tony's Pizza Parlor. John told her that when he ordered from Tony's last week, he paid \$34 for two 16-inch pizzas and two drinks. Jodi told Serena that when she ordered one 16-inch pizza and three drinks, it cost \$23.

- 1. Write two equations to represent the two statements that Serena hears.
- 2. Interpret what the point of intersection means for the two lines representing the equations.



3. Verify your answers by graphing the two equations.

NOTES

TALK the TALK 🖚

Putting It All on the Table

Look back at the tables you used in this lesson.

1. How can you use a table alone to determine the point of intersection of two linear graphs?

2. How does determining a point of intersection from a table compare with determining the point of intersection from a graph and from equations?

Assignment

Write

In your own words, define the terms point of intersection and break-even point.

Remember

The point where two linear graphs intersect represents the solution to both of the equations that describe the graphs.

Practice

Misha is the manager of Movie Parlor, a video store. She is in charge of buying the videos for the store to sell. She buys videos from a wholesaler that sells them for \$8 each. The wholesaler also charges a fee of \$200 for each bulk purchase. Misha then sells the videos for \$12 each.

- 1. Write an equation to represent the cost to buy videos from the wholesaler. Describe what your variables represent. Write a second equation to represent the amount of money the store will earn from selling the videos. Describe what your variables represent in this equation.
- 2. Calculate the cost to buy 30 videos from the wholesaler.
- 3. Calculate the amount of money the store will earn from selling 30 videos.
- 4. Calculate the profit the store will make from selling 30 videos. Interpret the meaning of your answer.
- 5. Calculate the cost to buy 70 videos from the wholesaler.
- 6. Calculate the amount of money the store will earn from selling 70 videos.
- 7. Calculate the profit the store will make from selling 70 videos. Interpret the meaning of your answer.
- 8. Complete the table to show the cost of buying videos from the wholesaler and income for different numbers of videos.

Number of Videos	Cost from Wholesaler (\$)	Income (\$)
x		
0		
10		
30		
45		
70		
100		

9. Create graphs of both the cost and income equations. Use the given bounds and intervals.

Variable Quantity	Lower Bound	Upper Bound	Interval
Videos	0	70	5
Money	0	900	50

10. Use your graphs to determine the number of videos for which the cost to buy them is greater than the income from selling them. Explain your reasoning.

- 11. Use your graphs to determine the number of videos for which the income from selling them is greater than the cost to buy them. Explain your reasoning.
- 12. Determine the break-even point for buying and selling the videos.
- 13. What is the video store's profit at the break-even point?
- 14. What is the point of intersection of the two lines you graphed?
- 15. What do the coordinates of the point of intersection mean in terms of buying and selling videos?
- 16. Describe the number of videos that must be sold in order for a profit to be made.

Stretch

Suppose a jet plane is traveling at 500 miles per hour at a height of 30,000 feet. If you took off from the ground in a flying car, traveling straight up at 100 miles per hour, how far away would the plane need to be when you take off in order for the car to meet the plane at the same height and time?

Review

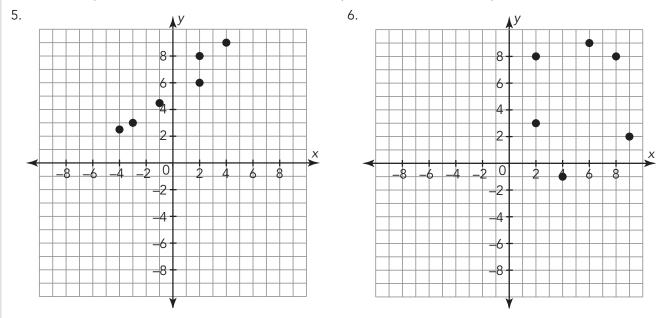
Determine whether the equation has one solution, no solutions, or infinite solutions.

1. 3x - 4 = 6x - 8 2. 2x + 1 = 2x - 1

Solve each equation.

3. -4x - 2 = 6x + 24. $\frac{1}{2}x - 5 = 8 + 2x$

Describe the pattern of association between the two quantities in each scatter plot.



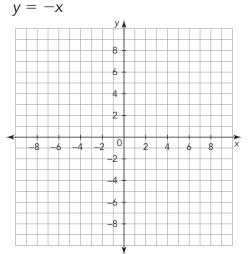
The Road Less Traveled

Systems of Linear Equations

WARM UP

1. Graph the equations on the coordinate plane.

y = x



- 2. What are the coordinates of the point of intersection?
- 3. Interpret the meaning of the point of intersection.

LEARNING GOALS

- Write a system of equations to represent a problem context.
- Analyze and solve a system of two simultaneous linear equations in two variables graphically.
- Interpret the solution to a system of equations in terms of a problem situation.
- Use slope and *y*-intercept to determine whether two linear equations have one solution, no solutions, or infinite solutions.

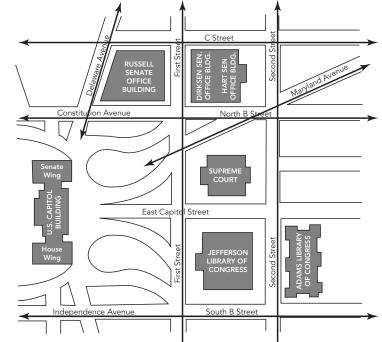
KEY TERMS

- system of linear equations
- solution of a linear system
- consistent system
- inconsistent system

You have graphed linear equations on a coordinate plane. How can you interpret two linear equations together as a system?

According to the Map

Many of the diagonal roads in Washington, DC, are named after US states. Except for California and Ohio, every state provides the name for an avenue. California is a street, and Ohio is a drive. There is also a Puerto Rico Avenue.



- 1. Answer each question and explain your reasoning according to the map shown.
 - a. Would it be possible to meet a friend at the intersection of First Street and Second Street?
 - b. Would it be possible to meet a friend at the intersection of Delaware Avenue and Constitution Avenue?
 - c. Would it be possible to meet a friend at the intersection of C Street and Second Street?
- 2. How many places could you be if you are at the intersection of Independence Avenue and South B Street?

астічіту **2.1**

Representing a Problem Situation with a System of Equations



Colleen and Jimmy have part-time jobs after school. Both have decided that they want to see how much money they can save in one semester by placing part of their earnings each week into a savings account. Colleen currently has \$120 in her account and plans to save \$18 each week. Jimmy currently has \$64 in his savings account and plans to save \$25 each week.

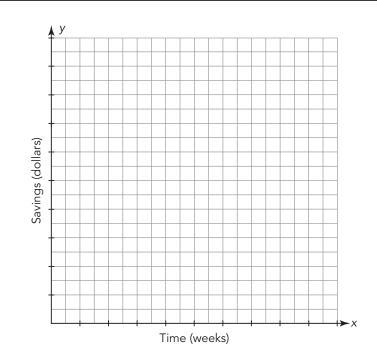
- Write an equation for Colleen and for Jimmy that represents the total amount of money, in dollars, in each of their savings accounts, y, in terms of the number of weeks, x, that they place money in their respective accounts.
- 2. How much money will each person have in his or her savings account after five weeks?

- 3. Which person will have more money in his or her savings account after five weeks?
- 4. How much money will each person have in his or her savings account after 18 weeks (the amount of time in one semester)?



- 5. Which person will have more money in his or her savings account at the end of the semester?
- 6. Create a graph of each equation on the coordinate plane shown. Choose your bounds and intervals for each quantity.

Variable Quantity	Lower Bound	Upper Bound	Interval

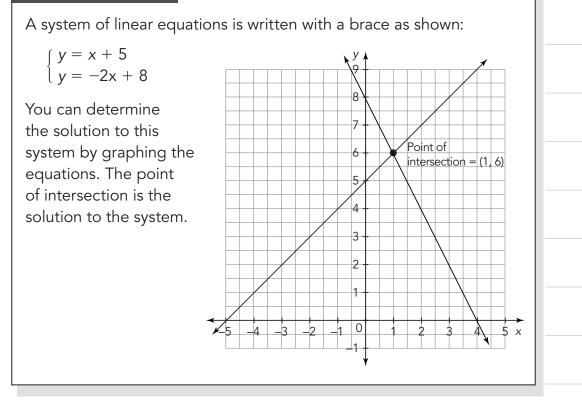


- 7. Determine the number of weeks after which Colleen and Jimmy will have the same amount of money in their savings accounts.
- 8. Verify your solution to Question 7 algebraically.
- 9. Interpret the meaning of the slope of each graph in this problem situation.

- 11. How can you tell who is saving more money each week by analyzing the graph?
- 12. Interpret the meaning of the *y*-intercept of each graph in this problem situation.

When two or more linear equations define a relationship between quantities, they form a **system of linear equations**. The **solution of a linear system** is an ordered pair (x, y) that is a solution to both equations in the system. Graphically, the solution is the point of intersection, the point at which two or more lines cross.

WORKED EXAMPLE



NOTE

астічіту **2.2**



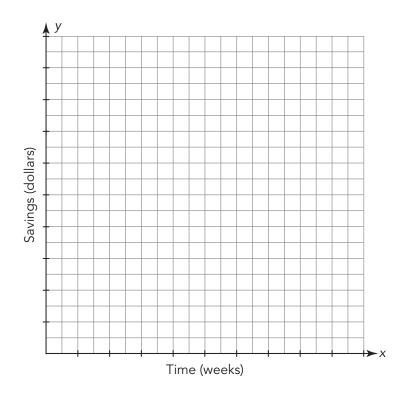
Eric also has a part-time job after school working at the same place as Jimmy. He heard about the money that Colleen and Jimmy were saving and decided that he wanted to save money, also. Eric has \$25 in his savings account and will save the same amount as Jimmy, \$25 per week.

1. Write an equation that represents the total amount of money in Eric's savings account, y, in terms of the number of weeks, x, that he places money in his savings account.

2. Write a linear system that shows the total amount of money that will be saved by Eric and Jimmy.

3. Create a graph of the linear system on the coordinate plane shown. Choose your bounds and intervals for each quantity.

Variable Quantity	Lower Bound	Upper Bound	Interval



4. What does the slope of each graph represent in this problem situation?

5. What is the same for both Eric and Jimmy?

6. What is different for Eric and Jimmy?

7. What is the point of intersection for this system of equations? Explain your reasoning in terms of the graph.

The lines you graphed in Question 3 are parallel lines. Remember that two lines are parallel if they lie in the same plane and do not intersect.

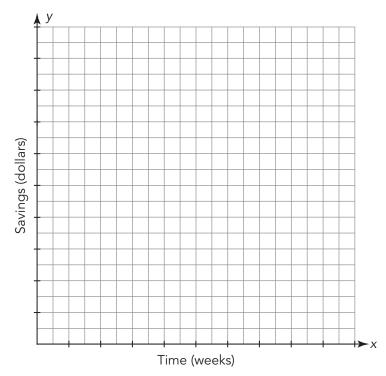
- 8. What do you know about the slopes of parallel lines?
- 9. Does the linear system of equations for Eric and Jimmy have a solution? Explain your reasoning in terms of the graph.
- 10. Will Eric and Jimmy ever have the same amount of money in their savings accounts?

Eric's sister Trish was able to save \$475 working part-time during the first semester of school. She recently quit her part-time job to play on the high school's softball team. She is hoping to get a college scholarship to play softball and wants to devote her time to achieving her goal. She will withdraw \$25 each week from her savings account for spending money while she is not working.

- 11. Write an equation that gives the total amount of money in Trish's savings account, y, in terms of the number of weeks, x, that she withdraws money out of her savings account.
- 12. Write a system of equations that represents the amount of money that Trish and Eric will have in their respective savings accounts.

13. Create a graph of the linear system on the coordinate plane shown. Choose your bounds and intervals for each quantity.

Variable Quantity	Lower Bound	Upper Bound	Interval



14. What does the point of intersection of the lines represent?

- 15. Compare the slopes of the lines.
- 16. According to the graph, approximately when will Trish and Eric have the same amount of money in their savings accounts? How much will they each have?



ACTIVITY

2.3



You have worked with systems of linear equations that have one solution and no solutions.

- 1. Describe the graphs in a system of linear equations that has one solution.
- 2. Describe the graphs in a system of linear equations that has no solution.
- 3. Consider the system of equations:

$$\begin{cases} y = 3x + 6\\ y = 3(x + 2) \end{cases}$$

a. Complete the table of values for this linear system.

x	y = 3x + 6	y=3(x+2)
-2		
0		
2		
4		
8		
13		
20		

b. Describe the equations that make up this system. What can you conclude about the number of solutions to this type of linear equation?

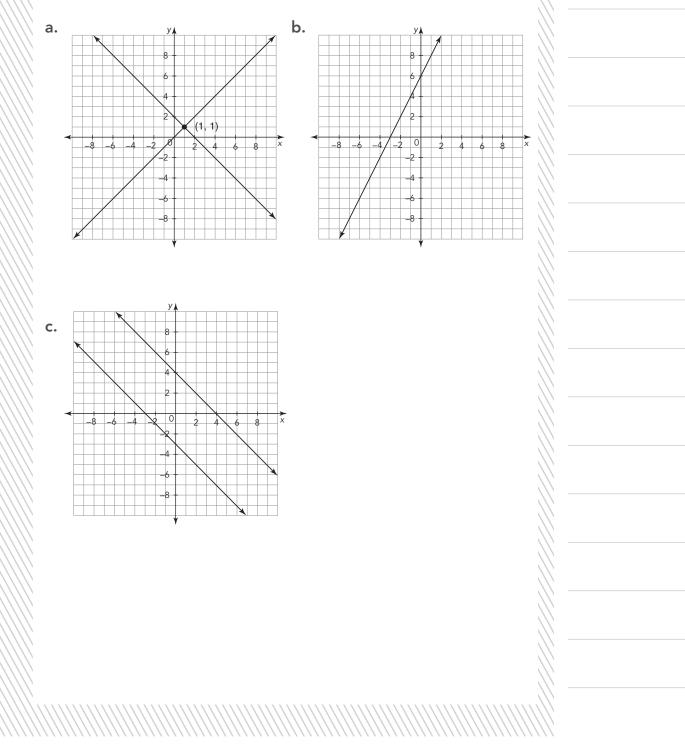


TALK the TALK

Line Up for Inspection!

Each graph shows a system of two linear relationships.

1. Write the linear system that represents each.



NOTES

2. Using only the equations, determine whether each system has one solution, no solutions, or infinite solutions. Explain your reasoning.

a.
$$y = \frac{4}{5}x - 3$$
 and $y = -\frac{5}{4}x + 6$

b.
$$y = \frac{2}{3}x + 7$$
 and $y = \frac{1}{6}(4x + 42)$

c. y = -2.5x + 12 and y = 6 - 2.5x

d. y = 5x and $y = \frac{1}{5}x$

A system of equations may have one unique solution, infinite solutions, or no solutions. Systems that have one or infinite solutions are called **consistent systems**. Systems that have no solution are called **inconsistent systems**.

3. Complete the table.

	Consistent Systems		Inconsistent Systems
	One Unique Infinite Solution Solutions		No Solutions
Compare the slopes.			
Compare the y-intercepts.			
Describe the lines.			

Assignment

Write

Complete each sentence by writing the correct term or phrase from the lesson.

- A(n) ______ is formed when the equations or graphs of two or more linear equations define a relationship between quantities.
- 2. A(n) _____ is an ordered pair (*x*, *y*) that is the point of intersection, the point at which two or more lines cross.
- 3. A(n) _____ has one or infinite solutions.
- 4. A(n) _____ has no solution.

Remember

- A system of equations whose graphs intersect at just one point is a system with one solution.
- A system of equations that has parallel line graphs is a system with no solutions.
- A system of equations that has identical graphs is a system with infinite solutions.

Practice

Aiko works in the fish department of a pet store. She is asked to drain, clean, and refill two reef tanks. The first tank holds 175 gallons of water, and the second tank holds 200 gallons of water. The hoses that she uses drain the tanks at a rate of 25 gallons of water per hour.

- 1. Write an equation for each tank that represents the total amount of water in gallons in the tank, *y*, in terms of the number of hours, *x*, that the tanks are draining.
- 2. How much water is in each tank after 3 hours?
- 3. Write your equations in the first row of the table. Then, complete the table of values for the linear system.

Number of Hours	First Tank	Second Tank
x		
0		
1		
2		
3		
4		
5		
6		
7		

- 4. Create a graph of both equations.
- 5. Interpret the meaning of the slope of each line in this problem situation.
- 6. What is the same for both tanks?
- 7. What is different for the two tanks?
- 8. What is the point of intersection for this system of equations? Explain your reasoning in terms of the graph.
- 9. When will both tanks have the same amount of water?
- While Aiko is draining both tanks, she is also filling a 250-gallon tank. The water fills at a rate of 25 gallons per hour. Write an equation that gives the total amount of water in gallons in the third tank, y, in terms of the number of hours, x, that the tank is filling.

Stretch

A system with an equation that has an exponent of 2 can have more than one solution. How many solutions does the system y = x and $y = x^2 - 2$ have? What are the solutions?

Review

- 1. Billy is selling lemonade for \$1 per cup. It costs him 50 cents per cup to make the lemonade. He also has to spend an additional \$10 for supplies such as ice, cups, and plastic shakers.
 - a. Write a system of equations to represent this situation.
 - b. What does the point of intersection represent in this situation?
- 2. Determine whether the equations have one solution, no solutions, or infinite solutions.

a.
$$1.5x + 6.5 = \frac{3}{2}x + \frac{13}{2}$$

b. $-\frac{1}{5}x - 12 = -0.2x - \frac{24}{2}$

- 3. Solve each equation.
 - a. 4(x + 5) = 6(x + 4)b. -3(p - 4) = -2p + 1

Rockin' **Roller Rinks**

Choosing a Method to Solve a Linear System

WARM UP

By inspection, determine if each system has no solution, infinite solutions, or one solution.

1.
$$\begin{cases} y = 4x - 14 \\ y = -4x - 14 \end{cases}$$

2. $\begin{cases} y = 4x - 14 \\ y - 4x = -14 \end{cases}$
3. $\begin{cases} y = 4x - 14 \\ y = 4x - 14 \end{cases}$
4. $\begin{cases} y = 4x - 14 \\ 4x - y = 14 \end{cases}$

LEARNING GOALS

- Write a system of linear equations to represent a problem context.
- Interpret the solution of a system of linear equations.
- Choose the best method to solve a system of linear equations.

Now that you know how to solve systems of linear equations by graphing, by inspection, and by substitution, how do you decide which method to use?

4

So Many Possibilities

Tickets for a movie cost \$8 for evenings and \$5 for matinees. There were 440 tickets sold, and \$3130 was collected in ticket sales.

1. Consider each system of equations. Determine which system(s) could be used to calculate the number of matinee tickets sold. Explain your reasoning.

a.∫x + y = 3130	b. $\int x + y = 440$
35x + 8y = 440	b. $x + y = 440$ 5x + 8y = 3130

c.
$$\begin{bmatrix} x + y = 3130 \\ 8x + 5y = 440 \end{bmatrix}$$

d. $\begin{bmatrix} x + y = 440 \\ 8x + 5y = 3130 \end{bmatrix}$

2. Consider the valid system(s) from Question 1. How would you solve each valid system: by graphing or by substitution? Explain your reasoning.

Comparing Two ACTIVITY Fee Schedules

41



The activities director of the Community Center is planning a skating event for all the students at the local middle school. There are several skating rinks in the area, but the director does not know which one to use. At a previous event at Skate Park the director initially paid \$230 for a party of 10, but when 20 students attended she ended up paying \$260. For a different event at Roller Rama, she paid \$125 for 25 students, but ended up paying \$200 when 40 students attended.

1. Define variables to represent the total cost and the number of students attending the event.

2. Write and interpret an equation for the total cost of using Skate Park in terms of the number of students attending.

3. Write and interpret an equation for the total cost of using Roller Rama in terms of the number of students attending. Assume that the skating rinks have not changed their rates for skating parties.

- 4. Suppose the activities director anticipates that 50 students will attend.
 - a. Calculate the total cost of using Skate Park.
 - b. Calculate the total cost of using Roller Rama.
- 5. Suppose the activities director has \$650 to spend on the skating event.
 - a. Determine the number of students who can attend if the event is held at Skate Park.
 - b. Determine the number of students who can attend if the event is held at Roller Rama.

6. Write a system of equations to represent this problem situation.

7. Solve this system using each strategy. Interpret the meaning of the solution in the context of the problem situation.

Table

Number of Students	Skate Park	Roller Rama

You can use a variety of strategies and representations to solve a system of linear equations.

- inspection
- table
- graph
- substitution

Graph

Substitution

- 8. Which skating rink would you recommend to the activities director? Explain your reasoning.
- 9. Explain the advantages and disadvantages of using each strategy.

graph

table

substitution

4.2 A Third Equation



Super Skates offers the use of the rink for a flat fee of \$1000 for an unlimited number of skaters.

- 1. Write a linear equation to represent this situation.
- 2. Add a column to the table in the previous activity for Super Skates. Also, graph the equation for Super Skates on the grid in the previous activity.



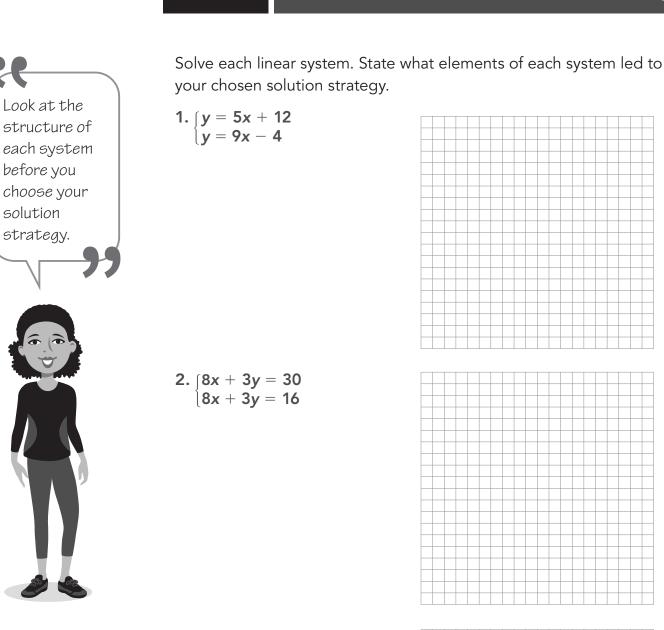
Can you

determine

3. Use substitution to determine when Super Skates is the same price as Skate Park and Roller Rama. In which case did you need to use substitution to determine the solution?

4. Describe when going to Super Skates is a better option than going to Skate Park or Roller Rama. Explain your reasoning.

5. Explain under what conditions you would recommend each skating rink to the director of the Community Center based solely on the cost to rent each skating rink. Analyzing Structure



3. $\begin{cases} 4y = 11 - 3x \\ 3x + 2y = -5 \end{cases}$

ΑCTIVITY

4.3

4. $\begin{cases} 15x + 28y = 420 \\ 30x + 24y = 720 \end{cases}$

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5. $\begin{cases} 3x + 2y = 6 \\ 1.5x + y = 3 \end{cases}$

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6. $\begin{cases} 4x + 3y = 27 \\ \frac{1}{3}x = 2y + 1 \end{cases}$

NOTES

TALK the TALK ┿

How Do You Choose?

Throughout this topic, you have solved systems of linear equations through inspection of the equations, graphing, and substitution. How do you decide when each method is most efficient?

Create a presentation or a poster to illustrate your decision-making process when you solve a system of linear equations.

Consider these questions to guide the content of your presentation.

- What methods do you know for solving systems of linear equations? When can you use each one?
- What visual cues or characteristics of the equations in the system of linear equations guide your decision?
- What role do the slope and y-intercept of the equations play in your decision-making?
- Does the form of the equations in the system affect your choice?

Use the systems of linear equations you solved throughout this lesson to support your reasoning and as examples of when you would choose each solution method.

List at least three key points that you want to include in your presentation.

1.

2.

3.

Assignment

Write

Explain why you may need to use substitution to solve a system of linear equations if you already solved the system by graphing.

Remember

To most efficiently solve a system of linear equations, look at the equations in the system. The coefficients and constants in the equations can help you choose the best solution method.

Practice

- Rent-A-Wreck rents cars for \$50 a day, plus \$0.25 per mile. Drive-A-Lemon rents cars for \$40 a day, plus \$0.30 per mile.
 - a. Write a system of equations that best models the cost of renting a car from each business. Let x represent the number of miles, and let y represent the cost per day.
 - b. Solve the system using your chosen method.
 - c. Interpret the solution of the linear system in terms of the problem situation.
 - d. In what situations would you recommend renting a car from Rent-A-Wreck?
- 2. Rika works in the perfume department at Hoover's Department Store. She is giving away samples of a new fragrance and a new scented hand lotion to customers that pass by her station. She is required to hand out a total of 114 samples during her shift. She has already handed out 36 samples, which represents $\frac{1}{3}$ of the number of fragrance samples and $\frac{1}{4}$ of the number of hand lotion samples that she must hand out.
 - a. Write a system of equations for this problem situation. Let *x* represent the number of fragrance samples, and let *y* represent the number of hand lotion samples.
 - b. Solve the system using your chosen method.
 - c. Interpret the solution of the linear system in terms of the problem situation.
- 3. Belinda works in the kitchen department of Hoover's Department Store. As part of the store's effort to reward their customers, Belinda is handing out coupons for two different types of silverware packages. The first coupon is for the classic set, and the second coupon is for the modern set. On one particular day, she has handed out a total of 144 coupons, which represents $\frac{1}{2}$ of the number of classic coupons and $\frac{3}{4}$ of the number of modern coupons. She handed out twice as many coupons for the modern set as she did for the classic set.
 - a. Write a system of equations for this problem situation. Let *x* represent the number of coupons for the classic set, and let *y* represent the number of coupons for the modern set.
 - b. Solve the system using your chosen method.
 - c. Interpret the solution of the linear system in terms of the problem situation.

- 4. Ms. Jupino is the leader of her daughter's Girl Scout troop, which has 15 members. The troop would like to take an end-of-year field trip to an amusement park, but they need to raise money for the trip. They have researched different fundraising companies and have narrowed their search down to two. Both companies have fundraising opportunities that involve selling coupon booklets. The first company, Great Ideas, will donate \$50 if the troop uses their company, plus the girls will make \$10 for every booklet that they sell. The second company, Paper and Things, will donate \$275 if the troop uses their company, plus the girls will make \$7 for every booklet that they sell.
 - a. Write a system of equations that represents the problem situation. Define your variables.
 - b. Solve the system using your chosen method.
 - c. Interpret the solution of the linear system in terms of the problem situation.
 - d. Which company would you recommend the girls use? Explain.
- 5. Solve each system using your chosen method.

a. $\int 3x - 2y = 9$	b. $\int 5x - 3y = 30$
$\int -3x + y = -12$	$\int \frac{5}{3}x - 10 = y$
c. $\int 2x + 6y = 12$	d. $\int 2x + 2y = 4$
$\int x + 3y = 4$	2y = x - 17

Stretch

You can also use inequalities to solve problems that involve systems. Suppose the Community Center director who was planning the skating party has a budget of \$895.

Write and solve an inequality to determine the number of students who can be invited to each of the three locations. Then interpret each solution in terms of the problem situation.

Review

1. Write and solve each system using substitution.

- a. You want to make your grandmother's recipe for fudge. You have all the ingredients except sugar and chocolate. You have \$10.50 to spend on the sugar and chocolate. Sugar costs \$1.40 per pound, and chocolate costs \$8.40 per pound. Your grandmother's recipe calls for 4 times as much sugar as chocolate. How much sugar and chocolate can you buy?
- b. Your piggy bank contains 68 coins, made up of quarters and dimes. The piggy bank gives a digital readout of the total amount of money that it contains. The display reads \$13.10. How many quarters and dimes do you have?
- 2. Solve each equation.

a. $4(2x + 1) - 3(x - 2) = 10 + 5x$	b. $10(x - 2) + 15 = 8x + 7$
c. $2(x + 3) + 2 = 2(x + 4)$	d. $3(2x + 2) = 6(x + 6)$

The County Fair

Using Substitution to Solve Linear Systems

WARM UP

Analyze each system of equations. What can you conclude about the value of *y* in each?

1.
$$\begin{cases} x = 12 \\ y = x + 22 \end{cases}$$

2.
$$\begin{cases} x = 0 \\ y = x - 45 \end{cases}$$

3.
$$\begin{cases} x = y \\ y = 2x - 10 \end{cases}$$

4.
$$\begin{cases} x = y + 3 \\ y = 2x - 10 \end{cases}$$

LEARNING GOALS

- Write a system of equations to represent a problem context.
- Solve a system of equations algebraically using substitution.
- Interpret a solution to a system of linear equations in terms of the problem situation.
- Solve real-world and mathematical problems with two linear equations in two variables.

KEY TERMS

- standard form of a linear equation
- substitution method

Suppose you graph a system of equations, but the point of intersection is not clear from the graph? How can you determine the solution to the system?

Goats, Chickens, and Pigs

At the county fair, farmers bring some of their animals to trade with other farmers. To make all trades fair, a master of trade oversees all trades. Assume all chickens are of equal value, all goats are of equal value, and all pigs are of equal value.

- In the first trade of the day, 4 goats were traded for 5 chickens.
- In the second trade, 1 pig was traded for 2 chickens and 1 goat.
- In the third trade, Farmer Lyndi put up 3 chickens and 1 pig against Farmer Simpson's 4 goats.
- 1. Is this a fair trade? If not, whose animals are worth more? How could this be made into a fair trade?

3.1



In this lesson, you will explore systems of equations that may or may not be accurately solved using graphs. As you have seen, reasoning can also be used to solve systems. In the next activities, you will learn about solving systems algebraically.

Janet was helping her mother make potato salad for the county fair and was asked to go to the market to buy fresh potatoes and onions. Sweet onions cost \$1.25 per pound, and potatoes cost \$1.05 per pound. Her mother told her to use the \$30 she gave her to buy these two items.

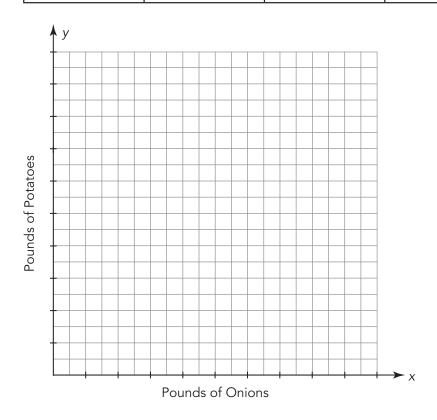
 Write an equation in standard form that relates the number of pounds of potatoes and the number of pounds of onions that Janet can buy for \$30. Use x to represent the number of pounds of onions, and y to represent the number of pounds of potatoes that Janet can buy.

2. Janet's mother told her that the number of pounds of potatoes should be 8 times greater than the number of pounds of onions in the salad. Write an equation in x and y that represents this situation.

3. Will 1 pound of onions and 8 pounds of potatoes satisfy both equations? Explain your reasoning.

The standard form of a linear equation is Ax + By = C, where A, B, and C are constants and A and B are not both zero. 4. Create graphs of both equations. Choose your bounds and intervals for each quantity.

Variable Quantity	Lower Bound	Upper Bound	Interval



5. Can you determine the exact solution of this linear system from your graph? Explain your reasoning.

6. Estimate the point of intersection from your graph.

In many systems, it is difficult to determine the solution from the graph. There is an algebraic method that can be used called the *substitution method*. The **substitution method** is a process of solving a system of equations by substituting a variable in one equation with an equivalent expression.

WORKED EXAMPLE

Let's consider the system you wrote.

 $\begin{cases} 1.25x + 1.05y = 30\\ y = 8x \end{cases}$

Because y = 8x is in slope-intercept form, use this as the first equation.

- **Step 1:** To use the substitution method, begin by choosing one equation and isolating one variable. This will be considered the first equation.
- **Step 2:** Now, substitute the expression equal to the isolated variable into the second equation.

Substitute 8x for y in the equation 1.25x + 1.05y = 30.

Write the new equation.

1.25x + 1.05y = 301.25x + 1.05(8x) = 30

You have just created a new equation with only one unknown.

Step 3: Solve the new equation.

1.25x + 8.40x = 309.65x = 30 $x \approx 3.1$

Therefore, Janet should buy approximately 3.1 pounds of onions.

Now, substitute the value for x into y = 8x to determine the value of y.

$$y = 8(3.1) = 24.8$$

Therefore, Janet should buy approximately 24.8 pounds of potatoes.

Step 4: Check your solution by substituting the values for both variables into the original system to show that they make both equations true.

The slope-intercept form of a linear equation is y = mx + b, where *m* is the slope of the line and *b* is the *y*-intercept of the line.



NOTES	7. Check that the solution is correct. Show your work.
	 8. What is the solution to the system? What does it represent in terms of the problem situation?
	9. Compare your solution using the substitution method to the solution on your graph. What do you notice?

Substitution with Special Systems

астіvіту **3.2**



Samson and Adrian are helping to set up the booths at the fair. They are each paid \$7 per hour to carry the wood that is needed to build the various booths. Samson arrives at 7:00 A.M. and begins working immediately. Adrian arrives 90 minutes later and starts working.

1. Write an equation that gives the amount of money that Samson will earn, y, in terms of the number of hours he works, x.

2. How much money will Samson earn after 90 minutes of work?

3. Write an equation that gives the amount of money Adrian will earn, *y*, in terms of the number of hours since Samson started working, *x*.

4. How much money will each student earn by noon?

- 5. Will Adrian ever earn as much money as Samson? Explain your reasoning.
- 6. Write a system of linear equations for this problem situation.
- 7. Analyze the system of linear equations. What do you know about the solution of the system by observing the equations? Explain your reasoning.

Let's see what happens when we solve the system algebraically.

- 8. Since both equations are written in slope-intercept form as expressions for y in terms of x, substitute the expression from the first equation into the second equation.
 - a. Write the new equation.

b. Solve the equation for x.

c. Does your result for x make sense? Explain your reasoning.



How is this similar to 9. What is the result when you algebraically solve a linear system that contains parallel lines?

On Monday night, the fair is running a special for the the local schools: if tickets are purchased from the school, you can buy student tickets for \$4 and adult tickets for \$4. You buy 5 tickets and spend \$20.

- 10. Write an equation that relates the number of student tickets, *x*, and the number of adult tickets, *y*, to the total amount spent.
- 11. Write an equation that relates the number of student tickets, x, and the number of adult tickets, y, to the total number of tickets purchased.
- 12. Write both equations in slope-intercept form.

13. Analyze the system of linear equations. What do you know about the solution of the system by looking at the equations?

NOTES

Let's see what happens when you solve the system algebraically.

- 14. Since both equations are now written in slope-intercept form as expressions for y in terms of x, substitute the expression from the first equation into the second equation.
 - a. Write the new equation and solve the equation for x.
 - b. Does your result for x make sense? Explain your reasoning.
- 15. How many student tickets and adult tickets did you purchase?
- 16. What is the result when you algebraically solve a linear system that contains two lines that are actually the same line?



Write and solve a system of equations to solve each problem.

- 1. The admission fee for the fair includes parking, amusement rides, and admission to all commercial, agricultural, and judging exhibits. The cost for general admission is \$7, and the price for children under the age of 5 is \$4. There were 449 people who attended the fair on Thursday. The admission fees collected amounted to \$2768.
 - a. Write a system of equations in standard form for this situation. Use x to represent the number of people 5 and over, and use y to represent the number of children under 5 years of age.
 - b. Without solving the system of linear equations, interpret the solution.
 - c. Solve the system of equations using the substitution method. Then interpret the solution of the system in terms of the problem situation.

- 2. The business manager for a band must make \$236,000 from ticket sales to cover costs and make a reasonable profit. The auditorium where the band will play has 4000 seats, with 2800 seats on the main level and 1200 on the upper level. Attendees will pay \$20 more for main-level seats.
 - a. Write a system of equations with x representing the cost of the main-level seating and y representing the cost of the upper-level seating.

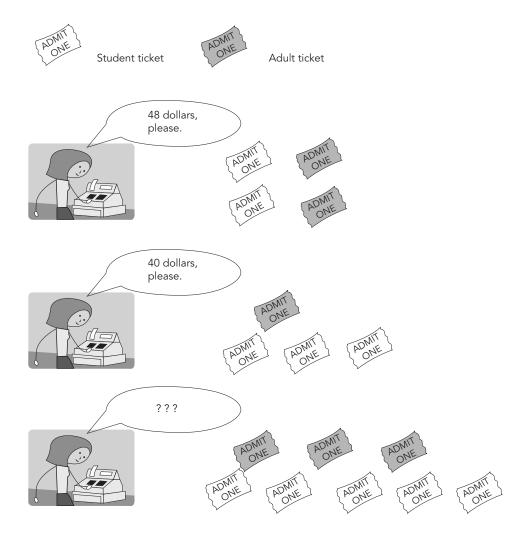
b. Without solving the system of linear equations, interpret the solution.

c. Solve the system of equations using the substitution method. Then interpret the solution of the system in terms of the problem situation.

- 3. Ms. Ross told her class that tomorrow's math test will have 20 questions and be worth 100 points. The multiple-choice questions will be 3 points each, and the open-ended response questions will be 8 points each. Determine how many multiple-choice and open-ended response questions will be on the test.
 - a. Write a system of equations. Describe your variables.

b. Without solving the system of linear equations, interpret the solution.

c. Solve the system of equations using the substitution method. Then interpret the solution of the system in terms of the problem situation. 4. Ashley is working as a cashier at the sports arena. What should she tell the next person in line?



Write and solve a system of equations that represents the problem situation. Define the variables. Then determine the cost of each type of ticket. Finally, state the amount Ashley charges the third person.

- Alex is applying for positions at two different electronic stores in neighboring towns. The first job offer is a \$200 weekly salary plus 5% commission on sales. The second job offer is a \$75 weekly salary plus 10% commission.
 - a. Write a system of equations that represents the problem situation. Define the variables. Then solve the system of linear equations and interpret the solution in terms of the problem situation.

b. What is the difference in the weekly pay between stores if Alex sells \$3000?

c. What is the difference in the weekly pay if he sells \$4225?

d. Which job offer would you recommend Alex take? Explain your reasoning.

Alex's sales targets for each job would be between \$1500 and \$3000 weekly. Each manager tells Alex the same thing: "Some weeks are better than others, depending on the time of year and the new releases of technology." NOTES

TALK the TALK ┿

The Substitution Train

1. Determine the solution to each linear system by using the substitution method. Check your answers algebraically.

a.
$$\begin{cases} 2x + 3y = 34 \\ y = 5x \end{cases}$$

b. $\begin{cases} y = 4x + 2 \\ y = 3x - 2 \end{cases}$

c. $\begin{cases} 3x + 2y = 4\\ 2x - y = 5 \end{cases}$

d. $\begin{cases} 3x + y = 8\\ 6x + 2y = 10 \end{cases}$

Assignment

Write

Explain how to use the substitution method to solve systems of linear equations.

Remember

When a system has no solution, the equation resulting from the substitution step has no solution.

When a system has infinite solutions, the equation resulting from the substitution step has infinite solutions.

Practice

- 1. Serena is trying to become more environmentally conscious by making her own cleaning products. She researches different cleaners and decides to make furniture polish using olive oil and lemon juice. She wants to make enough to fill two 24-ounce bottles.
 - a. Write an equation in standard form that relates the amount of olive oil and lemon juice to the total amount of mixture Serena wants to make. Use *x* to represent the amount of lemon juice and *y* to represent the amount of olive oil.
 - b. The recommendation for the mixture is that the amount of olive oil be twice the amount of lemon juice. Write an equation in terms of *x* and *y* as defined in part (a) that represents this situation.
 - c. Use substitution to solve the system of equations. Check your answer.
 - d. What does the solution of the system represent in terms of the mixture?
 - e. The best price Serena can find for lemon juice is \$0.25 per ounce. The best price she can find for olive oil is \$0.39 per ounce. She buys a total of 84 ounces of lemon juice and olive oil, and spends \$29.40. Write equations in standard form for this situation. Use x to represent the amount of lemon juice she buys, and use y to represent the amount of olive oil she buys.
 - f. Solve the system of equations you wrote using the substitution method. Check your answer. Describe the solution in terms of the problem situation.
- 2. In an effort to eat healthier, Bridget is tracking her food intake by using an application on her phone. She records what she eats, and then the application indicates how many calories she has consumed. One day, Bridget eats 10 medium strawberries and 8 vanilla wafer cookies as an after-school snack. The caloric intake from these items is 192 calories. The next day, she eats 20 medium strawberries and 1 vanilla wafer cookie as an after-school snack. The caloric intake from these items is 99 calories.
 - a. Write a system of equations for this problem situation. Define your variables.
 - b. Without solving the system of linear equations, interpret the solution.
 - c. Solve the system of equations using the substitution method. Check your work.
 - d. Interpret the solution of the system in terms of the problem situation.
 - e. Bridget's friend Monica also has a calorie counting application on her phone. The two friends decide to compare the two programs. Bridget eats 1 banana and 5 pretzel rods, and her application tells her she consumed 657 calories. Monica eats 1 banana and 5 pretzel rods, and her application tells her she consumed 656 calories. The girls want to know how many calories are in each food. Write a system of equations for this problem. Define your variables.
 - f. Solve the system of equations using the substitution method. Interpret your answer in terms of the problem.

- 3. Write a system of linear equations to represent each situation. Then solve the system using substitution. Interpret the solution of the system in terms of the problem situation.
 - a. James has 13 coins. The coins are nickels and quarters. The coins have a total value of \$2.05. Let *n* represent the number of nickels, and let *q* represent the number of quarters.
 - b. Ms. Snyder is giving a 28-question test that is made up of 2-point questions and 4-point questions. The entire test is worth 100 points. Let *t* represent the number of 2-point questions, and let *f* represent the number of 4-point questions.
 - c. The basketball team scored 82 points from 2-point and 3-point baskets. They make 38 baskets altogether. Let *a* represent the number of 2-point baskets, and let *b* represent the number of 3-point baskets.
- 4. Use the substitution method to determine the solution of each system of linear equations. Check your solutions.

a. $\begin{cases} 9x + y = 16\\ y = 7x \end{cases}$	b. $\begin{cases} 3x + \frac{1}{2}y = -3.5\\ y = -6x + 11 \end{cases}$
$C. \begin{cases} y = -5x \\ 21x - 7y = 28 \end{cases}$	d. $\begin{cases} 2x + 4y = -32\\ y = -\frac{1}{2}x - 8 \end{cases}$

Stretch

Create a system of linear equations with solution (2, 5). Solve the system using substitution to verify your system has the given solution.

Review

- 1. Graph each system of linear equations to determine the solution to the system.
- a. y = 34 ⁵/₂x and y = ²/₅x + 5
 b. y = 21x + 144 and y = 3(7x + 48)
 2. The population growth (in thousands) for a small town near Bay City can be represented by the expression x + ⁴/₅(x + 315), where x represents the number of years since 2005. The population growth (in thousands) for a neighboring town can be represented by the expression 2x ¹/₅(x 630), where x
- represents the number of years since 2005. When will the populations of the two towns be the same? 3. Two neighboring towns are not having population growth. In fact, they both have been losing population
- since 1995. The population decline for one of the towns (in thousands) can be represented by the expression $-\frac{2}{5}(x 500)$, where x represents the number of years since 1995. The population decline for the other town (in thousands) can be represented by the expression $-\frac{1}{2}x + \frac{1}{10}(x + 2000)$, where x represents the number of years since 1995. When will the populations of the two towns be the same?
- 4. Solve each equation.
 - a. 8(2m + 7) = 10(m + 11) b. -3(y + 20) = -9y

Topic 2 Systems of Linear Equations

Name _

Date .

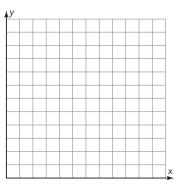
I. Modeling Linear Systems

- A. Graph each system of linear equations. Use the graph to answer the questions.
- Shawn started walking from home to school just as his brother Dante was leaving school to walk home. The distance from their home to school is 11,680 feet. Dante was walking at a slow pace averaging about 280 feet per minute. Shawn, who was excited to get to class, was walking more quickly, averaging about 450 feet per minute. Assume they both left at the same time and maintained their rate of speed for the entire trip.

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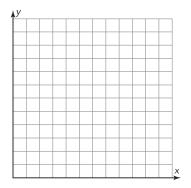
- **a.** How far was each sibling from home after 6 minutes?
- **b.** When was Dante 8320 feet from home?
- **c.** How long after leaving did Shawn meet Dante?

 Sylvia runs a company that produces clothing accessories—hats, patches, scarves, etc.—for events such as a Presidential inauguration. To produce each item costs her \$1. She also pays an initial startup cost for production of \$100, regardless of the number of products that she produces. She plans to sell each product for \$5.



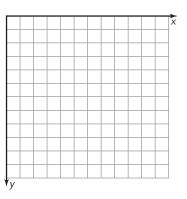
- **a.** How much money would the cost be to produce fifty products? What is Sylvia's income if she sells fifty products?
- **b.** If her income was \$235, how many products did she sell?
- **c.** How many products must Sylvia produce if she wants her income from this product to be equal to her production cost?

 Computer Company A had total sales of 4.9 billion dollars in 2013. Its sales have been declining at the rate of 0.22 billion dollars per year. Computer Company B, another major manufacturer of computers, had total sales of 1.64 billion dollars in 2013. Its sales have been increasing at a rate of 0.19 billion dollars per year.



- **a.** What will Computer Company A's and Computer Company B's predicted total sales be for the year 2022?
- **b.** In how many years will Computer Company A's predicted total sales reach 4.24 billion dollars?
- **c.** In how many years will the predicted sales for these two computer companies be equal?

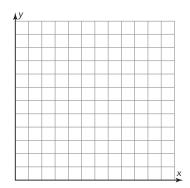
4. Deep-sea divers Jacques Cousteau and his assistant are searching for sunken treasure. Jacques Cousteau is currently 13.9 meters below the surface (-13.9 meters) and his assistant is currently 97.3 meters below the surface (-97.3 meters). Jacques Cousteau is swimming down at the rate of 7.5 meters per minute, and his assistant is swimming towards the surface at 6.4 meters per minute.



- a. What is the depth of each diver 3 minutes from now?
- **b.** In how many minutes will the assistant be 33.3 meters below the surface?
- **c.** According to the algebraic model, in how many minutes will the divers be at the same depth?

Name _

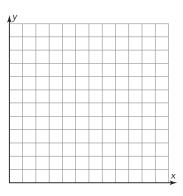
5. Jean and Brian both have coffee cans in which they keep quarters. Jean has 64 quarters in her can while Brian has 228 in his. This summer Brian is working at the library five days per week and spends 3 of his quarters every day in the parking meter. Jean, however, receives 1 quarter every day in change from her lunch and is putting them into her can. (Jean also works five days per week.)



- **a.** How many quarters will Jean and Brian have after 2 full work weeks?
- **b.** At this rate, after how many business days will Brian's can be empty?
- **c.** In how many business days will both cans have the same amount of money?

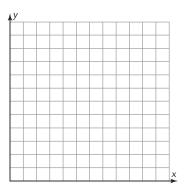
Date

6. In a hot air balloon race, one balloon goes up and is given some time to get a head start. The other balloons are launched together to chase the first one. The winner is the first chase balloon that gets within a certain distance of the target balloon. Suppose the target balloon is launched and given a headstart of 4.7 miles, and travels at the rate of 0.2 miles per minute. Mr. Montgolfiere is chasing it. His balloon has a top speed of 0.3 miles per minute.



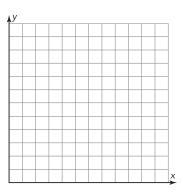
- **a.** How far will Mr. Montgolfiere's balloon have traveled after 30 minutes?
- **b.** When will the target balloon have traveled 13.7 miles?
- **c.** At what time will Mr. Montgolfiere's balloon catch the target balloon?

7. In a 1994 survey, 1 in 2 respondents reported that they usually did not take protective measures for sun exposure. One person in 8 reported having been sunburned in the past year.



- a. If these rates were true for a town of 320 people, how many people would be unlikely to protect themselves? How many would be likely to be sunburned?
- **b.** If twenty people reported that they were sunburned last year, how many people were surveyed?
- c. Would the number of people who were sunburned and the number of people who didn't protect themselves ever be equal? When?

8. It was estimated that the Pittsburgh metropolitan area would have a population of 2,377,800 people at the end of 1993. Its population was expected to increase at the rate of 10 people per day. The metropolitan area of Tampa Bay was estimated to have a population of 2,067,000 at the end of 1993. Its population was expected to increase at the rate of 130 people per day. Assume there are 365 days in a year.



- **a.** What was the population of Pittsburgh 3 years later, at the end of 1996?
- **b.** According to the algebraic model, in how many days will the population of the Pittsburgh metropolitan area reach three million?
- **c.** In how many days does the model predict that the populations of the two metropolitan areas were or will be equal?

Name .

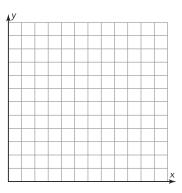
9. Two skydivers are jumping out of two separate planes to do a stunt for a movie. The first skydiver is at an altitude of 2700 feet and will fall at the rate of 95 feet per second by stretching out his arms and legs to slow his descent. The second skydiver will jump from an altitude of 3600 feet but will fall at the rate of 185 feet per second.

+						

- **a.** What will each skydiver's altitude be in thirteen seconds?
- **b.** After how many seconds will the first skydiver's altitude be 2225 feet?
- **c.** When will the two skydivers' altitudes be equal?

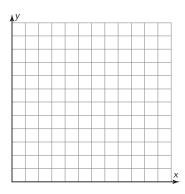
Date

10. Under one current health insurance plan, you get different insurance coverage depending on whether or not you go to someone who is associated with the plan. If you go to a provider who is not a member of the health plan, the plan will cover only 65% of your medical bill after the first \$225. You pay the rest. However, if you go to a doctor or health provider who is a plan member, the plan will cover 100% of your bill after the first \$70.



- a. If you had \$560 worth of doctor's bills, how much would be covered if you visited a member provider?
 a non-member provider?
- **b.** If the health plan paid \$510 when you went to a member provider, how much was your medical bill?
- According to the algebraic model, is the coverage for member and non-member providers ever the same? If so, when, and can that cost ever occur in real life?

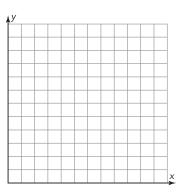
11. Yumi is planning a wedding shower for her best friend. She has come up with two options. The first option is to rent a hall and have the shower there. She figures the hall would cost \$195 and food, refreshments, and decorations would cost \$650. She also plans to give everyone some flowers in a vase. The vase would cost \$4 and the flowers would cost \$3.50. The second option is to take everyone on a river cruise. The Liberty Belle has a party package for \$23.75 per person.



- **a.** If 39 people attend the shower, how much will each option cost?
- **b.** If Yumi has \$1900 set aside for this function, how many people can she invite if she chooses option #2?
- **c.** For what amount of people is the cost of both options the same?

PAGE 98

12. Old growth forests are forests that have not experienced unnatural or man-made disturbances. Currently, the United States has about thirteen thousand square miles designated as old growth forest, and this is increasing at the rate of 340 square miles a year. The logging industry proposes that it be permitted to harvest 990 square miles of old growth timber per year.



- a. How many square miles of old growth forest will be harvested in the next 9 years if the timber industry gets the quotas they are requesting?
- **b.** When will 9900 square miles be harvested?
- c. When will the size of the old growth forest be equal to the amount harvested under the logging industry's proposal?

Name _

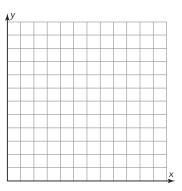
13. Ms. Williamson woke up one morning to find her basement flooded with water. She called two different plumbers to get their rates. The first plumber charges \$36 just to walk in the door plus \$28 an hour. The second plumber charges a flat \$64 an hour.

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- **a.** What is the cost for each plumber if the job takes four hours?
- **b.** How many hours did the first plumber take to do the job if he charged \$176?
- **c.** After how many hours will the cost for both plumbers be the same?

Date

14. A company was hired to build a tunnel through a mountain. The company started at the south end of the mountain and completed only 545 feet of the required 5450 feet before going bankrupt. A different company was hired to complete the job, but they decided to use two crews. Crew A would start where the other company left off at the southern end, while Crew B would start at the northern end and dig towards the other crew. Crew A was able to dig 22 feet of the tunnel per week. Crew B, which was larger, was able to dig 87 feet of the tunnel per week.



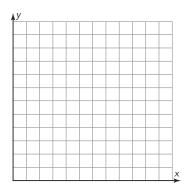
- **a.** How far from the southern end are both crews after 25 weeks of digging?
- **b.** When will Crew A be 853 feet from the southern opening?
- **c.** How long after they start digging will they meet?

15. A couple of college students get the idea to open a snack stand at the regatta festival this summer. The students sell delicious soft pretzels. They pay the city \$648 to set up their stand for the entire regatta. They also figure the cost for dough, coarse salt, and other things they need is \$0.20 per pretzel. They sell each pretzel for \$2.90.

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- **a.** What is the cost and the income obtained from selling forty pretzels?
- **b.** If the income from selling the pretzels was \$261, how many pretzels did they sell?
- **c.** How many pretzels must they sell to break even, according to the algebraic model?

- **16.** A hot-air balloon rising at a rate of 52.2
 - feet per minute left the ground and, after some time, is now at an altitude of 425.4 feet. A blimp overhead at an altitude of 7231.8 feet begins descending at the rate of 160.5 feet per minute.



- a. What is the height of the balloon and the blimp thirty-three minutes from now?
- **b.** How long does the hot-air balloon take to reach a height of 1834.8 feet?
- **c.** When will the balloon and the blimp be at the same height?

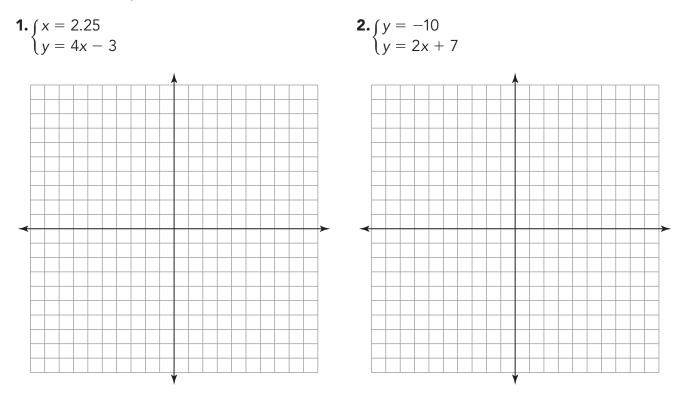
Topic 2	
SYSTEMS OF LINEAR EQUATIONS	

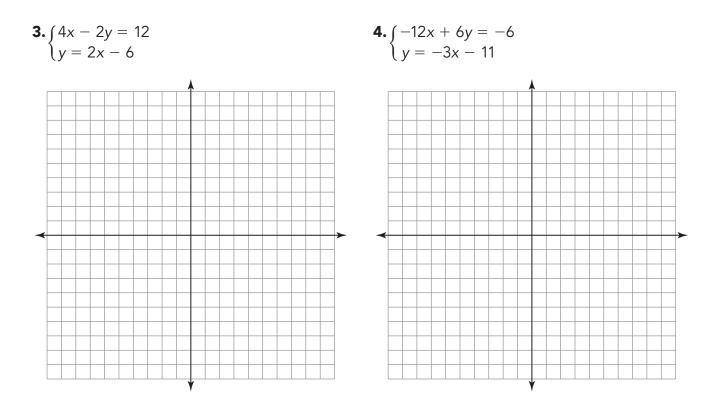
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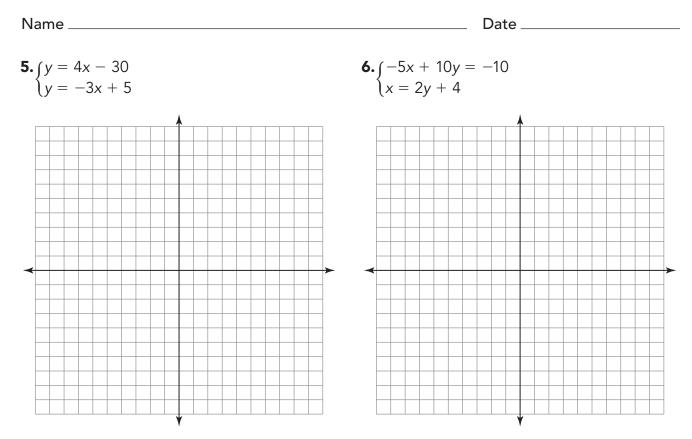
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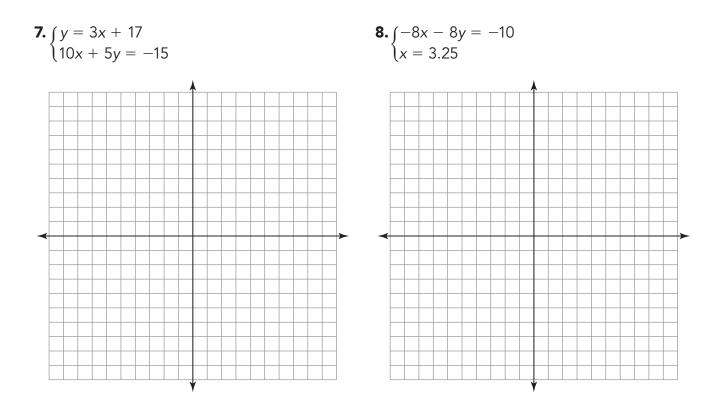
II. Solving Linear Systems

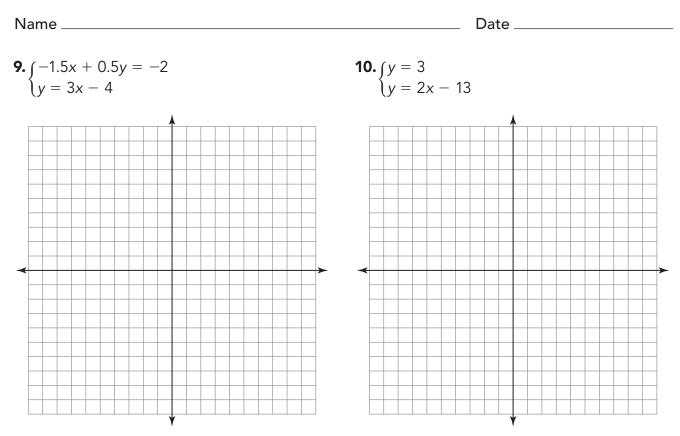
A. Graph the equations in each system. Tell whether the system has one solution, no solutions, or infinite solutions. If the system has one solution, write the values of the variables that make the equations true.

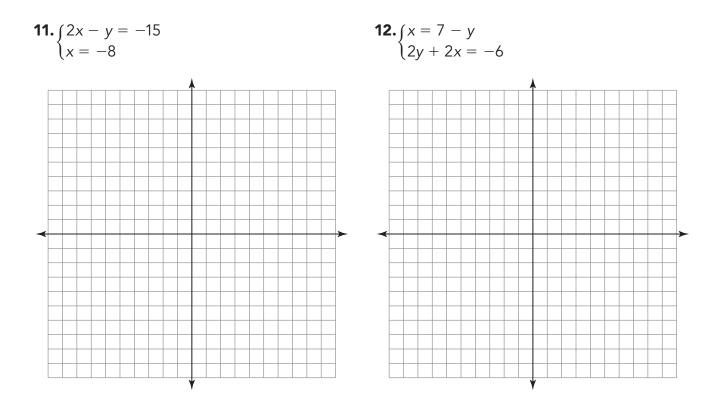


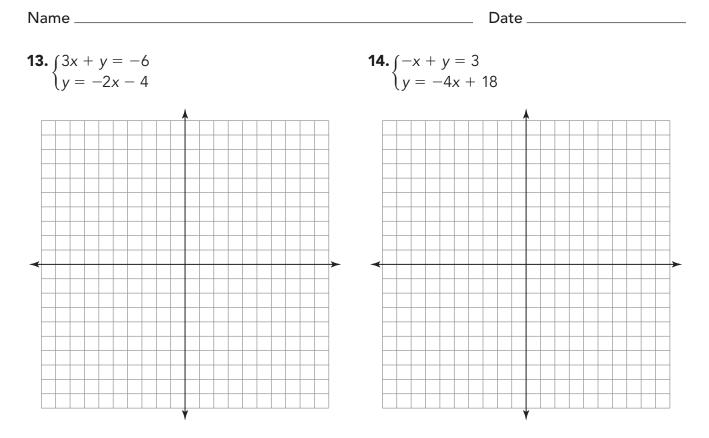


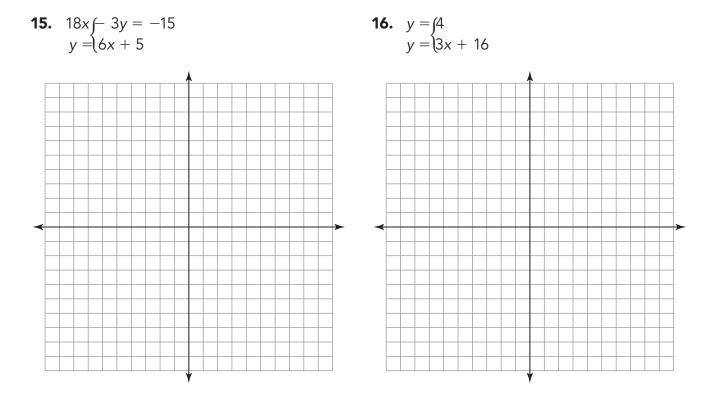












A Constant Ratio

Geometric Sequences and Exponential Functions

Warm Up

Use the explicit formula to generate the first 4 terms of each geometric sequence.

1. $g_n = 2 \cdot 3^{x-1}$

2. $g_n = 8240 \cdot 1.05^{x-1}$

3.
$$g_p = 100 \cdot \left(\frac{1}{2}\right)^{x}$$

4. $g_n = (-2) \cdot 4^{x-1}$

Learning Goals

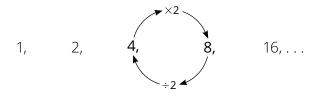
- Write a geometric sequence as an exponential function in the form $f(x) = a \cdot b^x$.
- Identify the constant ratio and *y*-intercept in different representations of exponential functions.
- Recognize when a relationship is exponential.
- Use algebra to show that, for an exponential function in the form $f(x) = a \cdot b^x$, the ratio $\frac{f(x + 1)}{f(x)}$ is constant and equal to *b*, and the *y*-intercept is represented by the ordered pair (0, *a*).

You have learned about geometric sequences and have briefly explored exponential functions. How can you use geometric sequences to define exponential functions?

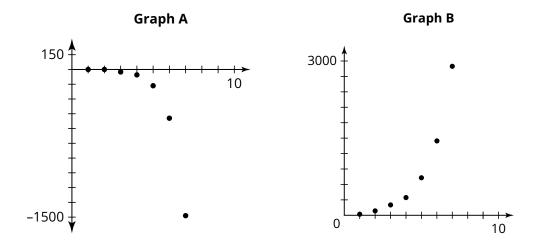
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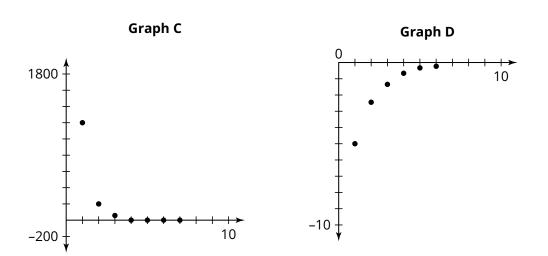
Compare and Contrast

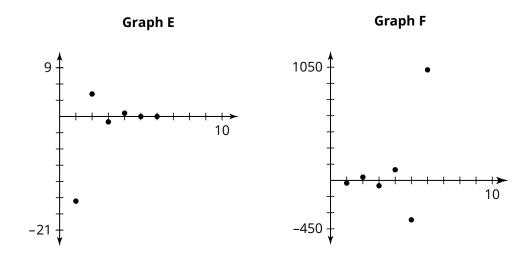
Recall that a geometric sequence is a sequence of values in which consecutive terms are separated by a common ratio, or constant ratio. For example, the sequence shown is a geometric sequence with a constant ratio of 2.



The graphs of six different geometric sequences are shown.







1. Identify similarities and differences among the graphs. What do you notice?



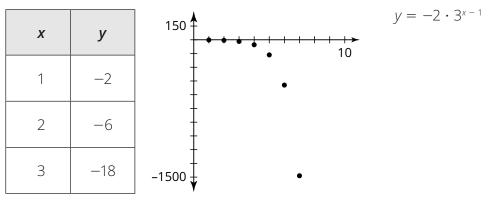
The explicit formula for a geometric sequence is $g_n = g_1 \cdot r^{n-1}.$

A table of values, a graph, and the explicit formula are given for six geometric sequences.

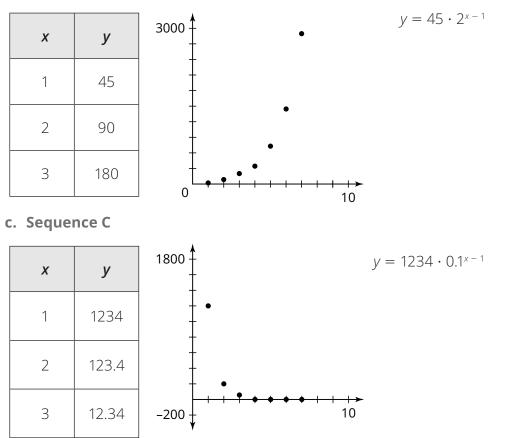
1. Identify the constant ratio in each representation.

a. Sequence A

1.1

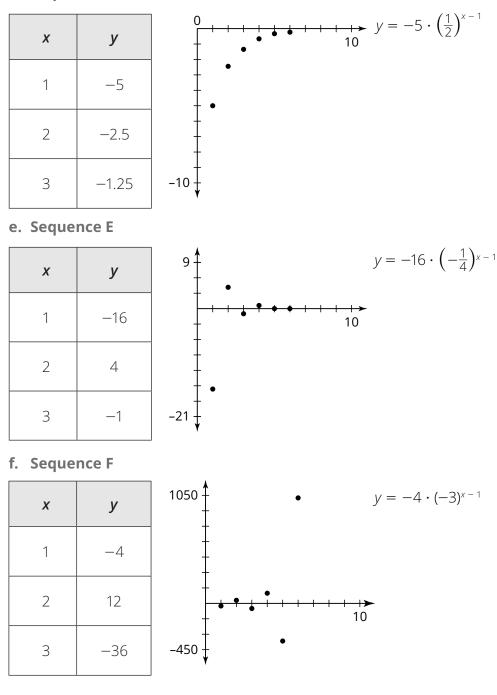


b. Sequence B



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d. Sequence D



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2. What strategies did you use to identify the constant ratio for each sequence?



All arithmetic sequences can be represented as linear functions. Is there a function family that can represent geometric sequences? 3. Analyze the graphs of the geometric sequences. Do any of the graphs appear to belong to a specific function family? If so, identify the function family. Explain your reasoning.

астічіту **1.2**

Exponential Growth



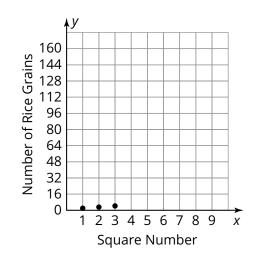
Square Number	Number of Rice Grains	Power
1	1	
2	2	
3	4	
4	8	
5		
6		
7		
8		

A famous legend tells the story of the inventor of the game of chess. When the inventor showed the new game to the emperor of India, the emperor was so astonished, he said to the inventor, "Name your reward!"

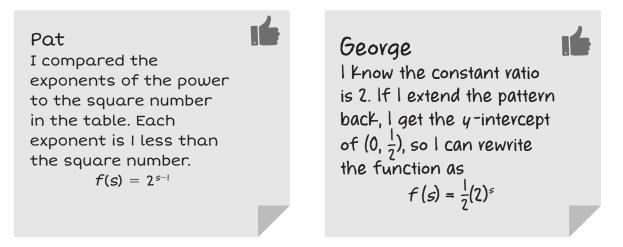
The wise inventor asked the emperor for 1 grain of rice for the first square of the chessboard, 2 grains for the second square, 4 grains for the third square, 8 grains for the fourth square, and so on.

- Determine the number of rice grains on the next 4 squares and include them in the table. Complete the third column by writing each number of rice grains as a power with the same base.
- 2. What pattern do you notice in the table?

3. Graph the points from your table. The first few points have been plotted. Describe the meaning of the plotted points and then identify the function family represented.



- 4. Identify the constant ratio in the graph, in the table, and in the situation.
- 5. Pat and George each used different methods to write an exponential function to represent the number of rice grains for any square number on the chessboard.

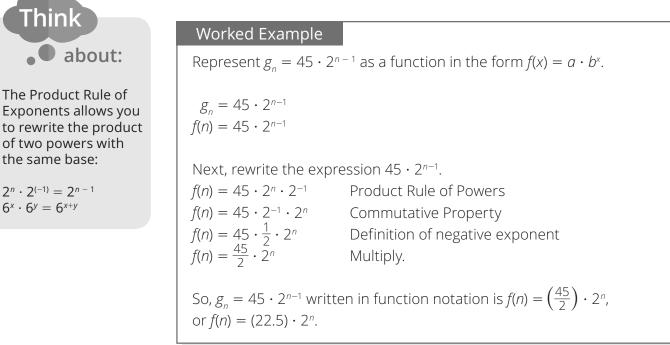


Use properties of exponents to verify that 2^{s-1} and $\frac{1}{2}(2)^s$ are equivalent.

The function that George wrote is in exponential form. Recall that an exponential function is a function of the form $f(x) = a \cdot b^x$, where *a* and *b* are real numbers, and *b* is greater than 0 but is not equal to 1.

- 6. What do the *a*-value and *b*-value represent in terms of the equation and graph?
- 7. Use the exponential function and a calculator to determine the number of rice grains that would be on the very last square of the chessboard. A chessboard has 64 squares.

You can write the explicit formula for geometric sequences in function notation.



In the previous activity you identified some of the geometric sequences as exponential functions and some that were not exponential functions.

Sequence	Explicit Formula	Exponential Function $f(x) = a \cdot b^x$	Constant Ratio	<i>y</i> -Intercept
А	$-2 \cdot 3^{x-1}$			
В	$45 \cdot 2^{x-1}$			
С	1234 · 0.1 ^{x-1}			
D	$-5 \cdot \left(\frac{1}{2}\right)^{(x-1)}$			

8. Rewrite each explicit formula of the geometric sequences that are exponential functions in function form. Identify the constant ratio and the y-intercept. Based on the graphs of Sequences E and F, you can tell they do not represent exponential functions.

9. Rewrite each explicit formula in function form and explain why these geometric sequences are not exponential functions.

a. Sequence E:
$$y = -4 \cdot (-3)^{x-1}$$
 b. Sequence F: $y = -16 \cdot (-\frac{1}{4})^{x-1}$

- 10. You know that all arithmetic sequences are linear functions. What can you say about the relationship between geometric sequences and exponential functions?
- Complete the table by writing each part of the exponential function that corresponds to each part of the geometric sequence.

Geometric Sequence $g_n = g_1 \cdot r^{n-1}$	Exponential Function $f(x) = a \cdot b^x$	Mathematical Meaning
g _n		
$\frac{g_1}{r}$		
r		
n		

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1.3 Identifying Exponential Functions



As part of a project in health class, Aliyah, Kim, and Reese are raising awareness and challenging others to eat a healthy breakfast each morning. Today, they each sent selfies of themselves eating a healthy breakfast to 4 friends and challenged them to do the same the next day. This next day when others send selfies of themselves eating a healthy breakfast will be considered Day 1 of their results. The following day, only those contacted the previous day will send selfies to 4 friends, and the challenge will continue to spread. Assume everyone contacted completes the challenge and new participants are contacted each day.

1. Write an exponential function, *f*(*x*), to represent the number of new participants of the challenge as a function of the day number, *x*.

The results after 4 days of the challenge are shown in the table.

Time (Day)	Number of New Participants
1	12
2	48
3	192
4	768

- 2. The relationship between time and number of participants is exponential.
 - a. Verify the relationship is exponential by identifying the constant ratio.

The constant ratio of an exponential function must be greater than 0 and not equal to 1.

- b. What is the number of new participants for Day 0? Explain your answer.
- c. If the number of new participants for Day 0 is represented by $f(x) = a \cdot b^x$, then the number of new participants for Day 1 can be represented by $f(x + 1) = a \cdot b^{(x+1)}$. Complete the table to show the number of new participants as a function of the day in terms of x and f(x).

Time (Day)		r of New ipants	Function Form
x	<i>f</i> (<i>x</i>)		$f(x) = a \cdot b^x$
0	<i>f</i> (<i>x</i>)		$f(x) = a \cdot b^x$
1	f(x + 1)	12	$f(x+1) = a \cdot b^{(x+1)}$
2		48	
3		192	
4		768	

d. Use the expressions from the Function Form column of the table and algebra to prove that the table shows a constant ratio between consecutive output values of the function.

Recall that the Quotient Rule of Powers states that when dividing powers with the same base you can subtract their exponents. $\frac{b^{x+2}}{b^{x+1}} = b^{(x+2)-(x+1)}$

Writing Exponential Functions

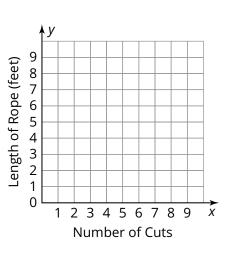
The Amazing Aloysius is practicing one of his tricks. As part of the trick, he cuts a rope into many pieces and then magically puts the pieces of rope back together. He begins the trick with a 10-foot rope and then cuts it in half. He takes one of the halves and cuts that piece in half. He keeps cutting the pieces in half until he is left with a piece so small he can't cut it anymore.

1. Complete the table to show the length of rope after each of Aloysius's cuts. Write each length as a whole number, mixed number, or fraction. Then graph the points from the table.

Number of Cuts	Length of Rope (feet)
0	
1	
2	
3	
4	
5	

ΑCTIVITY

Δ



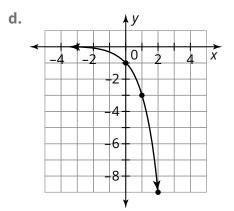
- 2. Write the function, *L*(*c*), to represent the length of the rope as a function of the cut number, *c*.
- 3. Use your function to determine the length of the rope after the 7th cut.

4. Write an exponential function of the form $f(x) = a \cdot b^x$ for each table and graph.

a.	X	У
	0	4
	1	2
	2	1
	3	$\frac{1}{2}$

b.		
	X	У
	-2	$-\frac{1}{2}$
	-1	-2
	0	-8
	1	-32

с.	x	У
	0	1
	1	4
	2	16
	3	64





	TALK	the	TALK	
--	------	-----	------	--

Did We Mention Constant Ratio?

1. For an exponential function of the form $f(x) = a \cdot b^x$, what is the relationship between the base of the power, the expression $\frac{f(x + 1)}{f(x)}$, and the common ratio of the corresponding geometric sequence?

2. How can you decide whether a geometric sequence of the form $g_n = g_1 \cdot b^{n-1}$ represents an exponential function?

Assignment

Write

Describe the differences between a linear function and an exponential function using your own words.

Remember

All sequences are functions, and some geometric sequences are exponential functions.

The form of an exponential function is $f(x) = a \cdot b^x$, where a and b are real numbers and b > 0, but $b \neq 1$. The a-value represents the y-intercept and the b-value represents the constant ratio, or constant multiplier.

c.

Practice

1. Each table shows the population of a city over a three-year period. Write an exponential function to represent each population as a function of time.

a.

Blueville		
1	7098	
2	7197	
3	7298	

L.	
b.	

Youngstown		
1	12,144	
2	12,290	
3 12,437		

Greenville		
1	7860	
2	7722	
3	7587	

- 2 . Consider each situation. If possible, identify a constant ratio and write an exponential function to represent the relationship. Be sure to define your variables.
 - a. Manuel works in a lab. The number of bacteria over time in a petri dish he is studying is shown in the table.

Bacteria		
Time Number of (hours) Bacteria		
0	605	
1	2420	
2	9680	
3	38,720	

 b. Jessica has been studying the honey bee population. The number of honey bees she documents over time is shown in the table.

Honey Bee Population		
Time (years) Number of Honey Bees		
1	52,910	
2	43,069	
3	35,058	
4	28,537	

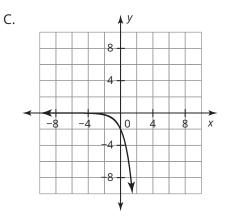
c. Jackson started depositing money into a savings account. The amount of money over time in the account is shown in the table.

Savings Account		
Time (years) Value (\$)		
5	875	
10	1200	
15	1525	
20	1850	

Stretch

Which of the functions does not fit with the others? Explain your answer.

A. The exponential function that goes through (0, -3) and (5, -96).



D		
D.	x	У
	1	<u>2</u> 3
	2	<u>2</u> 9
	3	$\frac{2}{27}$

B. $f(x) = -1 \cdot 6^x$

Review

1. Solve each equation. Show your work.

a.
$$|x - 4| = 7$$
 b. $|3x + 5| = 11$

2. Determine the inverse of each function. Is the inverse also a function? Explain why or why not.

a. y = -4 b. $y = (\frac{1}{4})x + \frac{3}{2}$

3. Solve each system of linear equations.

a.
$$\begin{cases} y = -5x - 21 \\ -2x + 5y = -24 \end{cases}$$
 b.
$$\begin{cases} 8x - 3y = 4 \\ 7x - 10y = -26 \end{cases}$$

Topic 1 The Real Number System

Name	Date	
L Introduction to Irrational Numbers		

I. Introduction to Irrational Numbers

A. Determine whether each number is a perfect square. If it is a perfect square, write the number as a product of its two factors.

1. 20	2. 36
3. 49	4. 68
5. 121	6. 169
7. 400	8. 150

B. Determine the square root for each perfect square.

1. $\sqrt{64}$	2. √100
3. $\sqrt{81}$	4. √16
5. $\sqrt{4}$	6. $\sqrt{0}$
7. √25	8. √144

C. Approximate each square root to the nearest tenth.

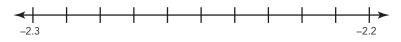
1. $\sqrt{130}$	2. √8
3. $\sqrt{85}$	4. √40
5. $\sqrt{24}$	6. √110

D. Classify each number as rational or irrational.

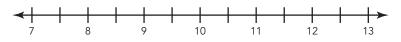
1. 0	2. –5
3. $-\sqrt{2}$	4. 1.3
5. $\sqrt{5}$	6. π
7. 0.33	8. √16
9. 6	10. $\frac{3}{4}$
11. 0.67236982158	12. $\frac{31}{13}$

II. Graphing Real Numbers on a Number Line

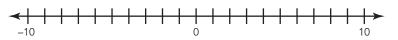
- A. Plot a point on the number line to represent each given number.
- 1. Represent -2.257 on the number line.



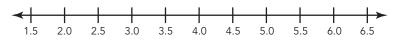
2. Represent $7\frac{1}{9}$ on the number line.



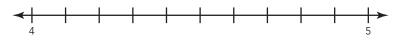
3. Represent $-\sqrt{4}$ on the number line.



4. Represent π on the number line.



5. Represent $4\frac{7}{8}$ on the number line.



6. Represent $-\sqrt{28}$ on the number line.



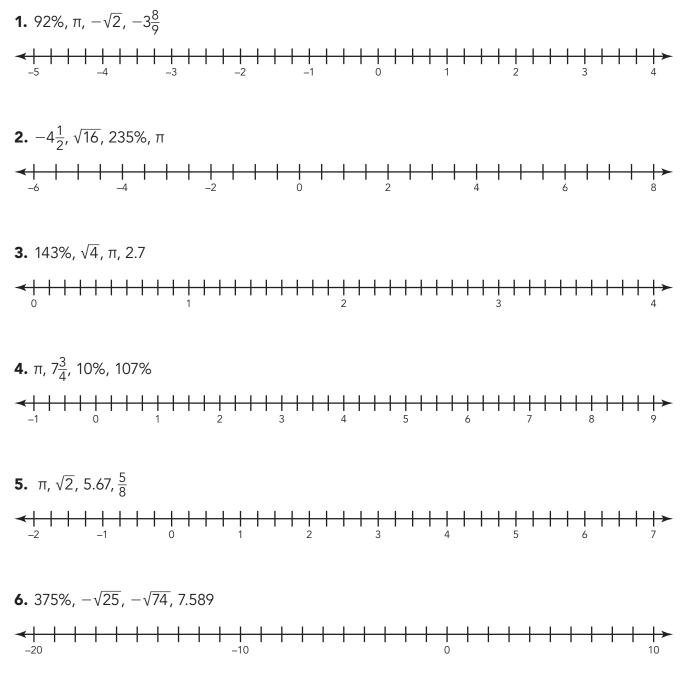
PAGE 111

Name _

Date ___

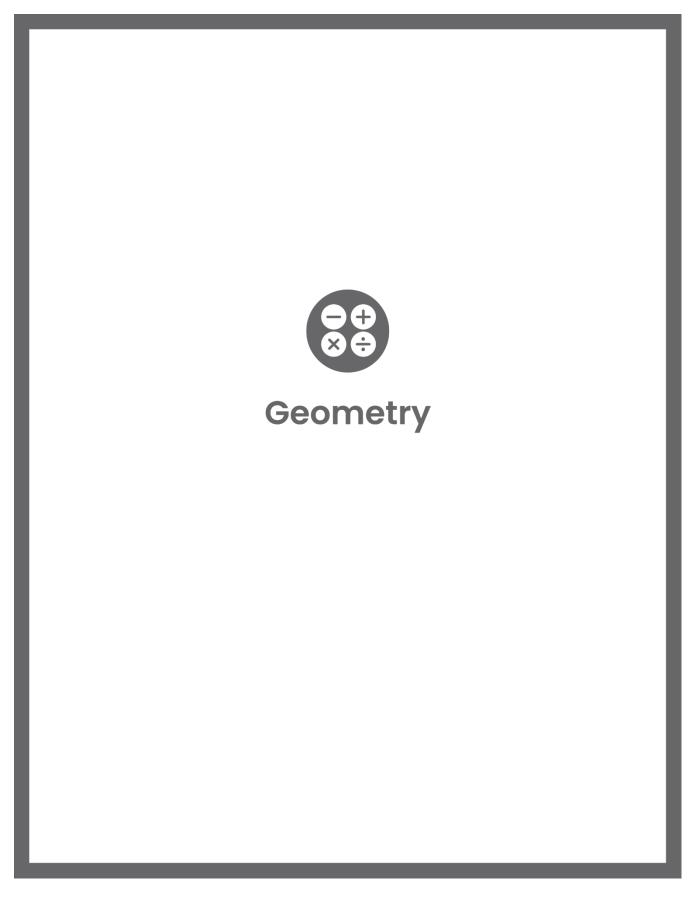
III. Ordering Rational and Irrational Numbers

A. Plot points to represent the given numbers on each number line. Then, order the numbers from least to greatest.



THE REAL NUMBER SYSTEM: Skills Practice







Ninth Grade Summer At-Home Learning

Three Angle Measure

Introduction to Trigonometry

Warm Up

-ear

legie

Gar

- 1. How many centimeters are in a meter?
- 2. Write a ratio equal to 1 that represents the relationship between meters and centimeters.
- Use the ratio you wrote in Question
 to convert 520 centimeters
 to meters.

Learning Goals

- Explore trigonometric ratios as measurement conversions.
- · Analyze the properties of similar right triangles.

Key Terms

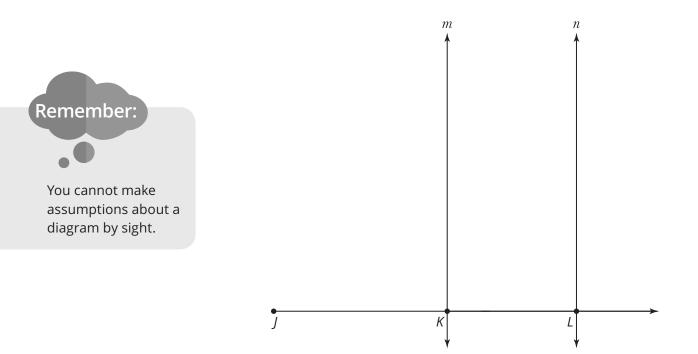
- reference angle
- opposite side
- adjacent side

You know about the proportionality between the side lengths of similar figures. What is the relationship between the ratios of the side lengths of similar figures?



You're Acute Angle

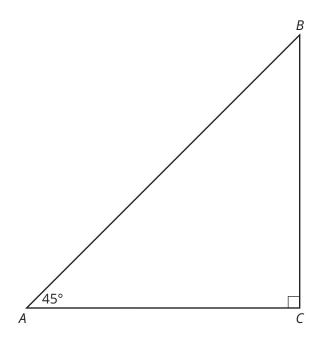
Lines *m* and *n* are parallel.



- 1. Locate a point on line *n* and label it point *P* to create $\triangle JLP$. Then label the intersection of \overline{JP} and line *m* as point *Q* to create $\triangle JKQ$.
- 2. Verify that $\triangle JLP \sim \triangle JKQ$. Explain your reasoning.
- 3. Measure and analyze the side length ratios of the triangles: $\frac{KQ}{JK}$ to $\frac{LP}{JL}$, $\frac{KQ}{JQ}$ to $\frac{LP}{JP}$, $\frac{JK}{JQ}$ to $\frac{JL}{JP}$.

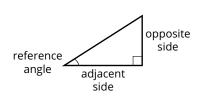


Triangle *ABC* shown is a 45°-45°-90° triangle.



1. Choose any point along the hypotenuse of $\triangle ABC$ and label it point *D*. Then construct a vertical line segment, \overline{DE} , connecting with side \overline{AC} so that $\overline{DE} \perp \overline{AC}$. Label the other endpoint as point *E*.

 Determine all of the side length ratios and corresponding angle measures for the two triangles. Explain how you know that △ABC is similar to △ADE.



You know that the hypotenuse of a right triangle is the side that is opposite the right angle. In trigonometry, the legs of a right triangle are often referred to as the *opposite side* and the *adjacent side*. These references are based on the angle of the triangle that you are considering, which is called the **reference angle**. The **opposite side** is the side opposite the reference angle. The **adjacent side** is the side adjacent to the reference angle that is *not* the hypotenuse.

3. For $\triangle ABC$ and $\triangle ADE$, identify the opposite side, adjacent side, and hypotenuse, using $\angle A$ as the reference angle.

4. Record the side length measurements for both triangles in the table.

Triangle Name	Length of Side Opposite ∠A	Length of Side Adjacent to ∠A	Length of Hypotenuse
∆ABC			
∆ADE			

5. Determine each side length ratio using $\angle A$ as the reference angle.

Triangle Name	side opposite ∠A hypotenuse	$\frac{\text{side adjacent to } \angle A}{\text{hypotenuse}}$	side opposite $\angle A$ side adjacent to $\angle A$
∆ABC			
∆ADE			

6. Explain why Gabriel is correct.

Gabriel

The side length vatios of the opposite side to the hypotenuse or the adjacent side to the hypotenuse is a percent. If the vatio is approximately 0.70, that means the length of the side is about 70% the length of the hypotenuse.

Let's analyze the recorded measurements.

7. Compare the side length ratios of the triangles from your table. What do you notice?



What patterns do you see in the measurements you recorded?

8. Compare your measurements and ratios with those of your classmates. What do you notice?

Given the same reference angle measure, are each of the ratios you studied constant in similar right triangles? You can investigate this question by analyzing similar right triangles without side measurements.

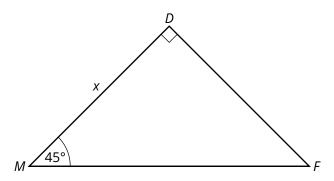
Worked Example

Consider $\triangle ABC$ and $\triangle ADE$ shown. They are both 45°-45°-90° triangles. $\frac{\log \log th}{\Delta ABC}$ Triangle *ABC* is similar to $\triangle ADE$ by the AA Similarity Theorem. Therefore, the lengths of the corresponding sides are proportional. $\frac{AE}{AC} = \frac{AD}{AB}$ You can rewrite the proportion. side length adjacent to $\angle A$ $\frac{AE}{AD} = \frac{AC}{AB}$ length of hypotenuse So, given the same reference angle measure, the ratio $\frac{\text{side length adjacent to reference angle}}{\text{length of hypotenuse}}$ is constant in similar right triangles.

9. Use $\triangle ABC$ in the worked example with reference $\angle A$ to verify that the side length ratios $\frac{\text{side opposite reference angle}}{\text{hypotenuse}}$ and $\frac{\text{side opposite reference angle}}{\text{side adjacent to reference angle}}$ are constant in similar right

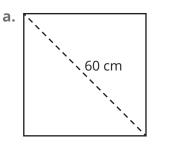
triangles. Show your work.

You have estimated certain constant ratios of side lengths in 45°-45°-90° triangles. You can use what you know about the 45°-45°-90° Triangle Theorem to determine the exact ratios.



10. Given a leg length *x*, determine the lengths of the other sides of the 45°-45°-90° triangle. Label the triangle.

- **11.** Determine the ratio of the:
 - a. opposite side length to the length of the hypotenuse.
 - b. adjacent side length to the length of the hypotenuse.
 - c. opposite side length to the adjacent side length.
- 12. Determine the unknown side lengths. Rationalize the denominator.



b. Meena is picking oranges from the tree in her yard. She rests a 12-foot ladder against the tree at a 45° angle. How far is the top of the ladder from the ground?



To rationalize the denominator of a fraction involving radicals, multiply the fraction by a form of 1 so that the product in the denominator includes a perfect square radicand.

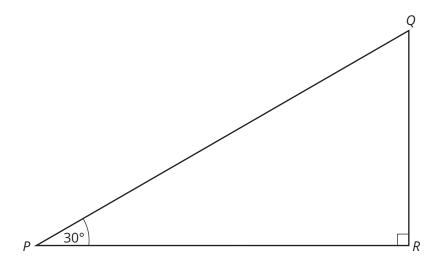


Ratios in 30°-60°-90° Triangles

Triangle *PQR* shown is a 30°-60°-90° triangle.

ΑCTIVITY

1.2



- 1. Choose any point along the hypotenuse of $\triangle PQR$ and label it point *D*. Then construct a vertical line segment, \overline{DE} , connecting with side \overline{PR} so that $\overline{DE} \perp \overline{PR}$. Label the other endpoint as point *E*.
- 2. Measure each of the sides of the similar right triangles in millimeters. Record the side length measurements in the table.

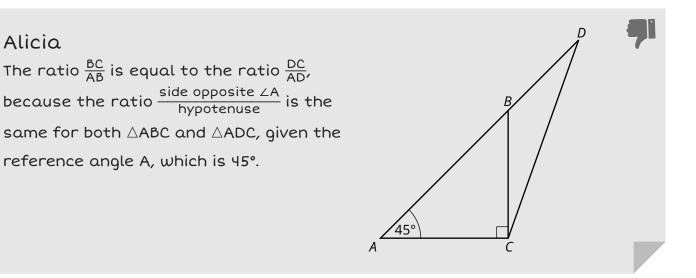
Triangle Name	Length of Side Opposite ∠P	Length of Side Adjacent to ∠ <i>P</i>	Length of Hypotenuse
$\triangle PQR$			
∆PDE			

3. Determine each side length ratio for the triangles using $\angle P$ as the reference angle.

Triangle Name	$\frac{\text{side opposite } \angle P}{\text{hypotenuse}}$	side adjacent to ∠P hypotenuse	$\frac{\text{side opposite } \angle P}{\text{side adjacent to } \angle P}$
$\triangle PQR$			
∆PDE			

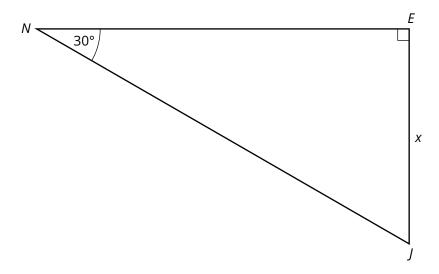
Let's analyze the recorded measurements.

- 4. Compare the side length ratios of the triangles in your table. What do you notice?
- 5. What conclusions can you draw about the three ratios you studied in 45°-45°-90° triangles and 30°-60°-90° triangles?
- 6. What conclusions can you draw about these three ratios for any right triangles with congruent reference angles? Explain your reasoning.
- 7. Explain why Alicia is incorrect.



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8. Is each of the three ratios you studied in this lesson the same for any triangles with congruent reference angles? Explain your reasoning. You have estimated certain constant ratios of side lengths in 30°-60°-90° triangles. You can use what you know about the 30°-60°-90° Triangle Theorem to determine the exact ratios.



9. Given a length of the shortest side, *x*, determine the lengths of the other sides of the 30°-60°-90° triangle. Label the triangle.

10. Determine the ratio of the:

- a. opposite side length to the length of the hypotenuse.
- b. adjacent side length to the length of the hypotenuse.
- c. opposite side length to the adjacent side length.

The three ratios you worked with in this lesson are very important to trigonometry and have special names and properties. You will learn more about these ratios in the next several lessons.



Don't forget to rationalize the denominators.

TALK the TALK



You have investigated and verified algebraically the three different side length ratios for 45°-45°-90° and 30°-60°-90° triangles. Consider how those ratios will change when the reference angle changes.

1. As the reference angle measure increases, what happens to each side length ratio? Explain your reasoning.

a. opposite hypotenuse

b. adjacent hypotenuse

c. opposite adjacent

Learning,

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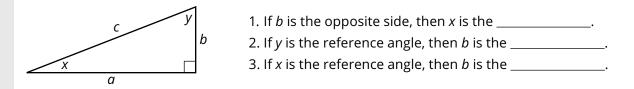
In each ratio, the
terms <i>opposite</i> ,
<i>adjacent,</i> and
hypotenuse refer to the
lengths of sides.
lenguis of sides.

NOTES

Assignment

Write

Use the diagram to complete each sentence.



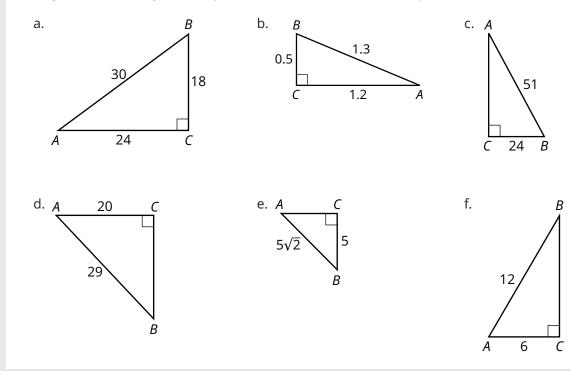
Remember

Given the same reference angle for similar right triangles, the side length ratios $\frac{\text{opposite}}{\text{hypotenuse}}$, $\frac{\text{adjacent}}{\text{hypotenuse}}$, and $\frac{\text{opposite}}{\text{adjacent}}$ are constant.

The side length ratios in right triangles with congruent reference angles are equal.

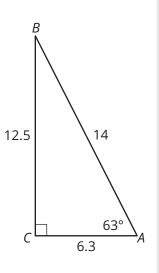
Practice

1. Determine the side length ratios $\frac{\text{opposite}}{\text{hypotenuse}}$, $\frac{\text{adjacent}}{\text{hypotenuse}}$, and $\frac{\text{opposite}}{\text{adjacent}}$ using $\angle A$ as the reference angle in each triangle. Write your answers as fractions in simplest form.



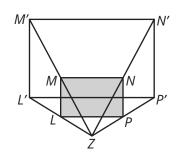
Stretch

- 1. Consider $\triangle ABC$ shown in the figure.
 - a. Determine the side length ratios $\frac{\text{opposite}}{\text{hypotenuse}}$, $\frac{\text{adjacent}}{\text{hypotenuse}}$, and $\frac{\text{opposite}}{\text{adjacent}}$ using $\angle A$ as the reference angle. Write each ratio as a decimal rounded to hundredths.
 - b. Trigonometric functions of angles include three important functions called the sine function, the cosine function, and the tangent function. These values can be determined with a graphing calculator. Use a graphing calculator to determine the sine (SIN), cosine (COS), and tangent (TAN) of 63°.
 - c. Compare the values from part (a) and part (b). What conclusion can you make about the sine, cosine, and tangent of an angle in a right triangle?

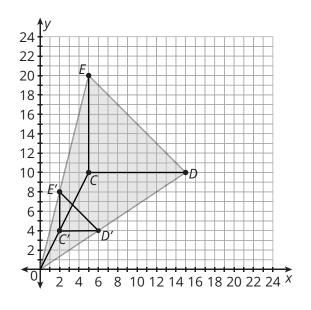


Review

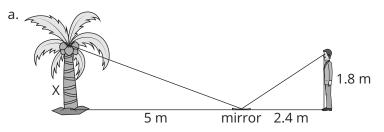
1. Given the pre-image and image, determine the scale factor.



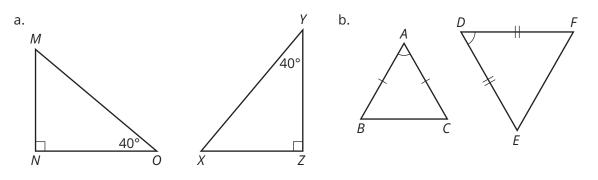
2. Given the pre-image and image, determine the scale factor.



3. Determine each unknown height.



- b. Pearl put a mirror 45 feet from the base of a building. She can see the top of the building in the mirror when she stands 12 feet from the mirror. If Pearl is 5 feet, 9 inches tall, what is the height of the building?
- 4. Determine whether the triangles are similar. If so, write a similarity statement. Explain your reasoning.

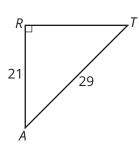


2

The Tangent Ratio

Tangent Ratio, Cotangent Ratio, and Inverse Tangent

Warm Up



- 1. Determine the length of \overline{RT} .
- 2. Write a ratio to compare the length of the side opposite $\angle A$ to the length of the side adjacent to $\angle A$.
- 3. Write a ratio to compare the length of the side adjacent to $\angle A$ to the length of the side opposite $\angle A$.
- 4. What is the difference between the ratios you wrote in Question 2 and Question 3?

Learning Goals

- Define the relationship between the lengths of the opposite side and the adjacent side in a right triangle as the tangent ratio.
- Relate the tangent ratio to the cotangent ratio.
- Use the tangent and cotangent ratios in a right triangle to solve for unknown side lengths.
- Use the inverse tangent in a right triangle to solve for unknown angle measures.

Key Terms

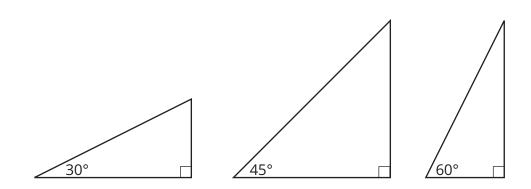
- tangent (tan)
- cotangent (cot)
- inverse tangent

You have learned about constant ratios in similar triangles, given a specific reference angle. How can you use the ratio of the side length opposite from the reference angle to side length adjacent to the reference angle to solve for unknown measurements?



Steepness

Consider the right triangles shown.



1. Describe the steepness of a right triangle in terms of its side lengths.

You can also use angle measures to describe a right triangle's steepness.

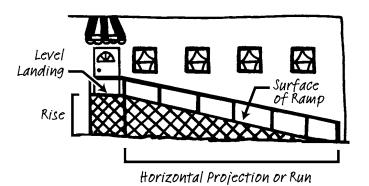
2. Compare the steepness of the triangles shown in terms of their given reference angle. What do you notice?

2.1

Connecting Slope and Tangent



The maximum incline for a safe wheelchair ramp should not exceed a ratio of 1 : 12. This means that every 1 unit of vertical rise requires 12 units of horizontal run. The maximum rise for any run is 30 inches. The ability to manage the incline of the ramp is related to both its steepness and its length.



The Americans with Disabilities Act (ADA) specifies the maximum incline for a safe wheelchair ramp.

Troy decides to build 2 ramps, each with the ratio 1 : 12.

- 1. The first ramp extends from the front yard to the front porch. The vertical rise from the yard to the porch is 2.5 feet.
 - a. Draw a diagram of the ramp. Include the measurements for the vertical rise and horizontal run of the ramp.

b. Calculate the length of the surface of the ramp.

- 2. The second ramp extends from the deck on the back of the house to the backyard. The vertical rise from the yard to the deck is 18 inches.
 - a. Draw a diagram of the ramp. Include the measurements for the vertical rise and horizontal run of the ramp.

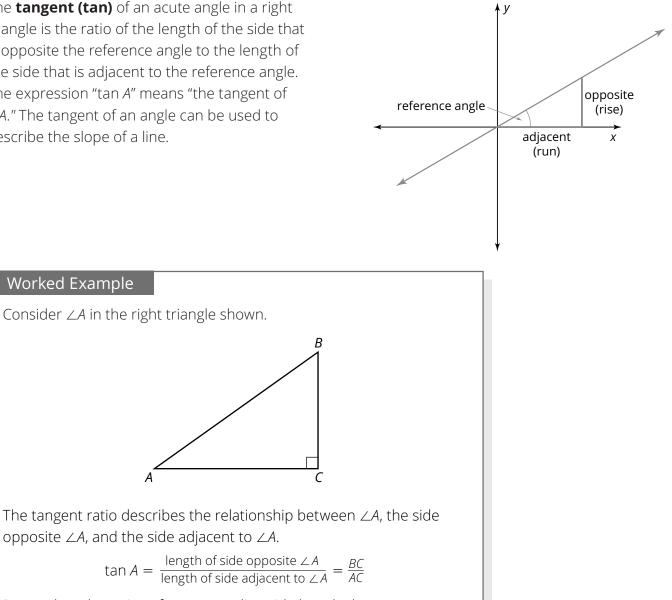
- b. Calculate the length of the surface of the ramp.
- 3. Compare the two ramps. Are the triangles similar? Explain your reasoning.

4. What does the ratio of the rise of the ramp to the run of the ramp represent?

An angle of inclination is the angle above the horizontal. In this case, you can think about it as the angle from the ground up to the top of the ramp. 5. Compare and describe the angles of inclination of the two ramps.

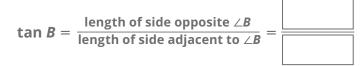
The tangent (tan) of an acute angle in a right triangle is the ratio of the length of the side that is opposite the reference angle to the length of the side that is adjacent to the reference angle. The expression "tan A" means "the tangent of $\angle A$." The tangent of an angle can be used to describe the slope of a line.

Worked Example

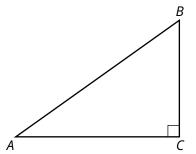


Remember, the ratios of corresponding side lengths between two similar triangles are congruent. The tangent values of congruent angles in similar triangles are always the same.

6. Use the worked example to complete the ratio that represents the tangent of $\angle B$.



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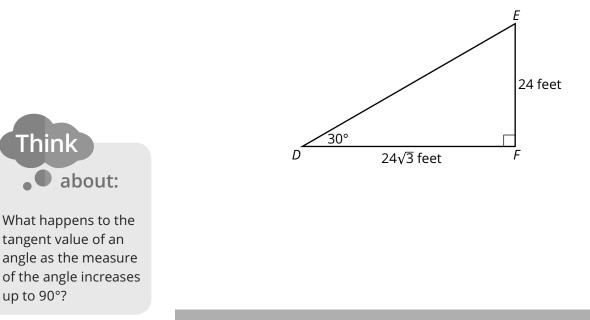
The **cotangent (cot)** of an acute angle in a right triangle is the ratio of the length of the side that is adjacent to the reference angle to the length of the side that is opposite the reference angle. The expression "cot *A*" means "the cotangent of $\angle A$."

7. Complete the ratio that represents the cotangent of $\angle A$.



8. Show algebraically that the cotangent of $A = \frac{1}{\tan A}$.

 Determine the tangent and cotangent values of both acute angles in △DEF. Leave your answers as exact values and rationalize the denominator.



2.2 Problem Solving with Tangents



You have used the Pythagorean Theorem to solve for an unknown side length in right triangles given two of the sides. In this activity, you will explore how you can use the tangent ratio to solve for unknown sides given an angle and a side length.

1. A proposed wheelchair ramp is shown.

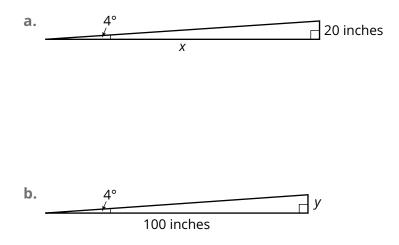


- a. What information about the ramp is required to show that the ramp meets the safety rules?
- b. Write a decimal that represents the greatest value of the slope of a safe ramp.
- c. Use technology to calculate the value of tan 4° and use it to determine whether the ramp meets the safety rules. Round your answer to the nearest hundredth.

Make sure that your technology is calculating the tangent in *degrees* and not *radians*. Radians are a different unit of measure for angles that you will learn about in a future topic.

d. Compute the run of the proposed ramp.

2. Two proposed wheelchair ramps are shown. Determine the run of each ramp to meet safety regulations. If necessary, round your answer to the nearest inch.



3. If other ramps that have a 4° angle with different side measurements are drawn by extending or shortening the rise and run, will the tangent ratios always be equivalent? Explain your reasoning.

LESSON 2: The Tangent Ratio • M3-145

aviously you used the measure of an acute angle and the length of a

Generalizing the Tangent Ratio

Previously, you used the measure of an acute angle and the length of a side in a right triangle to determine the unknown length of another side.

Consider a right triangle with acute angles of unknown measures and sides of unknown lengths. Do you think the same relationships are still valid?

1. Consider the two right triangles shown.

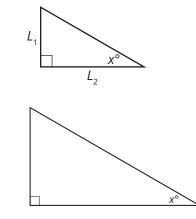
ACTIVITY

2.3

a. If one acute angle of a triangle has a measure of x°,
 what algebraic expression represents the measure of
 the second acute angle of that triangle? Label this angle
 in each triangle and explain your reasoning.

b. What can you say about the two triangles?

- c. If the side opposite the acute angle measuring x° in the smaller triangle is of length L_1 , what algebraic expression represents the length of the side opposite the acute angle measuring x° in the larger triangle?
- d. If the side opposite the acute angle measuring $(90 x)^{\circ}$ in the smaller triangle is of length L_2 , what algebraic expression represents the length of the side opposite the acute angle measuring $(90 - x)^{\circ}$ in the larger triangle?





What does the relationship between the two triangles tell you about the relationship between the side lengths? 2. For each triangle, write an expression to represent the tangent of the angle measuring *x*°.

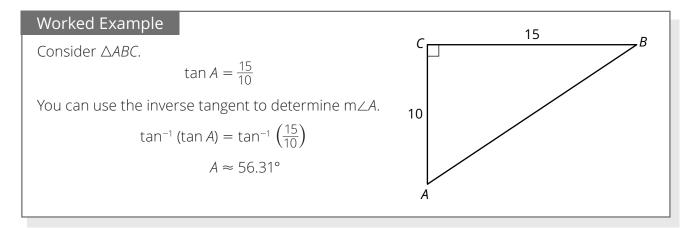
Write a proportion to represent the relationship between the two triangles in terms of the tangents of the angle measuring x°.
 Explain how this proportion shows that the tangent ratio is constant for all right triangles with congruent reference angles.

2.4 Inverse Tangent

0

The **inverse tangent** (or arctangent) of x is defined as the measure of an acute angle whose tangent is x. If you know the length of any two sides of a right triangle, it is possible to compute the measure of either acute angle by using the inverse tangent, or the tan⁻¹ button on a graphing calculator.

In right triangle ABC, if $\tan A = x$, then $\tan^{-1} x = m \angle A$.



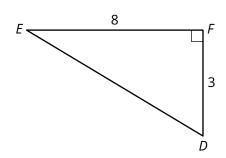
- **1.** Consider $\triangle ABC$ from the worked example.
 - a. Determine the ratio for tan *B*, and then use the inverse tangent to calculate $m \angle B$.

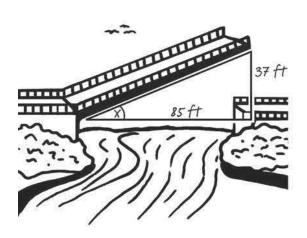


You are calculating the measure of $\angle B$ using the given information instead of using $\angle A$. Why is this important?

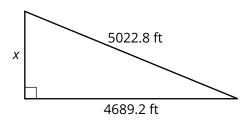
- b. Add m∠A and m∠B. Does your sum make sense in terms of the angle measures of a triangle?
- 2. Calculate m∠*E*.

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3. Movable bridges are designed to open water ways for large boats and barges. When the bridge moves, all vehicle traffic stops. The maximum height of the open bridge deck of the movable bridge shown is 37 feet above the water surface. The waterway width is 85 feet. Calculate the angle measure formed by the movement of the bridge.



4. A ski slope at Snowy Valley has these measurements. Determine the angle of elevation of the ski slope. Show your work.

TALK the TALK

Road Grades

Many mountainous areas have road signs like the sign shown that refer to the percentage grade for the road. An 8% grade, for example, means that the altitude changes by 8 feet for each 100 feet of horizontal distance.



1. What function would be most helpful to determine the percentage grade that should be put on a road sign where the angle of elevation of the road is 9°?

2. What function would be most helpful to determine the angle of elevation of a road with a percentage grade of 7%?

3. Determine the angle of elevation of a road with a percentage grade of 6%.

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4. Determine the percentage road grade that should be put on a road sign where the angle of elevation is 10°.



5. Does the image in the sign accurately represent an 8% grade? Explain how you can determine the answer.

6. What is the approximate angle of elevation that is actually shown in the sign?

Assignment

Write

Match each description to its corresponding term for \triangle *EFG*.

1. $\frac{EG}{EF}$ in relation to $\angle G$

2. $\frac{EF}{EG}$ relation to ∠G

a. tangent b. cotangent

3. $\tan^{-1}\left(\frac{EF}{EG}\right)$ in relation to $\angle G$

c. inverse tangent

Remember

The tangent (tan) of an acute angle in a right triangle is the ratio of the length of the side that is opposite the angle to the length of the side that is adjacent to the angle.

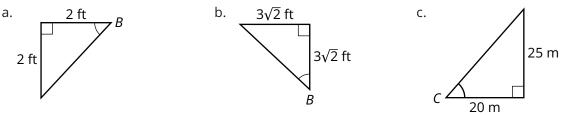
The cotangent (cot) of an acute angle in a right triangle is the ratio of the length of the side that is adjacent to the angle to the length of the side that is opposite the angle.

The inverse tangent (or arctangent) of *x* is the measure of an acute angle whose tangent is *x*.

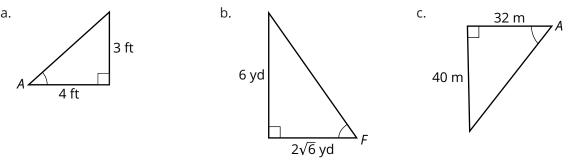
Practice

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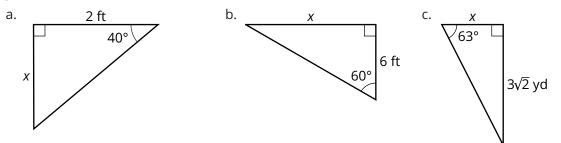
1. Calculate the tangent of the indicated angle in each triangle. Write your answers in simplest form.



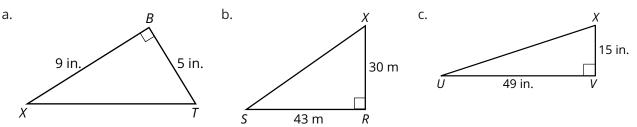
2. Calculate the cotangent of the indicated angle in each triangle. Write your answers in simplest form.



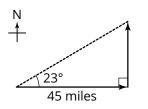
3. Use a tangent ratio or a cotangent ratio to calculate the unknown length of each triangle. Round your answers to the nearest hundredth.



4. Calculate the measure of $\angle X$ in each triangle. Round your answers to the nearest hundredth.



- 5. Solve each problem. Round your answers to the nearest hundredth.
 - a. A boat travels in the following path. How far north did it travel?

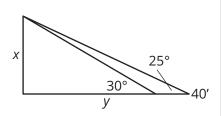


 A moving truck is equipped with a ramp that extends from the back of the truck to the ground. When the ramp is fully extended, it touches the ground 12 feet from the back of the truck. The height of the ramp is 2.5 feet. Calculate the measure of the angle formed by the ramp and the ground.



Stretch

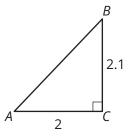
Bobby is standing near a lighthouse. He measured the angle formed from where he stood to the top of the lighthouse as 30°. Then he backed up 40 feet and measured the angle again as 25°. Solve for the height of the lighthouse.



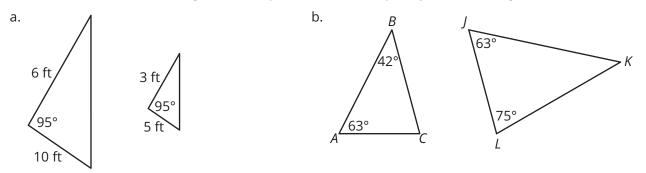
Review

- 1. Determine the side length ratio $\frac{\text{opposite}}{\text{hypotenuse}}$ using $\angle A$ as the reference angle. Write your answer as a fraction in simplest form.
 - 35 C 12 A

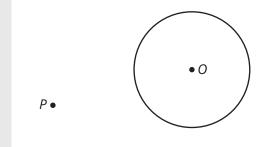
2. Determine the side length ratio $\frac{\text{adjacent}}{\text{hypotenuse}}$ using $\angle A$ as the reference angle. Write your answer as a fraction in simplest form.



3. Determine whether the triangles in each pair are similar. Explain your reasoning.



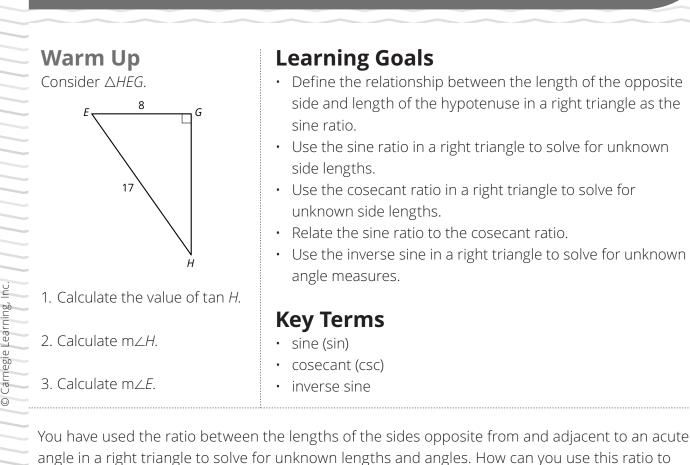
4. Construct the lines tangent to Circle O from point P.



3

The Sine Ratio

Sine Ratio, Cosecant Ratio, and Inverse Sine

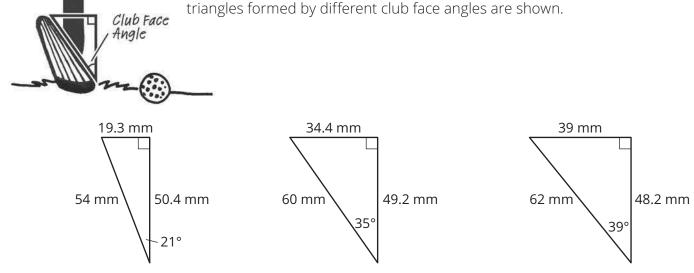


solve for unknown measurements?

Fore!

Each golf club in a set of clubs is designed to cause the ball to travel different distances and different heights. One design element of a golf club is the angle of the club face.

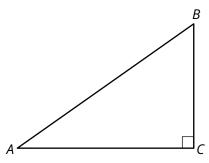
You can draw a right triangle that is formed by the club face angle. The right triangles formed by different club face angles are shown.



- 1. How do you think the club face angle affects the path of the ball?
- 2. For each club face angle, write the ratio of the side length opposite the given acute angle to the length of the hypotenuse. Write your answers as decimals rounded to the nearest hundredth.
- 3. What happens to this ratio as the angle measure gets larger?

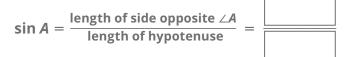


The **sine (sin)** of an acute angle in a right triangle is the ratio of the length of the side that is opposite the angle to the length of the hypotenuse.



The expression "sin A" means "the sine of $\angle A$."

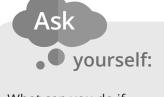
1. Complete the ratio that represents the sine of $\angle A$.



The **cosecant (csc)** of an acute angle in a right triangle is the ratio of the length of the hypotenuse to the length of the side that is opposite the angle. The expression "csc A" means "the cosecant of $\angle A$."

2. Complete the ratio that represents the cosecant of $\angle A$.

 $\operatorname{csc} A = \frac{\operatorname{length} \operatorname{of} \operatorname{hypotenuse}}{\operatorname{length} \operatorname{of} \operatorname{opposite} \operatorname{side} \angle A}$



What can you do if there is no cosecant button on your calculator?

3. For each triangle in the Getting Started, you calculated the sine value of the club face angle. Calculate the sine value of the other acute angle in each triangle. Round your answers to the nearest hundredth.

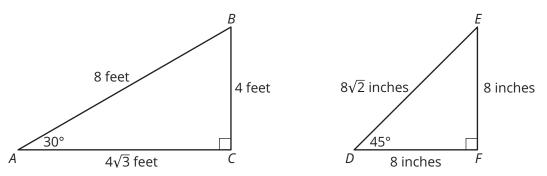
4. What do the sine values of the angles in Question 3 all have in common?



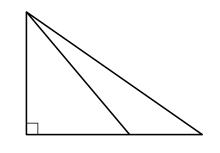
5. Jun says that the sine and cosecant value of every acute angle is less than 1. Todd says that the sine value of every acute angle is less than 1, but the cosecant value is greater than 1. Who is correct? Explain your reasoning.

6. What happens to the sine and cosecant values of an angle as the measure of the angle increases?

7. You calculated the sine ratios for different club faces in the Getting Started and in Question 3. Consider a golf club with a club face angle $\angle A$ for which sin $A \approx 0.45$. Estimate the measure of the club face angle based on the decimal value of the ratio. Use a calculator to verify your answer. 8. Use the right triangles shown to calculate the values of sin 30°, sin 45°, and sin 60°. Leave your answers as exact values and rationalize the denominator.



9. Two cables supporting the center pole of a circus tent are both connected at the top of the pole and are staked into the ground several feet apart. The length of the first cable is 30 feet and the length of the second cable is 46 feet. The angle formed by the pole and the first cable is 40°. The angle formed by the pole and the second cable is 55°. Label the diagram. Then calculate the height of center pole and the distance between the two stakes.



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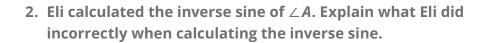




The **inverse sine** (or arcsine) of x is defined as the measure of an acute angle whose sine is x. If you know the length of any two sides of a right triangle, it is possible to calculate the measure of either acute angle by using the inverse sine, or sin⁻¹ button on a graphing calculator.

In right triangle ABC, if $\sin A = x$, then $\sin^{-1} x = m \angle A$.

B 1. In $\triangle ABC$, sin $A = \frac{2}{5}$. Use the inverse sine to determine m $\angle A$.

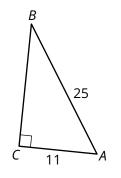


Eli

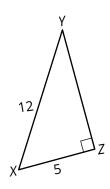
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 $\begin{array}{l} \sin A = \frac{2}{5} \\ \text{I can use the sin button on my calculator to} \\ \text{determine sin} \Big(\frac{2}{5} \Big) \approx 0.007. \\ \text{I can then take the inverse of 0.007 to} \\ \text{determine m} \angle A. \\ \text{m} \angle A \approx 143^{\circ} \end{array}$

3. Determine the ratio for sin *B*, and then use the inverse sine to calculate $m \angle B$.

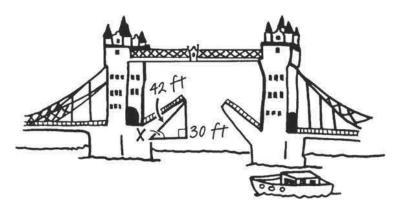


4. Calculate m∠Y.



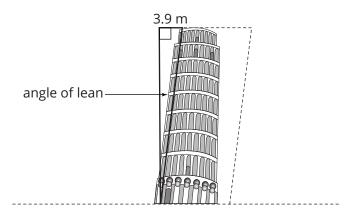
5. The movable bridge shown is called a double-leaf Bascule bridge. It has a counterweight that continuously balances the bridge deck, or "leaf," throughout the entire upward swing, providing an open waterway for boat traffic. The counterweights on double-leaf bridges are usually located below the bridge decks.

The length of one leaf, or deck, is 42 feet. The maximum height of an open leaf is 30 feet. Calculate the measure of the angle formed by the movement of the bridge.



6. The Leaning Tower of Pisa is a tourist attraction in Italy. It was built on unstable land, and as a result, it really does lean!

The height of the tower is approximately 55.86 meters from the ground on the low side and 56.7 meters from the ground on the high side. The top of the tower is displaced horizontally 3.9 meters as shown. Determine the angle at which the tower leans.



TALK the TALK 🔶

What Do You Know?

Cut out each diagram at the end of the lesson and glue it below the appropriate situation described. Then calculate the unknown measurement.

 An observer stands an unknown distance away from a building that is 80 feet tall. Looking up to the top of the building, he notes that the angle of elevation is 52°. Determine the distance from the base of the building to the observer.

2. An observer stands 62.5 feet away from a building that is 80 feet tall. Looking up to the top of the building, he ponders the measure of the angle of elevation. Determine the measure of the angle of elevation.

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NOTES

3. An observer stands an unknown distance away from a building. Looking up to the top of the building, he notes that the angle of elevation is 52°. He also knows the distance from where he is standing to the top of the building is 101.52 feet. Determine the height of the building.

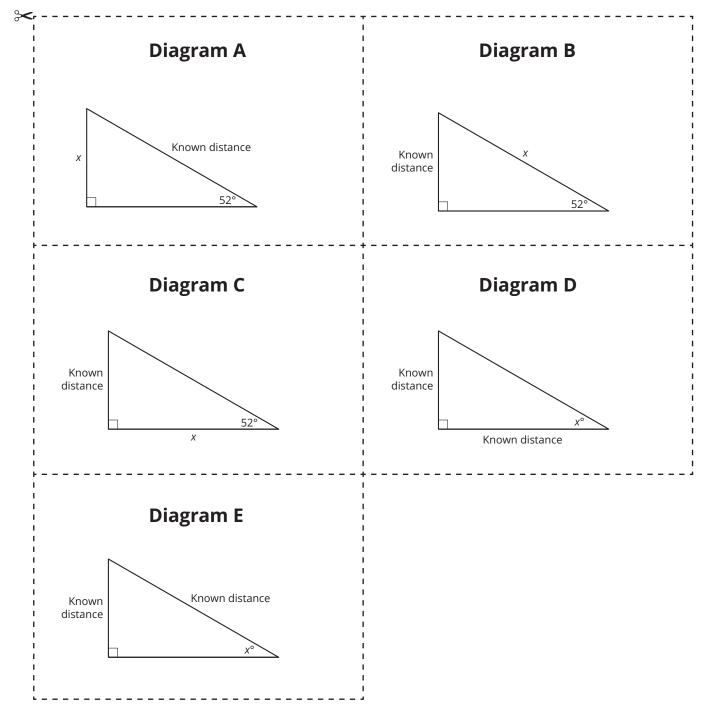
4. An observer stands an unknown distance away from a building that is 80 feet tall. Looking up to the top of the building, he ponders the measure of the angle of elevation. He knows the distance from where he is standing to the top of the building is 101.52 feet. Determine the measure of the angle of elevation.

 An observer stands an unknown distance away from a building that is 80 feet tall. Looking up to the top of the building, he notes that the angle of elevation is 52°. Determine the distance from the observer to the top of the building.

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Diagrams for Talk the Talk



Assignment

Write

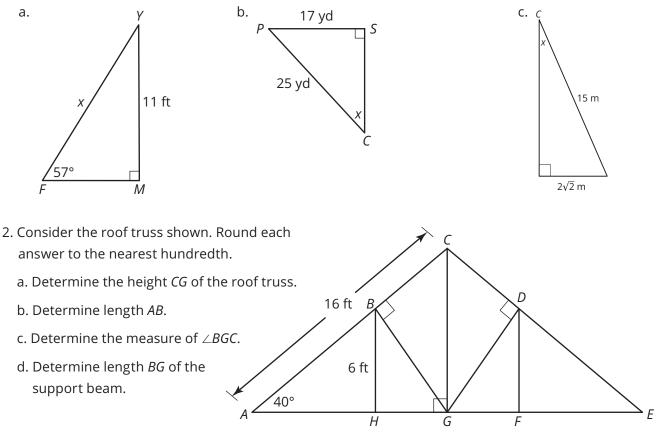
Draw and label right triangle *PQR* with $\angle Q = 90^{\circ}$. Then describe the sine ratio in terms of $\angle R$ and $\angle P$.

Remember

The sine of an acute angle in a right triangle is the ratio of the length of the side that is opposite the angle to the length of the hypotenuse. The cosecant of an acute angle is the inverse of the sine of the same angle. The inverse sine of *x*, or $\sin^{-1} x$, can be used to determine the measure of an acute angle whose sine is *x*.

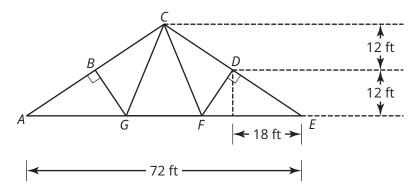
Practice

1. Use the sine ratio, the cosecant ratio, or the inverse sine to solve for *x*. Round each answer to the nearest tenth.



Stretch

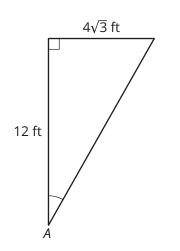
1. A roof truss is shown in the figure. Round each answer to the nearest hundredth.



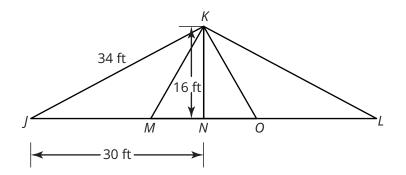
- a. Determine the length *DF* of the support beam.
- b. Determine the measure of $\angle DFE$.
- c. Determine the length *CF* of the support beam.
- d. Determine the measure of angle DCF.

Review

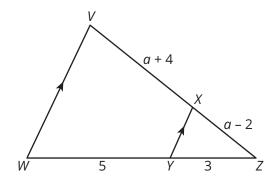
- 1. Calculate the tangent of the indicated angle in the triangle. Write your answer in simplest form.
- 2. Use a calculator to approximate cot 50°. Round your answer to the nearest hundredth.



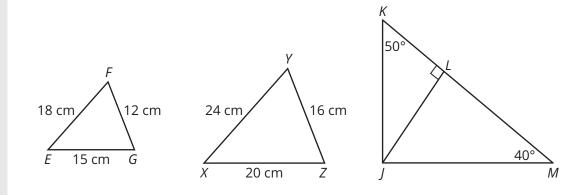
3. The figure shows a truss on a bridge. Segment *KM* bisects $\angle JKN$. Use this information to calculate *MN* and *MJ*.



4. Use the Triangle Proportionality Theorem and the Proportional Segments Theorem to determine the unknown value.



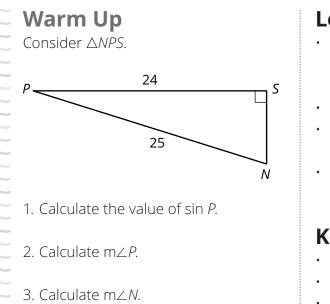
5. Determine if the triangles are similar. If so, write a similarity statement. Explain your reasoning.



4

The Cosine Ratio

Cosine Ratio, Secant Ratio, and Inverse Cosine



Learning Goals

- Define the relationship between the lengths of the adjacent side and the hypotenuse in a right triangle as the cosine ratio.
- Relate the cosine ratio to the secant ratio.
- Use the cosine and secant ratio in a right triangle to solve for unknown side lengths.
- Use the inverse cosine in a right triangle to solve for unknown angle measures.

Key Terms

- cosine (cos)
- secant (sec)
- inverse cosine

You have used the ratio between the side length opposite from an acute angle in a right triangle and the hypotenuse length to solve for unknown lengths and angles. How can you use the ratio of the side length adjacent to the acute angle to the hypotenuse length of a right triangle to solve for unknown measurements?

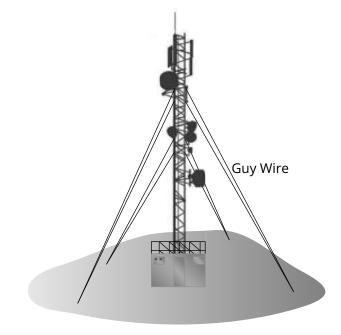
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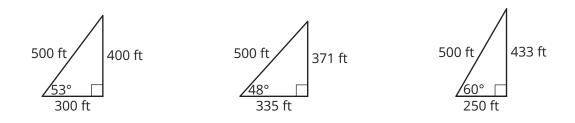
Mast or Tower?

Radio masts and radio towers are both tall human-made structures. The difference between a mast and a tower is that a mast has guy wires attached to it to provide stability. Guy wires are attached near the top of a mast and are attached to the ground. Radio masts are usually found in more open areas where there is room for the guy wires.



A guy wire and its mast form a right triangle. It is important that all pairs of guy wires form congruent triangles so that the tension on each wire is the same.

1. How does changing the distance between the guy wire and the base of the mast affect the angle formed by the wire and the ground? Each triangle shown represents the triangle formed by a mast and guy wire. The angle formed by the wire and the ground is given in each triangle.



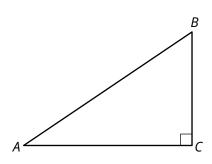
2. For each acute angle formed by the wire and the ground, write the ratio of the side length adjacent to the angle to the hypotenuse length. Write your answers as decimals rounded to the nearest hundredth if necessary.

3. What happens to this ratio as the angle gets larger?



The expression " $\cos A$ " means "the cosine of $\angle A$."

The **cosine (cos)** of an acute angle in a right triangle is the ratio of the length of the side that is adjacent to the angle to the length of the hypotenuse.



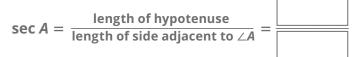
1. Complete the ratio to represent the cosine of $\angle A$.

$$\cos A = \frac{\text{length of side adjacent to } \angle A}{\text{length of hypotenuse}} = \frac{1}{1}$$

The expression "sec A" means "the secant of $\angle A$."

The **secant (sec)** of an acute angle in a right triangle is the ratio of the length of the hypotenuse to the length of the side that is adjacent to the angle.

2. Complete the ratio to represent the secant of $\angle A$.



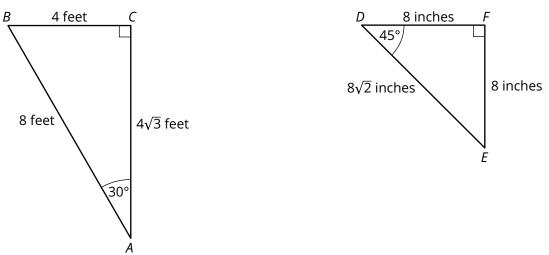
3. For each triangle in the Getting Started, you calculated the cosine value of the angle made by the guy wire and the ground. Calculate the cosine value of the other acute angle in each triangle. Round your answers to the nearest hundredth if necessary.



4. What do the cosine values of the angles in Question 3 all have in common?	
5. Is the cosine value of every acute angle less than 1? Explain your reasoning.	
6. What does this tell you about the secant value of every acute angle? Explain your reasoning.	
7. What happens to the cosine and secant values of an angle as the measure of the angle increases?	

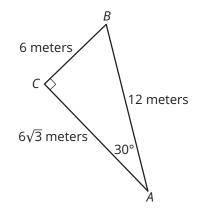
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8. Use the right triangles shown to calculate the values of cos 30°, cos 45°, and cos 60°. Leave your answers as exact values and rationalize the denominator.



9. A guy wire is 600 feet long and forms a 55° angle with the ground. First, draw a diagram of this situation. Then, calculate the number of feet from the tower's base to where the wire is attached to the ground.

- 10. Consider the triangle shown. Leave your answers as exact values and rationalize the denominator.
 - a. Calculate the values of sin 30°, cos 30°, and tan 30°.



b. Calculate the value of $\frac{\sin 30^{\circ}}{\cos 30^{\circ}}$.

c. What do you notice about the value of $\frac{\sin 30^{\circ}}{\cos 30^{\circ}}$?

11. Do you think that the relationship between the sine, cosine, and tangent values of an angle is true for any angle? Explain your reasoning. Inverse Cosine

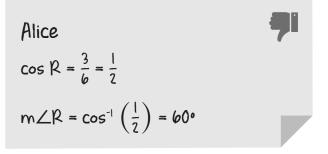
ΑCTIVITY

4.2

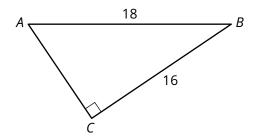
The **inverse cosine** (or arccosine) of x is defined as the measure of an acute angle whose cosine is x. If you know the length of any two sides of a right triangle, it is possible to compute the measure of either acute angle by using the inverse cosine, or cos⁻¹ button on a graphing calculator.

In right triangle ABC, if $\cos A = x$, then $\cos^{-1} x = m \angle A$.

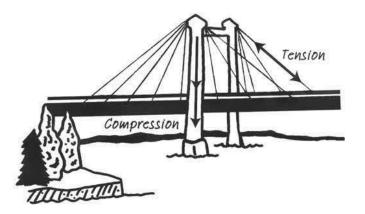
- 1. In right triangle *ABC*, if $\cos A = \frac{2}{7}$, use the inverse cosine determine m $\angle A$.
- 2. Alice draws acute angle QRS. She measures RS to be 3 inches and RQ to be 6 inches. She determines the measure of $\angle R$. What is the mistake in Alice's reasoning?



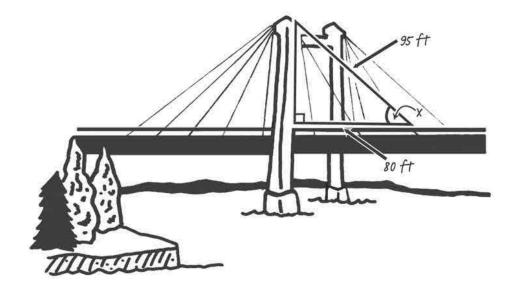
3. Use the inverse cosine to calculate $m \angle B$.



- 4. In $\triangle JKL$, m $\angle J = 90^\circ$, KL = 8, and JL = 5. Calculate m $\angle L$.
- A typical cable-stayed bridge is a continuous girder with one or more towers erected above piers in the middle of the span.
 From these towers, cables stretch down diagonally (usually to both sides) and support the girder. Tension and compression are calculated into the design of this type of suspension bridge.



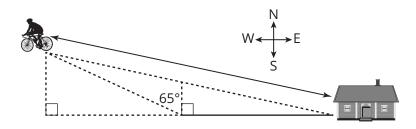
One cable is 95 feet. The span on the deck of the bridge from that cable to the girder is 80 feet. Calculate the angle formed by the deck and the cable.



6. Firemen are climbing a 65-foot ladder to the top of a 56-foot building. Calculate the distance from the bottom of the ladder to the base of the building and compute the measure of the angle formed where the ladder touches the top of the building.



7. Diane is training for a charity bicycle marathon. She leaves her house at noon and heads due west, biking at an average rate of 4 miles per hour. At 3 PM she changes course to N 65°W as shown. Label the diagram and determine the bike's distance from Diane's home at 5 PM.





TALK the TALK 🔶

Dig That Trig

1. Match each trigonometric ratio with the appropriate abbreviation.

1. Sine	A. cos ⁻¹
2. Cosine	B. cot
3. Tangent	C. csc
4. Cosecant	D. tan ⁻¹
5. Secant	E. sin ⁻¹
6. Cotangent	F. cos
7. Arctangent	G. sin
8. Arcsine	H. tan
9. Arccosine	l. sec

2. Match each trigonometric ratio with the appropriate description.

1. Sine	A. <u>hypotenuse</u> opposite
2. Cosine	B. <u>hypotenuse</u> adjacent
3. Tangent	C. opposite hypotenuse
4. Cosecant	D. opposite adjacent
5. Secant	E. adjacent opposite
6. Cotangent	F. adjacent hypotenuse

Ask yourself: Can you come up with a mnemonic for the trig ratios?

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Given the known information and the solution requirement, identify which trigonometric ratio can be used to solve each situation.

	Known Information	Solution Requirement	Function Used
a.	• Hypotenuse	Measure of	
	 Opposite 	reference angle	
b.	• Opposite	Llupatapusa	
	Acute angle measure	Hypotenuse	
С.	• Hypotenuse	Adia sant	
	Acute angle measure	Adjacent	
d.	• Opposite	Measure of	
	• Adjacent	reference angle	
e.	• Hypotenuse	Opposito	
	Acute angle measure	Opposite	
f.	• Hypotenuse	Measure of	
	• Adjacent	reference angle	

NOTEC	
NOTES	3.
	J.
	a
	b
	1.0
	C
	d
	1
	e
	f.
	1.

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Assignment

Write

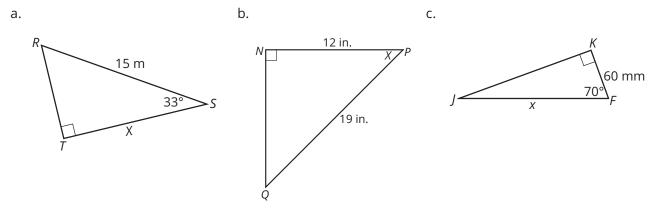
- 1. Describe the similarities and differences between the *cosine ratio* and *secant ratio*.
- 2. Define the term *inverse cosine* in your own words.

Remember

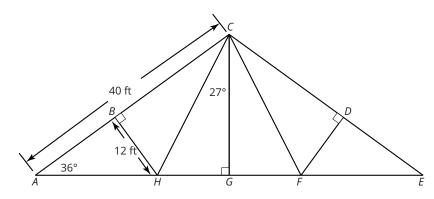
The cosine of an acute angle in a right triangle is the ratio of the length of the side that is adjacent to the angle to the length of the hypotenuse. The secant of an acute angle is the inverse of the cosine of the same angle. The inverse cosine of x, or cos⁻¹ x, can be used to determine the measure of an acute angle whose cosine is x.

Practice

1. Use the cosine ratio, the secant ratio, or the inverse cosine to solve for *x*. Round each answer to the nearest tenth.



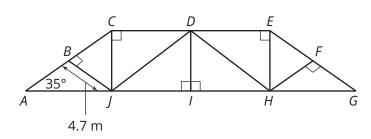
2. Consider the bridge shown. Use the figure and the fact that $\triangle AGC$ congruent to $\triangle EGC$ to complete parts (a) through (e). Round each answer to the nearest tenth.



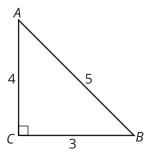
- a. Determine the width AE of the bridge
- b. Determine the height *CG* of the bridge.
- c. Determine the length of *CH*.
- d. Determine the measure of $\angle BHC$.
- e. Does \overline{CH} bisect $\angle ACG$? Explain your reasoning.

Stretch

1. Consider the bridge shown. Use the figure and the fact that $\triangle ACJ$ is congruent to $\triangle JDI$, $\triangle HDI$, and $\triangle GEH$ to complete parts (a) through (e). Round each answer to the nearest tenth.



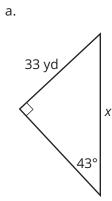
- a. Determine the width *AG* of the bridge.
- b. Determine the height *CJ* of the bridge.
- c. Determine the length of the support beam JD.
- d. Determine the measure of $\angle JDH$.
- e. Determine the distance *CE* across the top of the bridge.
- 2. Consider $\triangle ABC$.

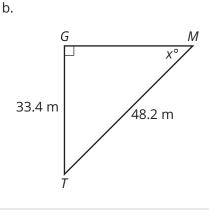


- a. Calculate the sine of $\angle B$. Determine what measure of $\angle A$ would have the equivalent ratio.
- b. Calculate the cosine of $\angle B$. Determine what measure of $\angle A$ would have the equivalent ratio.
- c. Calculate the tangent of $\angle B$. Determine what measure of $\angle A$ would have the equivalent ratio.

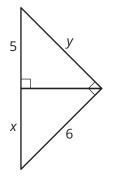
Review

1. Use the sine ratio, the cosecant ratio, or the inverse sine to solve for *x*. Round the answer to the nearest tenth.

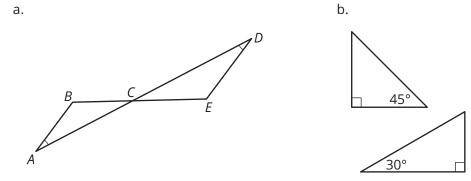




- 2. The geometric mean of two numbers is $4\sqrt{3}$. One of the numbers is 15. What is the other number?
- 3. Solve for the unknown side lengths.



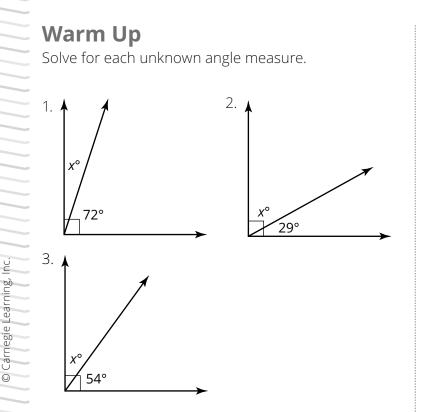
4. Determine whether the triangles are similar. If so, write a similarity statement. Explain your reasoning.



5

We Complement Each Other

Complement Angle Relationships



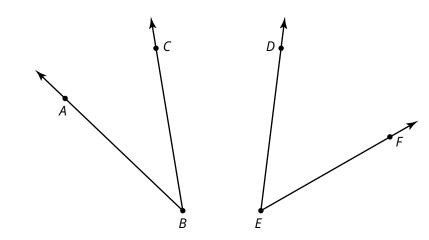
Learning Goals

- Explore complement angle relationships in a right triangle.
- Solve problems using complement angle relationships.

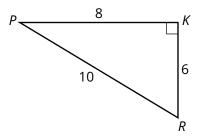
You have explored the ratios formed between two side lengths of a right triangle and how they relate to the acute angles within the triangle. How do the trigonometric ratios of the two acute angles in a right triangle compare to one another?

Angles Can Be Very Complementary!

Consider $\angle ABC$ and $\angle DEF$.



- 1. Use a protractor to determine the measure of each angle.
- 2. Trace $\angle ABC$ on a sheet of patty paper. Align \overline{BC} and \overline{ED} and then trace the ray from point *B* to point *F* on your patty paper to create $\angle ABF$.
- 3. What type of angle is $\angle ABF$? Justify your answer.



Angle *ABC* and angle *DEF* are complementary angles. The two acute angles in a right triangle are always complementary angles. Consider $\triangle PKR$.

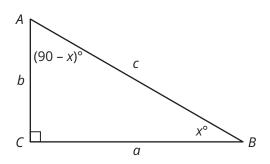


Two angles are complementary angles if the sum of the angle measures is equal to 90°.

- 4. Explain how you know that $\angle P$ and $\angle R$ are complementary angles.
- 5. Write a ratio that represents sin $\angle P$.
- 6. Write a ratio that represents $\cos \angle R$.
- 7. What do you notice about the ratios representing sin $\angle P$ and $\cos \angle R$?
- 8. How does the ratio representing $\cos \angle P$ compare to the ratio representing the $\sin \angle R$?

5.1 Complementary Relationships

Consider $\triangle ABC$ with right angle *C*. Angles *A* and *B* are complementary angles because the sum of their measures is equal to 90°. The trigonometric ratios also have complementary relationships.



1. Use $\triangle ABC$ to complete the table.

Reference Angle	sin	cos	tan	csc	sec	cot
A						
В						

2. Summarize the relationship between the trigonometric functions of complementary angles.

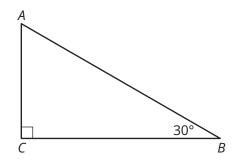
ACTIVITY

5.2

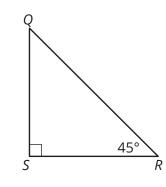


In this activity, you will investigate the relationships between complementary trigonometric functions for 30°-60°-90° and 45°-45°-90° triangles.

1. Use the complementary angle relationships, your knowledge of the side relationships of special right triangles, and the Pythagorean Theorem to complete the chart with the numeric ratios for each triangle.

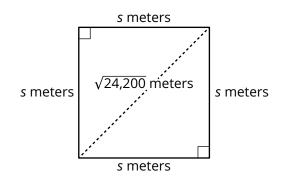


Reference Angle	sin	cos	tan	csc	sec	cot
30°						
60°						



Reference Angle	sin	cos	tan	csc	sec	cot
45°						

2. Trafalgar Square is a tourist attraction located in London, England. The name commemorates the Battle of Trafalgar (1805), a British naval victory of the Napoleonic Wars over France.



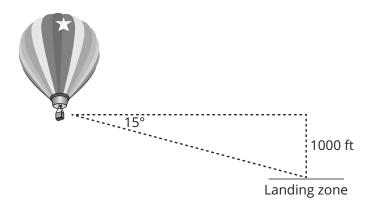
a. Use a trigonometric function to solve for the dimensions of Trafalgar Square.

b. Use the Pythagorean Theorem to verify the dimensions of Trafalgar Square.



In this activity, you will use your knowledge of trigonometric ratios to solve problems.

1. At an altitude of 1000 feet, a balloonist measures the angle of depression from the balloon to the landing zone. The measure of that angle is 15°. How far is the balloon from the landing zone?



2. An aircraft uses radar to spot another aircraft 8000 feet away at a 12° angle of depression. Sketch the situation and determine the vertical and horizontal separation between the two aircraft.

An angle of depression is an angle below horizontal.

ACTIVITY

5.3

3. To measure the width of the Grand Canyon, a surveyor stands at a point on the North Rim of the canyon and measures the angle of depression to a point directly across on the South Rim of the canyon. The angle of depression is 19°.

At the surveyor's position on the North Rim, the Grand Canyon is 7256 feet above sea level. The point on the South Rim, directly across, is 6159 feet above sea level. Sketch a diagram of the situation and determine the width of the Grand Canyon at the surveyor's position.



The altitude of a right triangle drawn to its hypotenuse is the geometric mean between the measures of the lengths of the segments of the hypotenuse. 4. Darius is camping in the woods. He notices on a map that his campsite is 50 yards from the ranger station. He walks 18 yards towards the ranger station before stopping to climb to the top of a tree to locate the station. The tree forms the altitude of a right triangle that connects the top of the tree, Darius's campsite, and the ranger station. Sketch a diagram of the situation and determine the angle of depression formed by Darius's sightline to the ranger station.

TALK the TALK 🌰

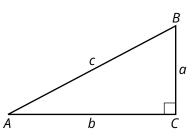
On a Need-to-Know Basis

Consider $\triangle ABC$.

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 Can you determine all of the unknown measures of any right triangle if you know just one of the measures? Explain your reasoning. 

2. Felix made the given statement. Give a counterexample to explain why Felix is incorrect.

Felix

You need to know any two measures of a right triangle to determine all the unknown measures of the triangle.

3. If c = 8 and $m \angle A = 32^{\circ}$, determine the other measures of $\triangle ABC$.

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Assignment

Write

Describe the minimum side and angle measures you need to determine all the unknown measurements in a right triangle.

Remember

The sine of an angle is equal to the cosine of its complement, the tangent of an angle is equal to the cotangent of its complement, and the secant of an angle is equal to the cosecant of its complement.

Practice

Re

1. Use triangle *XYZ* to complete the table of ratios.

					X	Z
eference Angle	sin	cos	tan	csc	sec	cot
∠X						
∠Y						

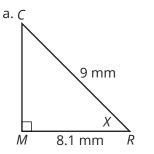
- 2. A pilot and co-pilot are performing a test run in a new airplane. The pilot is required to take off and fly in a straight path at an angle of elevation that is between 33° and 35° until the plane reaches an altitude of 10,000 feet. When the plane reaches 10,000 feet, the co-pilot will take over. Round each distance to the nearest tenth.
 - a. Draw a figure to model this situation. Label the angle of elevation and the side opposite the angle of elevation. Label the side adjacent to the angle of elevation as *x* and the hypotenuse as *y*.
 - b. Determine the minimum and maximum horizontal distance between the point of takeoff and the point at which the co-pilot takes over.
 - c. What is the minimum distance that the pilot flies the plane? What is the maximum distance that the pilot flies the plane?

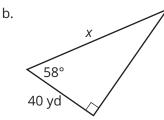
Stretch

- 1. A hot air balloon leaves the ground at 8 A.M. People on the ground watching the balloon are 250 meters from the take off point.
 - a. The people in the balloon wave when the angle of elevation of the balloon is 25°. How high up is the balloon? Round the distance to the nearest tenth.
 - b. The angle of elevation increases by 6°. How much further up is the balloon? Round the distance to the nearest tenth.
 - c. The balloon ascends another 24.9 meters. By how much did the angle of elevation increase?

Review

1. Use the cosine ratio, the secant ratio, or the inverse cosine to solve for *x*. Round the answer to the nearest tenth.

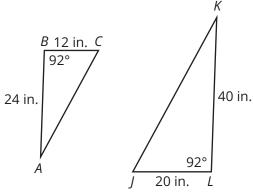


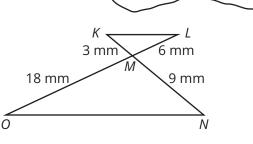


b.

- 2. Imani places a mirror 35 feet from the base of an Elm tree. When she stands at a distance of 4 feet from the mirror, she can see the top of the tree in the reflection. Imani is 5 feet 4 inches tall. Draw a diagram to represent the situation. Then, determine the height of the tree.
- Millie wants to know the distance between two points on a pond.
 She sets up triangles as shown in the figure. Determine the distance across the pond.
- 4. Determine if the triangles are similar. If so, write a similarity statement. Explain your reasoning.







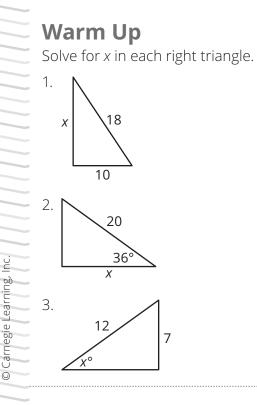
5 ft

18 ft

7 ft

A Deriving Force

Deriving the Triangle Area Formula, the Law of Sines, and the Law of Cosines



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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

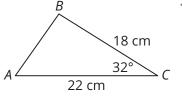
You have explored the trigonometric ratios that exist between the side lengths of right triangles. How can these ratios be used to determine unknown side lengths or angle measures of triangles that are not right triangles?

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 $\triangle ABC$ 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 $\triangle ABC$?





астічіту **6.1**

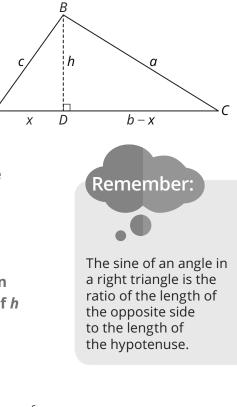
Deriving Another Version of the Area Formula



Solving for unknown measurements of sides or angles of a triangle becomes more involved if the given triangle is not a right triangle.

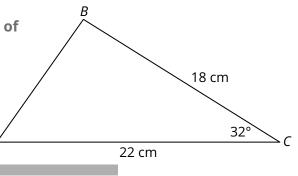
In this lesson, you will explore how trigonometric ratios are useful when determining the area of any triangle, solving for unknown side lengths of any triangle, and solving for unknown angle measures in any triangle.

- 1. Analyze *△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 △ABC in part (a) by substituting the expression for the value of h from part (b).



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.

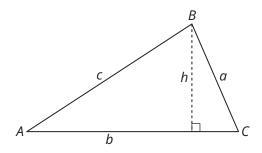
2. Use a trigonometric ratio to determine the area of the triangle.





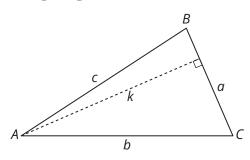
You have used the trigonometric ratios to solve for unknown side lengths and angle measures in right triangles. Let's explore relationships between side lengths and angle measures in any triangle.

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.

2. Analyze $\triangle ABC$ using height *k*.



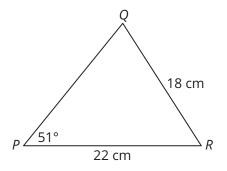
- a. Write a ratio that represents sin *B*, and then solve for the height, *k*.
- b. Write a ratio that represents sin *C*, and then solve for the height, *k*.
- c. What can you conclude about the relationship between c · sin B and b · sin C?
- d. Express $c \cdot \sin B = b \cdot \sin C$ as a proportion by dividing both sides of the equation by *bc*.

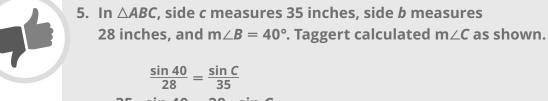
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3. Derive the *Law of Sines* by combining the proportions formed in Question 1, part (d) and Question 2, part (d).

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 $\angle Q$.





$$35 \cdot \sin 40 = 28 \cdot \sin C$$

 $22.5 \approx 28 \cdot \sin C$
 $\sin C \approx 0.8$ and $\sin^{-1} C \approx 53.1^{\circ}$
Since $180^{\circ} - 53.1^{\circ} = 126.9^{\circ}$, the measure of angle C could be
 53.1° or 126.9° .

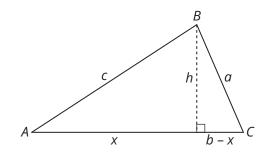
Is Taggert correct? Use a drawing to justify your reasoning.





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 *△ABC*.
 - a. Write a ratio that represents sin *A*, and then solve for the height, *h*.



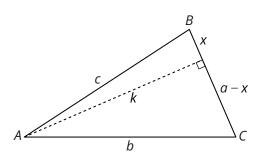
- b. Write a ratio that represents cos *A*, and then solve for *x*.
- c. Solve for a^2 using the Pythagorean Theorem.

d. Substitute the expressions for *h* and *x* into the equation in part (c).

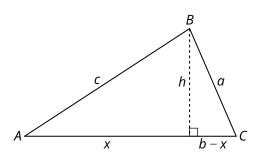
e. Rewrite the equation you wrote in part (d).



The Pythagorean identity states that $\sin^2 \theta + \cos^2 \theta = 1$. The symbol θ represents an angle measure. 2. Repeat the steps in Question 1 to solve for b^2 .



 Repeat the steps in Question 1 to solve for c².



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.

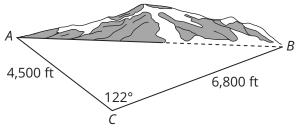
4. Why is the Pythagorean Theorem considered to be a special case of the Law of Cosines?

6.4



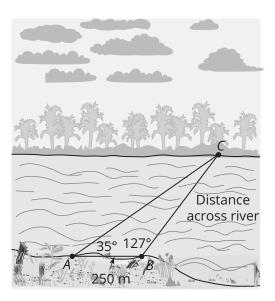
A surveyor was hired to determine the approximate length of a proposed tunnel, which will be necessary to complete a new highway. A mountain stretches from point *A* to point *B* as shown. The surveyor stands at point *C* and measures the distance from where she is standing to both points *A* and *B*, then measures the angle formed between these two distances.

1. Use the surveyor's measurements to determine the length of the proposed tunnel.

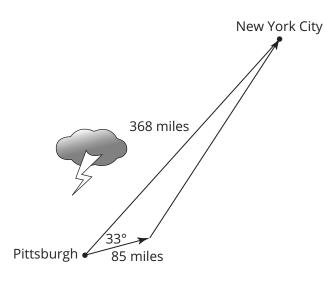


2. A nature lover decides to use geometry to determine if she can swim across a river. She locates two points, *A* and *B*, along one side of the river and determines the distance between these points is 250 meters. She then spots a point *C* on the other side of the river and measures the angles formed 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?



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.



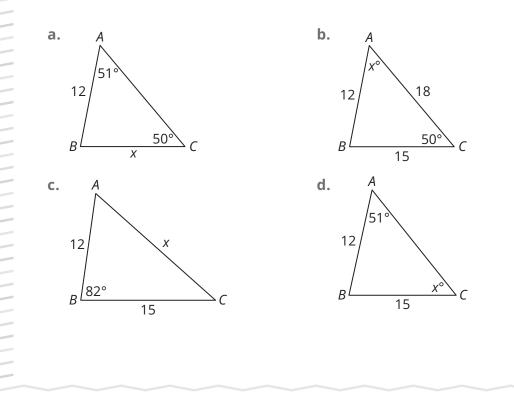
- a. How many additional miles did the aircraft travel to avoid the storm?
- b. If a commercial jet burns an average of 11.875 liters per kilometer, and the cost of jet fuel is \$3.16 per gallon, how much did this alteration in route cost the airline company?

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.





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Assignment

Write

Define each term in your own words.

- 1. Law of Sines
- 2. Law of Cosines

Remember

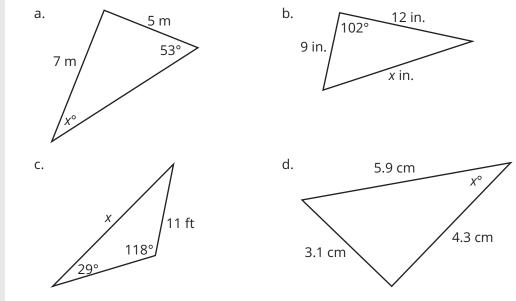
The area formula $A = \frac{1}{2}ab \cdot \sin C$ can be used to determine the area of any triangle if you know the

lengths of two sides and the measure of the included angle. The Law of Sines, or $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$, can be used to determine the unknown side lengths or unknown angle measures in any triangle.

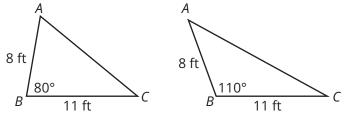
The Law of Cosines, $a^2 = b^2 + c^2 - 2bc \cdot \cos A$, $b^2 = a^2 + c^2 - 2ac \cdot \cos B$, and $c^2 = a^2 + b^2 - 2ab \cdot \cos C$, can be used to determine the unknown lengths of sides or the unknown measures of angles in any triangle.

Practice

1. Solve for *x* in each triangle. Round each answer to the nearest tenth.



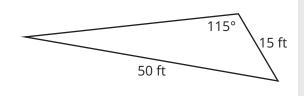
2. Emily and Joe are designing a fenced backyard play space for their children Max and Caroline. They start out by considering two designs for a triangular play space. They have made measurements in their yard and determined that either design would fit into the space that is available.

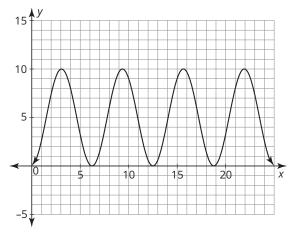


- a. Explain how Emily and Joe can use trigonometry to calculate the area and perimeter of the possible play spaces.
- b. Calculate the area of the play space for each design.
- c. Calculate the perimeter of the play space for each design.
- d. Which design do you think Emily and Joe should choose? Explain your reasoning.

Stretch

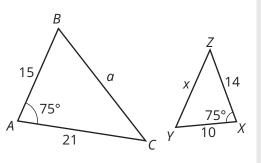
- 1. Consider the triangle shown.
 - a. Determine the area of the triangle. Round your answer to the nearest tenth.
 - b. Determine the perimeter of the triangle. Round your answer to the nearest tenth.
- 2. Consider the graph shown.
 - a. Is the graph continuous or discrete?
 - b. Does the graph contain 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. Determine the cosine of each angle measure's complement. a. 30° b. 45°
- 2. Identify the theorem that proves $\triangle ABC$ and $\triangle XYZ$ are similar. Explain your reasoning.



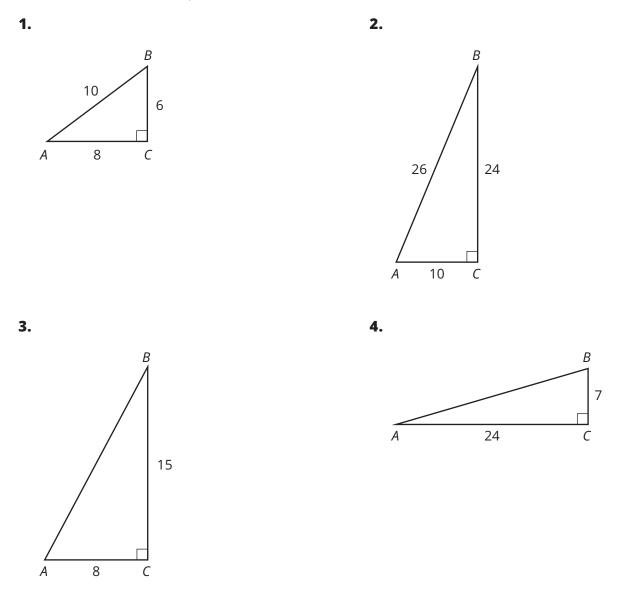
Skills Practice

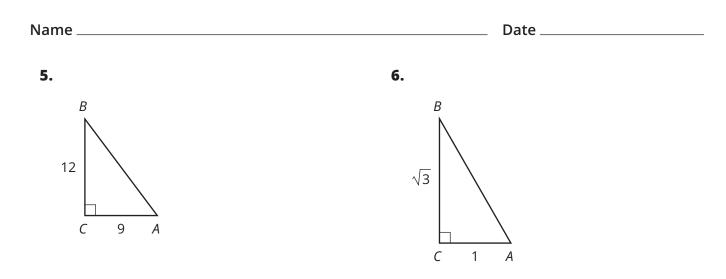
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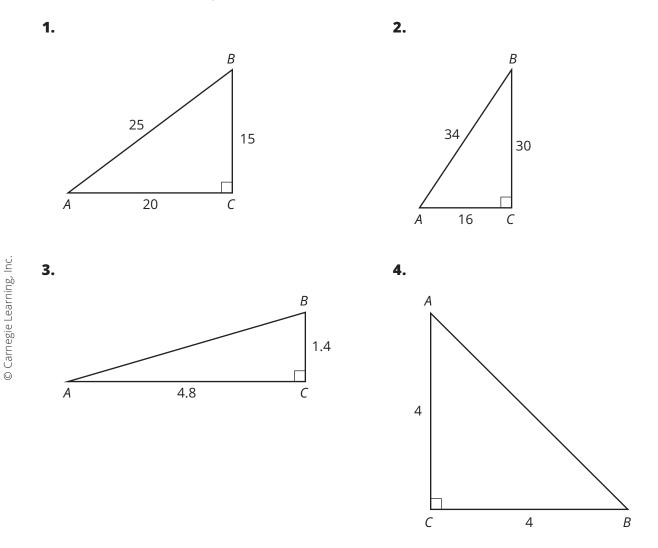
I. Exploring Trigonometric Ratios

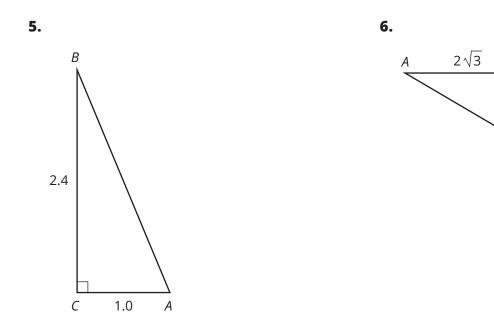
A. Determine the ratio $\frac{\text{opposite}}{\text{hypotenuse}}$ using $\angle A$ as the reference angle in each triangle. Write your answers as fractions in simplest form.





B. Determine the ratio $\frac{\text{adjacent}}{\text{hypotenuse}}$ using $\angle A$ as the reference angle in each triangle. Write your answers as fractions in simplest form.



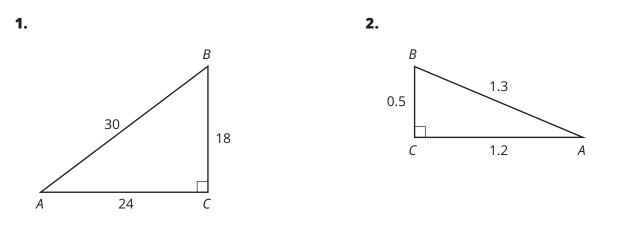


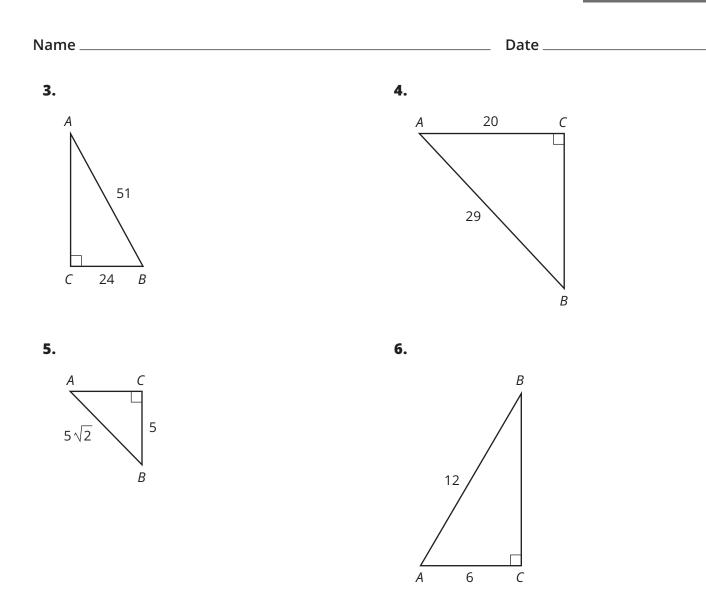
C. Determine the ratios $\frac{\text{opposite}}{\text{hypotenuse}}$, $\frac{\text{adjacent}}{\text{hypotenuse}}$, and $\frac{\text{opposite}}{\text{adjacent}}$ using $\angle A$ as the reference angle in each triangle. Write your answers as fractions in simplest form.

С

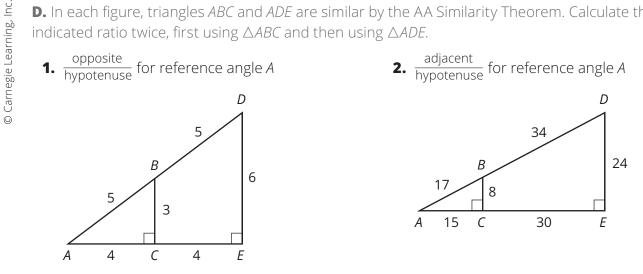
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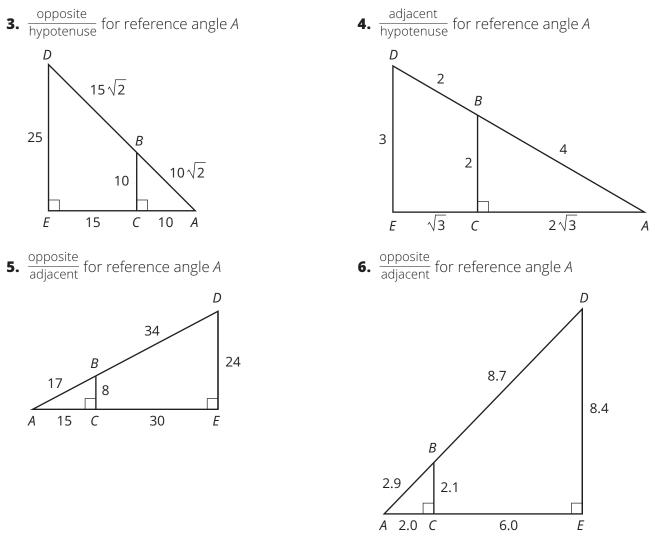
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D. In each figure, triangles *ABC* and *ADE* are similar by the AA Similarity Theorem. Calculate the indicated ratio twice, first using $\triangle ABC$ and then using $\triangle ADE$.



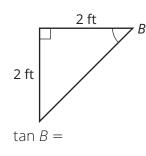


II. Calculating Trigonometric Ratios

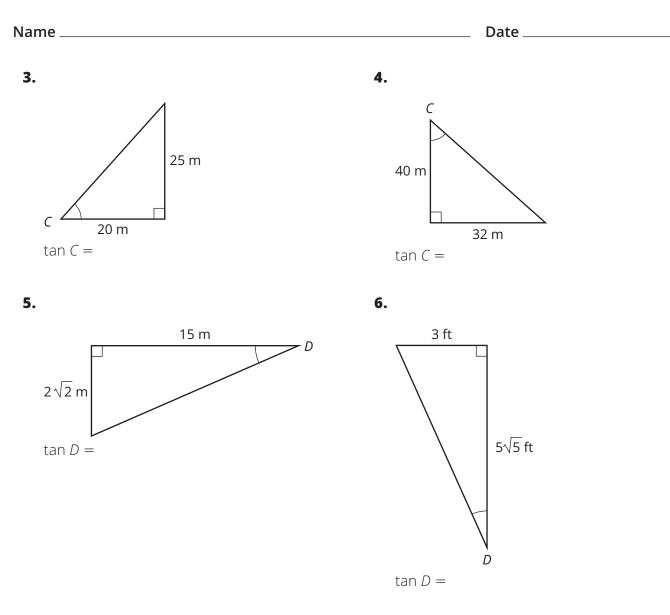
A. Calculate the tangent of the indicated angle in each triangle. Write your answers in simplest form.

2.

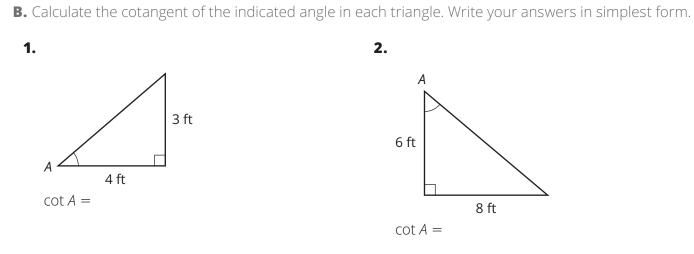




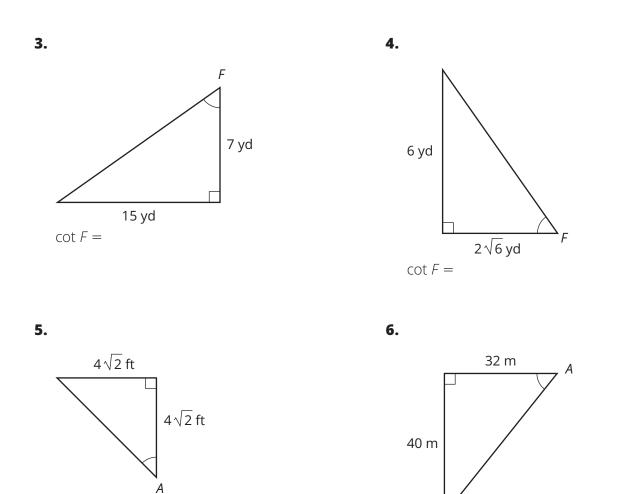
 $3\sqrt{2}$ ft $3\sqrt{2}$ ft $3\sqrt{2}$ ft tan B =



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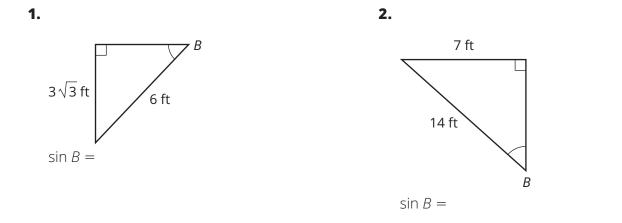


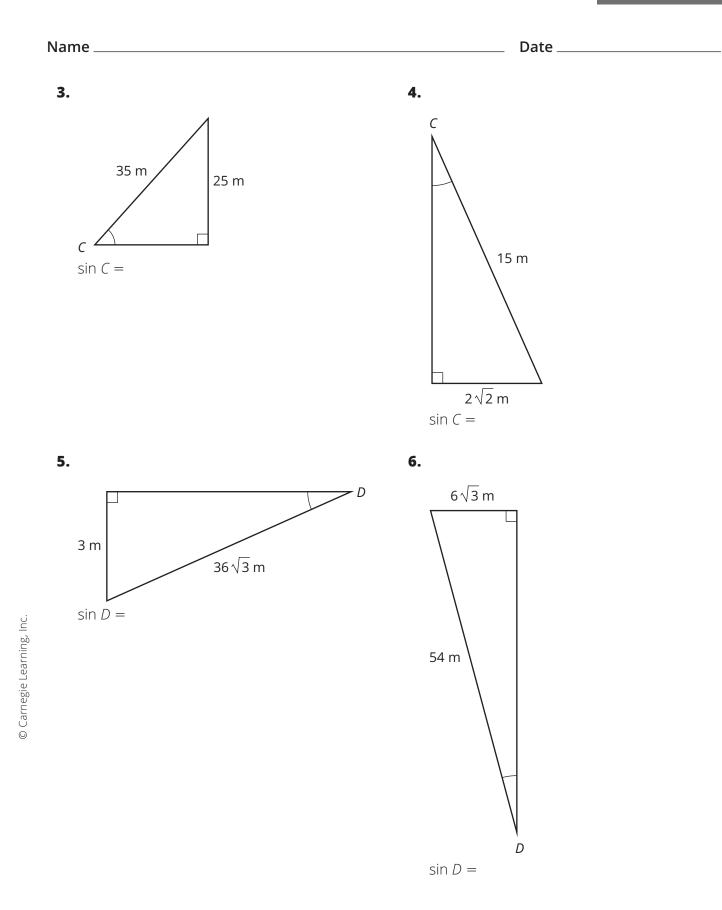
 $\cot A =$



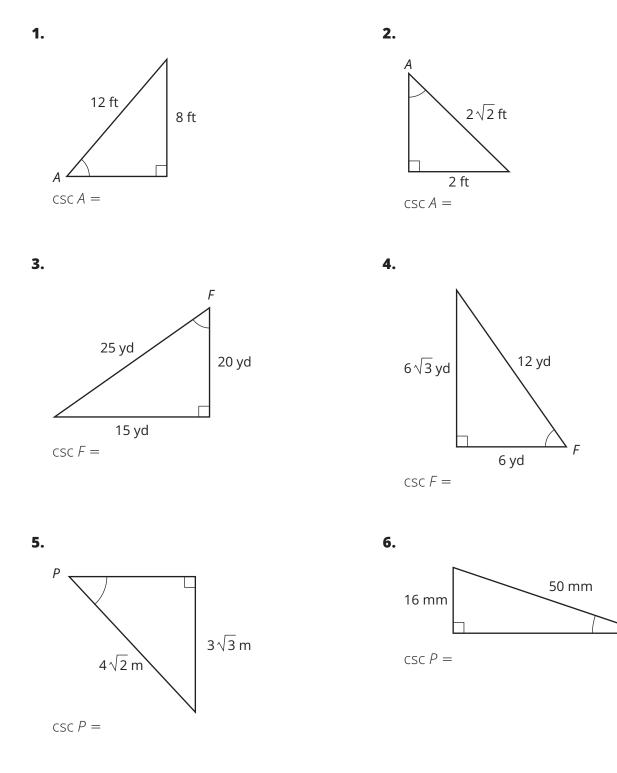
 $\cot A =$

C. Calculate the sine of the indicated angle in each triangle. Write your answers in simplest form.





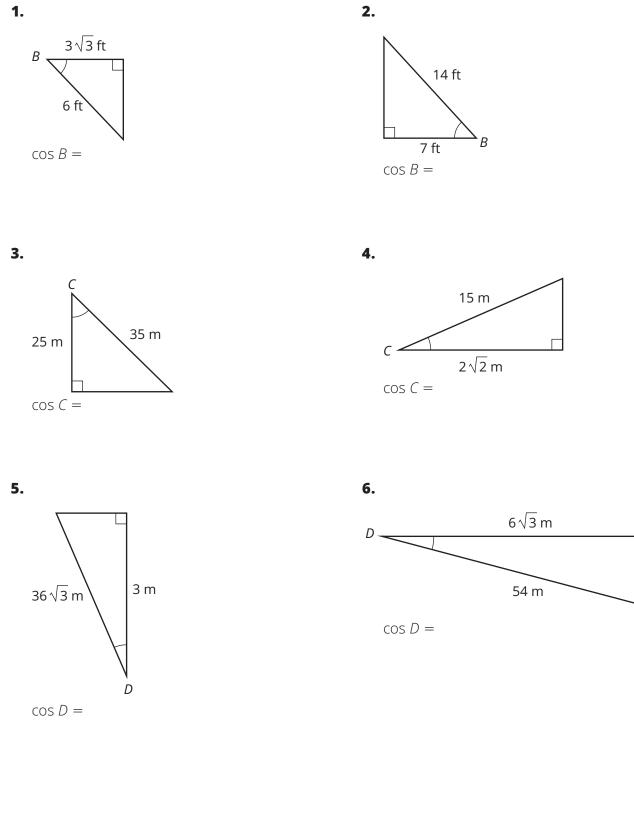
D. Calculate the cosecant of the indicated angle in each triangle. Write your answers in simplest form.



Р

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E. Calculate the cosine of the indicated angle in each triangle. Write your answers in simplest form.

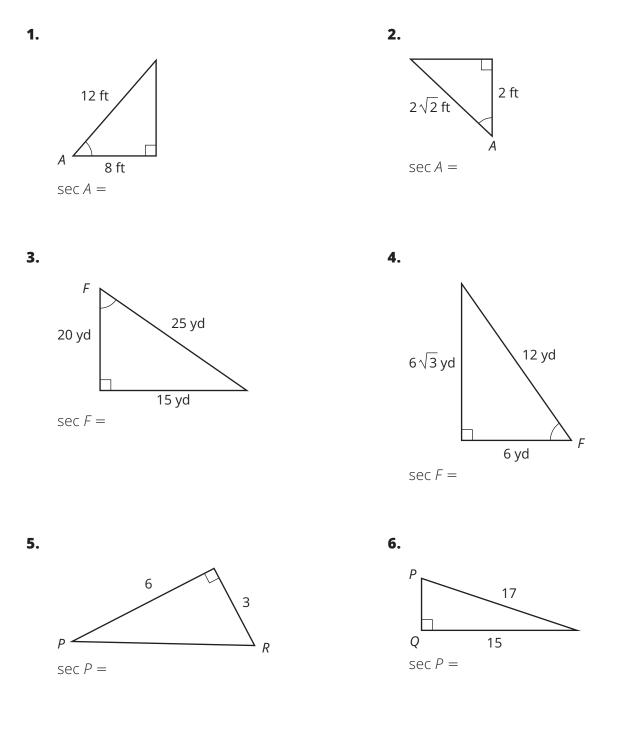


Name _____

Topic 2 TRIGONOMETRY

409

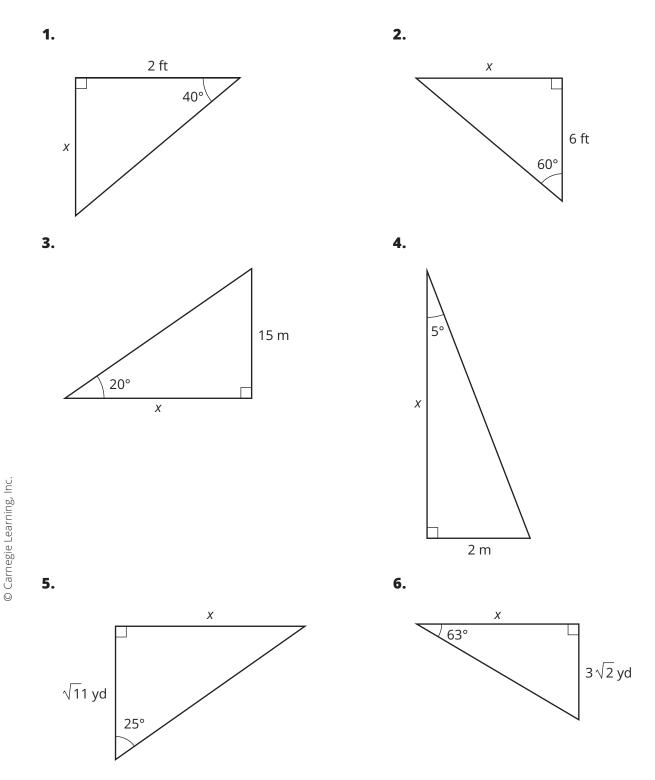
F. Calculate the secant of the indicated angle in each triangle. Write your answers in simplest form.

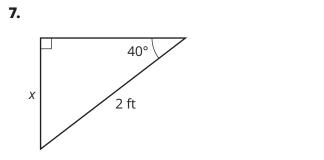


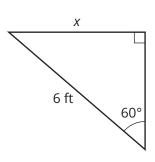
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III. Determining Unknown Lengths Using Trigonometric Ratios

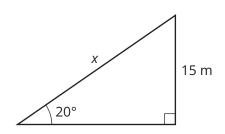
A. Calculate the missing length of each triangle. Round your answers to the nearest hundredth.





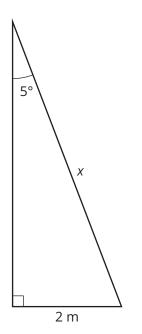


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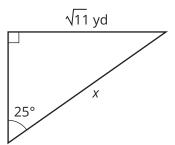




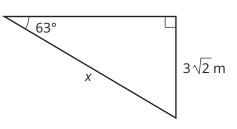
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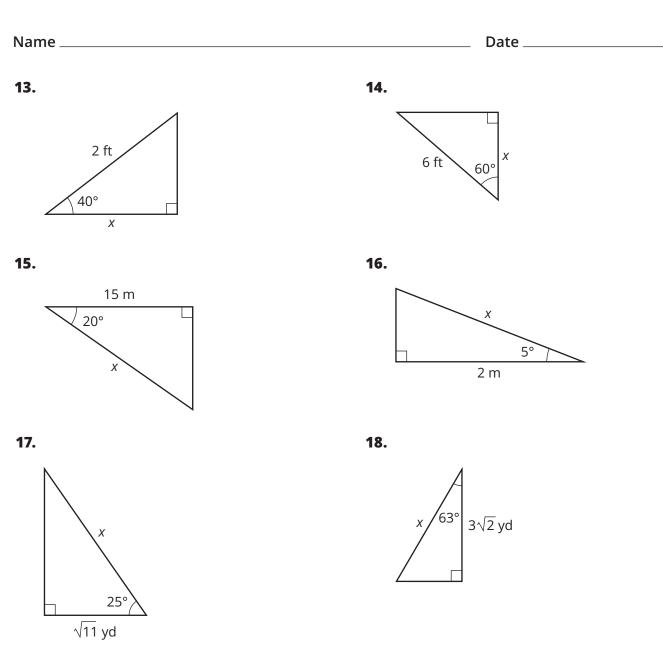






12.

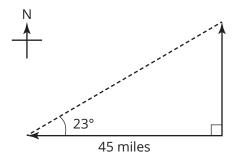




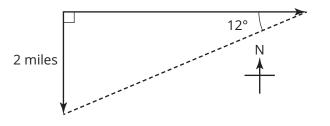
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B. Solve each problem. Round your answers to the nearest hundredth.

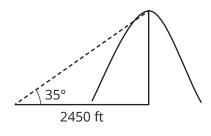
1. A boat travels in the following path. How far north did it travel?



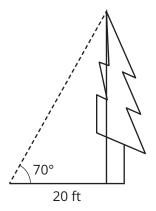
2. During a group hike, a park ranger makes the following path. How far west did they travel?



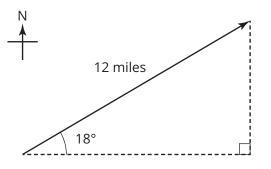
3. A surveyor makes the following diagram of a hill. What is the height of the hill?



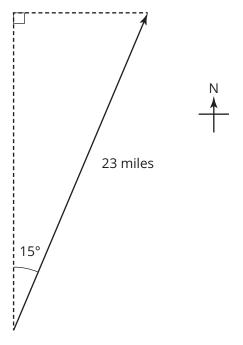
4. To determine the height of a tree, a botanist makes the following diagram. What is the height of the tree?



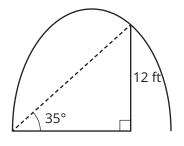
5. A scout troop traveled 12 miles from camp, as shown on the map below. How far north did they travel?



6. An ornithologist tracked a Cooper's hawk that traveled 23 miles. How far east did the bird travel?

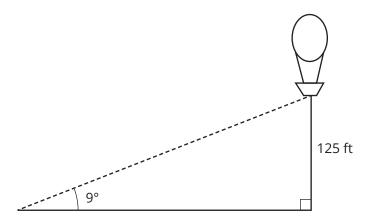


7. An architect needs to use a diagonal support in an arch. Her company drew the following diagram. How long does the diagonal support have to be?

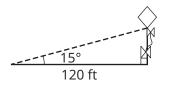


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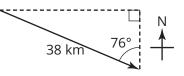
8. A hot air balloon lifts 125 feet into the air. The diagram below shows that the hot air balloon was blown to the side. How long is the piece of rope that connects the balloon to the ground?



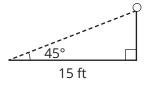
- **9.** The path of a model rocket is shown below. How far east did the rocket travel?
 - N 4230 ft 21°
- **11.** A kite is flying 120 feet away from the base of its string, as shown below. How much string is let out?



10. An ichthyologist tags a shark and charts its path. Examine his chart below. How far south did the shark travel?

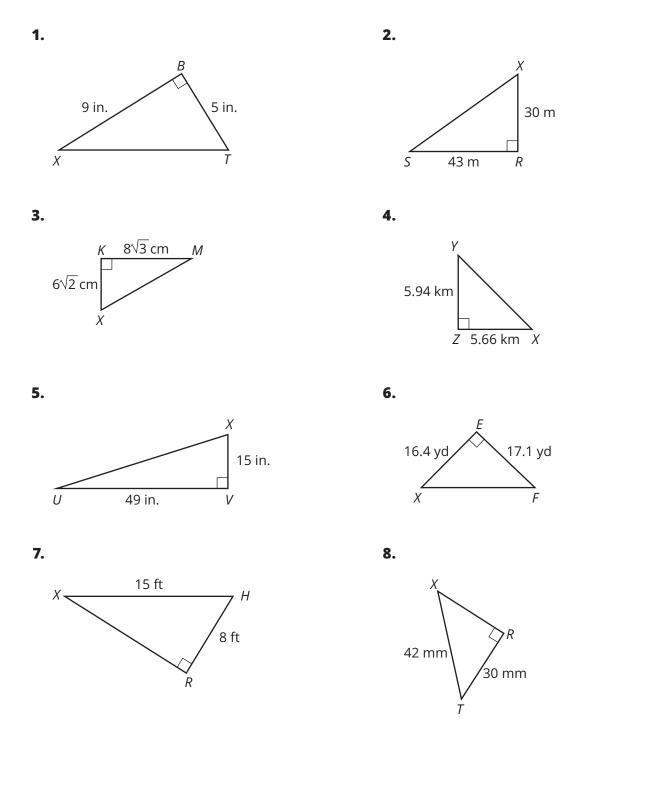


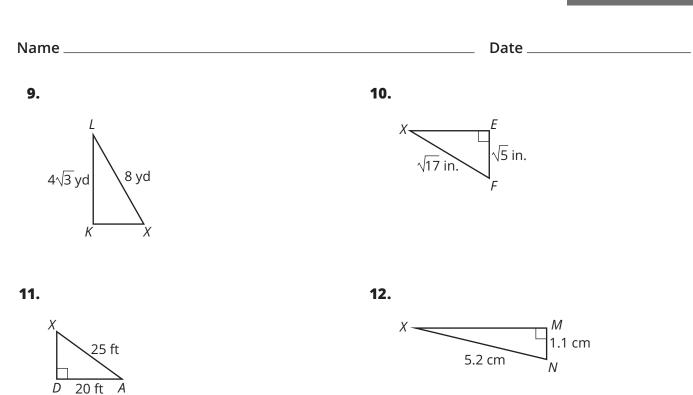
12. A pole has a rope tied to its top and to a stake 15 feet from the base. What is the length of the rope?



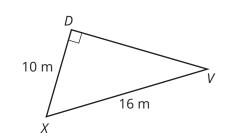
IV. Determining Unknown Angle Measures Using Trigonometric Ratios

A. Calculate the measure of angle *X* for each triangle. Round your answers to the nearest hundredth.



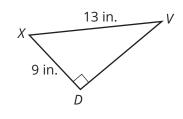


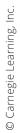
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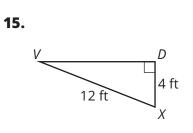


20 ft A

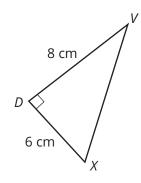




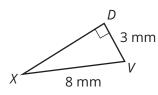


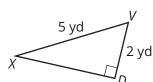


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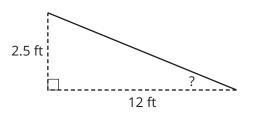




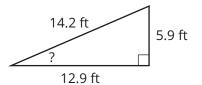
18.

B. Solve each problem. Round your answers to the nearest hundredth.

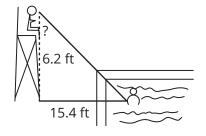
 A moving truck is equipped with a ramp that extends from the back of the truck to the ground. When the ramp is fully extended, it touches the ground 12 feet from the back of the truck. The height of the ramp is 2.5 feet. Calculate the measure of the angle formed by the ramp and the ground.



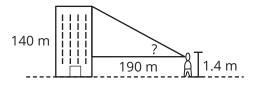
2. A park has a skateboard ramp with a length of 14.2 feet and a length along the ground of 12.9 feet. The height is 5.9 feet. Calculate the measure of the angle formed by the ramp and the ground.



3. A lifeguard is sitting on an observation chair at a pool. The lifeguard's eye level is 6.2 feet from the ground. The chair is 15.4 feet from a swimmer. Calculate the measure of the angle formed when the lifeguard looks down at the swimmer.

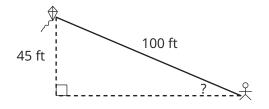


4. A surveyor is looking up at the top of a building that is 140 meters tall. His eye level is 1.4 meters above the ground, and he is standing 190 meters from the building. Calculate the measure of the angle from his eyes to the top of the building.

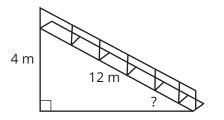


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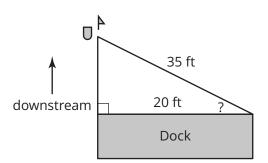
 Jerome is flying a kite on the beach. The kite is attached to a 100-foot string and is flying 45 feet above the ground, as shown in the diagram. Calculate the measure of the angle formed by the string and the ground.



7. Bleachers in a stadium are 4 meters tall and have a length of 12 meters, as shown in the diagram. Calculate the measure of the angle formed by the bleachers and the ground.

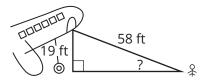


9. You park your boat at the end of a 20-foot dock. You tie the boat to the opposite end of the dock with a 35-foot rope. The boat drifts downstream until the rope is extended as far as it will go, as shown in the diagram. What is the angle formed by the rope and the dock?

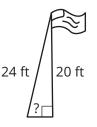


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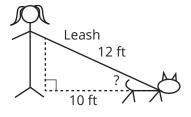
6. An airplane ramp is 58 feet long and reaches the cockpit entrance 19 feet above the ground, as shown in the diagram. Calculate the measure of the angle formed by the ramp and the ground.



 A 20-foot flagpole is raised by a 24-foot rope, as shown in the diagram. Calculate the measure of the angle formed by the rope and the ground.

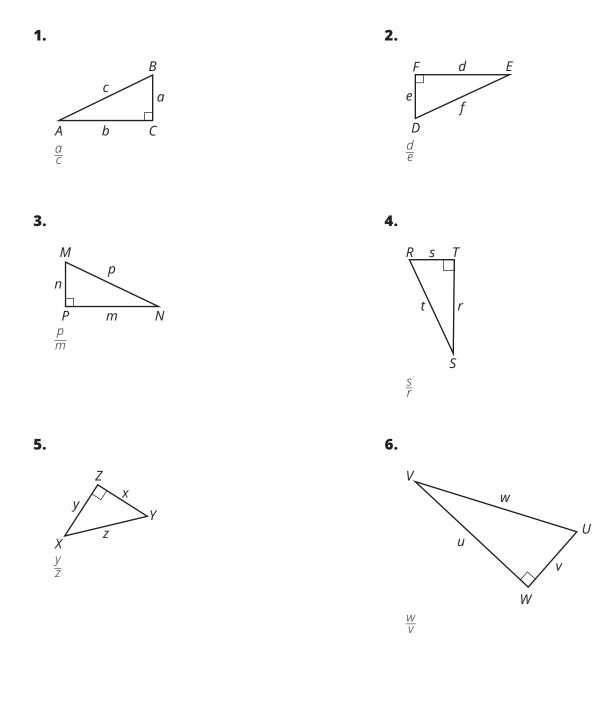


10. Rennie is walking her dog. The dog's leash is 12 feet long and is attached to the dog 10 feet horizontally from Rennie's hand, as shown in the diagram. What is the angle formed by the leash and the horizontal at the dog's collar?



V. Using Complementary Relationships

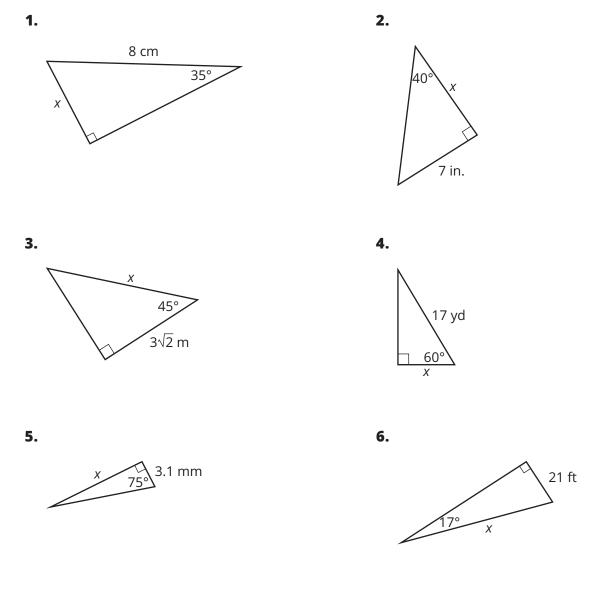
A. For each right triangle, name the given ratio in two different ways.



Topic 2
TRIGONOMETRY

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B. Determine the trigonometric ratio that you would use to solve for *x* in each triangle. Explain your reasoning. You do not need to solve for *x*.



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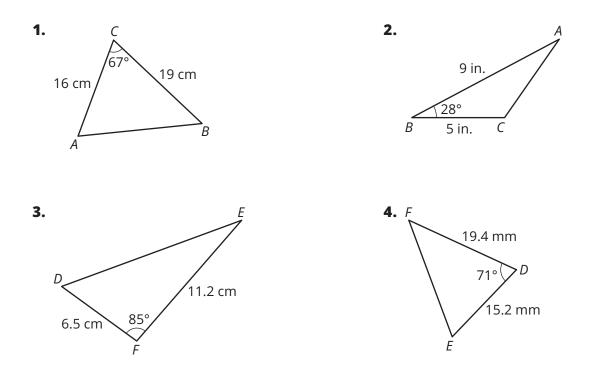
C. Solve each problem. Round your answers to the nearest hundredth.

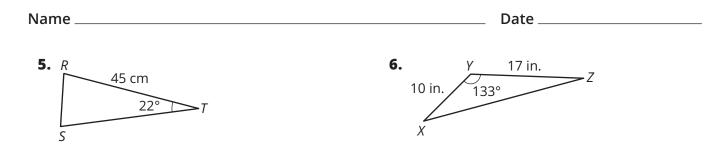
- You are standing 40 feet away from a building. The angle of elevation from the ground to the top of the building is 57°. What is the height of the building?
- 2. A surveyor is 3 miles from a mountain. The angle of elevation from the ground to the top of the mountain is 15°. What is the height of the mountain?

- 3. During the construction of a house, a 6-footlong board is used to support a wall. The board has an angle of elevation from the ground to the wall of 67°. How far is the base of the wall from the board?
- **4.** Museums use metal rods to position the bones of dinosaurs. If an angled rod needs to be placed 1.3 meters away from a bone, with an angle of elevation from the ground of 51°, what must the length of the rod be?
- 5. A factory conveyor has an angle of depression of 18° and drops 10 feet. How long is the conveyor?
- 6. A bicycle race organizer needs to put up barriers along a hill. The hill is 300 feet tall and from the top makes an angle of depression of 26°. How long does the barrier need to be?

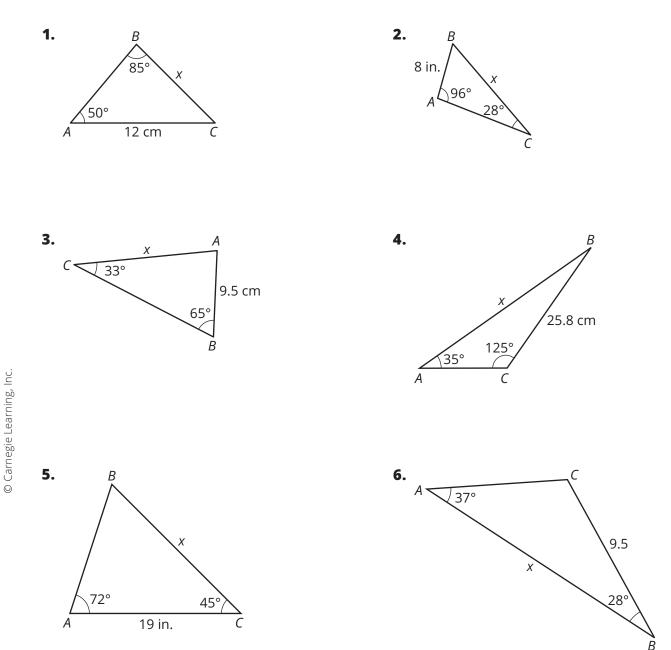
VI. Using the Triangle Area Formula, the Law of Sines, and the Law of Cosines

A. Determine the area of each triangle. Round your answers to the nearest tenth.

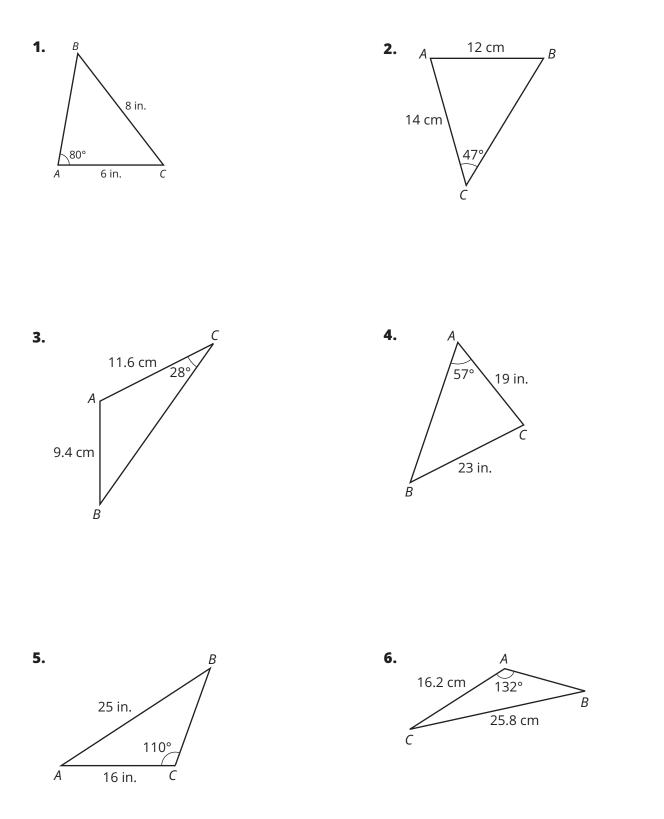




B. Determine the unknown side length *x* by using the Law of Sines. Round your answers to the nearest tenth.

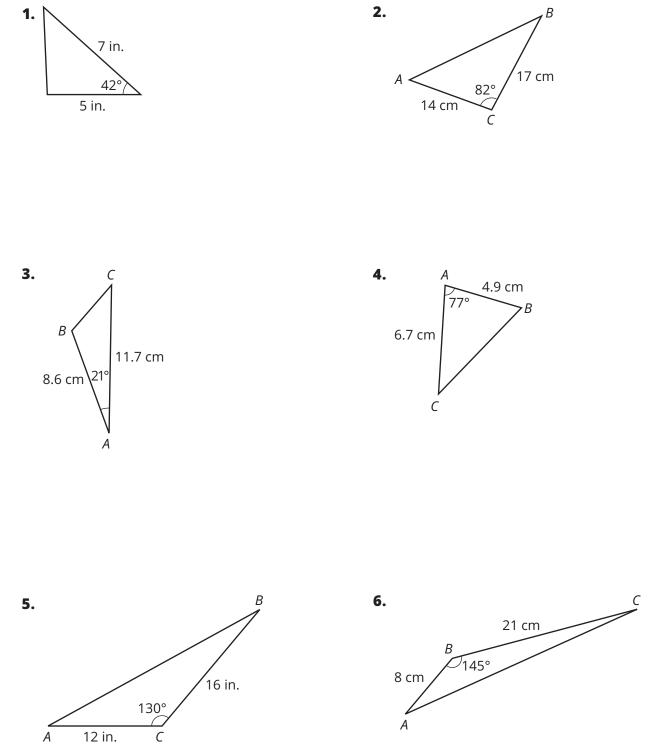


C. Determine $m \angle B$ by using the Law of Sines. Round your answers to the nearest tenth.





D. Determine the unknown side length by using the Law of Cosines. Round your answers to the nearest tenth.





What Are the Chances?

Compound Sample Spaces

Warm Up

• •

Consider the 7 days of a week. Suppose the name of each day is written on a separate piece of folded paper and placed into a bag. You reach into the bag and choose one piece of paper.

Determine each probability.

- a. Randomly choosing a day that begins with the letter S
- b. Randomly choosing a weekday
- c. Randomly choosing Wednesday

Key Terms

- outcome
- sample space
- event
- probability
- probability model
- uniform probability model

Learning Goals

- List the sample space for situations involving probability.
- Construct a probability model for a situation.
- Differentiate between uniform and non-uniform probability models.
- Develop a rule to determine the total number of outcomes in a sample space without listing each outcome.
- · Classify events as independent or dependent.
- Use the Counting Principle to calculate the size of sample spaces.
- non-uniform probability model
- complement of an event
- tree diagram
- organized list
- set

- element
- disjoint sets
- intersecting sets
 - union of sets
- independent events
- dependent events
- Counting Principle

In previous courses you have explored simple and compound probabilities. How are the possible outcomes of an experiment affected by the types of events and sets in the experiment?

Take a Spin

An **outcome** is a result of an experiment. The **sample space** is the set of all the possible outcomes of an experiment. An **event** is an outcome or set of outcomes in a sample space.

The **probability** of an event is the ratio of the number of desired outcomes to the total number of possible outcomes. The probability of event A is

 $P(A) = \frac{\text{number of outcomes in } A}{\text{total possible outcomes}}$

- 1. A board game includes the spinner shown that players must use to advance a game piece around the board.
 - a. What is the sample space if a player spins the spinner shown one time?

b. What is the probability of spinning the number 3, P(3)?

c. What is the probability of spinning a number greater than 1?

It is often helpful to construct a model when analyzing situations involving probability. A probability model lists the possible outcomes and the probability for each outcome.

- 2. Consider the spinner.
 - a. Complete the probability model for spinning the spinner.

Outcomes	1	2	3	4
Probability				

b. Is this a uniform probability model or a non-uniform probability model? Explain how you know.

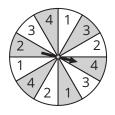
probabilities must equal 1.

In a **uniform** probability model,

the probabilities for each outcome are equal. When the probabilities of the outcomes are not all equal, the model is a **non-uniform** probability model.

In a probability

model, the sum of the



A sample space is

typically enclosed

in braces, { }, with commas between

the outcomes.

3. What is the probability of a spin not resulting in a 3?

In this game, players can earn different types of tokens as they move around the board. If a player lands on certain spaces, the player can

randomly choose a token from a box.

The token is then replaced before the next player's turn.



The complement of an event is an event that contains all the outcomes in the sample space that are not outcomes in the event. If *E* is an event, then the complement of *E* is often denoted as \overline{E} or E^c .

4. Robert and Larissa each determined the sample space for choosing a token. **Robert: Cylinder, Cube, Pyramid** Larissa: Cylinder, Cylinder, Cylinder, Cylinder, Cylinder Cube, Cube, Cube, Cube **Pyramid**, **Pyramid** Who determined the sample space correctly? Explain your reasoning.

- 5. Consider the choice of tokens.
 - a. What is the probability of choosing a pyramid, *P*(pyramid)? A cube, *P*(cube)?
 - b. Construct the probability model for choosing one of the tokens.

Outcomes	cylinder	cube	pyramid
Probability			

- c. Is this a uniform probability model or a non-uniform probability model? Explain how you know.
- d. What is the probability of choosing a token that is not a cylinder?



LESSON 1: What Are the Chances? • M5-9



Sample Space for Pizza Special

ΑCTIVITY

1.1



Mario's Pizzeria advertises special deals in the newspaper.

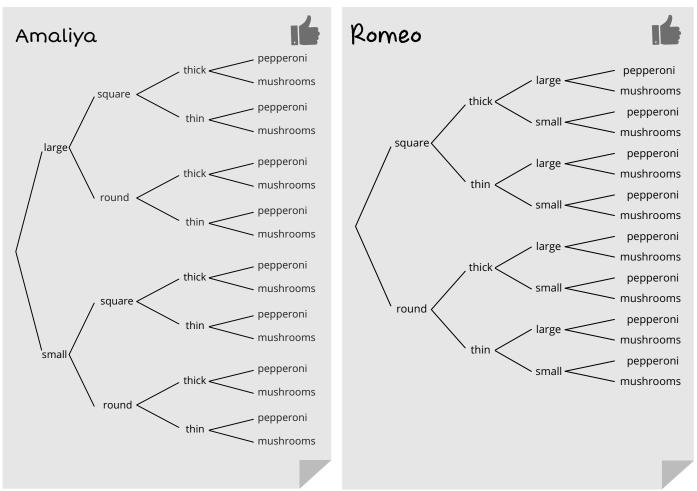
Today's Special at Mario's Pizzeria

Large one-topping pizza \$9.00 Small one-topping pizza \$6.50 Choose either a square or a round pizza with thick or thin crust. Available toppings: pepperoni or mushrooms Enjoy a fresh-baked pizza!!!

A tree diagram is

a visual model for determining the sample space of multiple events.

Amaliya and Romeo sketched tree diagrams to show the possible pizza specials at Mario's Pizzeria.



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Both tree diagrams show the same information, but each tree diagram is organized differently.

1. How many outcomes are included in the sample space of each tree diagram? Explain how you determined your answer.

2. What does each outcome of the sample space represent?

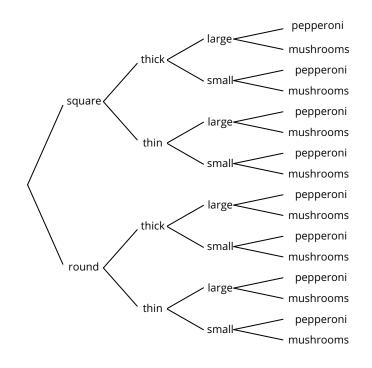
- 3. Compare the tree diagrams created by Amaliya and Romeo.
 - a. How are the tree diagrams similar and different?

b. Does the arrangement of the tree diagram affect the total number of possible outcomes? Explain why or why not.

An **organized list** is a visual model for determining the sample space of events.



There are descriptions that begin with the same letter. If you are abbreviating the names, what makes sense? Be sure to include a key so others know what you mean. 4. Use the tree diagram to write an organized list that displays all the possible pizza specials at Mario's Pizza.



- 5. Analyze the sample space to answer each question.
 - a. How many possible round pizza specials can you order?
 - b. How many possible thick and round pizza specials can you order?
 - c. How many of the possible pizza choices are square but do not have mushrooms?

1.2 Sample Space for Student Council Election



Jordan, Gray, Kelly, Morgan, and Taylor are running for student council offices. The student with the greatest number of votes is elected president, and the student receiving the next greatest number of votes is elected vice president.

- 1. Create a tree diagram to represent the possible outcomes for the election.
- 2. What does each level in your diagram represent? Does order matter? Explain your reasoning.
- 3. Write the sample space as an organized list.
- 4. Analyze the sample space to answer each question.
 - a. How many outcomes result in Gray being elected president or vice president?
 - b. How many outcomes result in Taylor not being elected president?
 - c. How many outcomes result in Jordan or Kelly as president and Taylor or Gray as vice president?



5. Bentley used the first initial of each student's name as an abbreviation in his sample space. He included both JM and MJ as different outcomes. Kaleb says these two outcomes mean the same thing and only one should be included in the sample space. Who's correct? Explain your reasoning.

- 6. Can you rearrange the tree diagram to produce a different number of total possible outcomes for the election? Explain why or why not.
- 7. Consider your sample spaces from *Pizza Special* and *Student Council Election.*
 - a. Does choosing a topping for a pizza at Mario's Pizzeria affect any of the other choices you have? Does choosing a size affect any of the other choices? Explain your reasoning.
 - b. Does electing the student council president affect the choices for vice president? Explain your reasoning.

1.3

Categorizing Scenarios Involving Events



A **set** is a collection of items. If *x* is a member of set *B*, then *x* is an **element** of set *B*.

Consider the examples of disjoint sets, intersecting sets, and the union of sets.

Worked Example

Disjoint Sets

Let *N* represent the set of 9th grade students. Let *T* represent the set of 10th grade students.

The set of 9th grade students and the set of 10th grade students are disjoint because the two sets do not have any common elements. Any student can be in one grade only.

Intersecting Sets

Let *V* represent the set of students who are on the girls' volleyball team. Let *M* represent the set of students who are in the math club. Julia is on the volleyball team and belongs to the math club.

The set of students who are on the girls' volleyball team and the set of students who are in the math club are intersecting because we know they have at least one common element, Julia.

The Union of Sets

Let *B* represent the set of students in the 11th grade band. Let *C* represent the set of students in the 11th grade chorus. The union of these two sets would be all the students in the 11th grade band or the 11th grade chorus. A student in both would be listed only once.

 Identify the sets in each scenario in the previous two activities. Then, determine whether the sets are disjoint or intersecting. Explain your reasoning.

a. Pizza Special

b. Student Council Election

Two or more sets are **disjoint sets** if they do not have any common elements.

Two or more sets are **intersecting sets** if they do have common elements.

The **union of sets**

is a set formed by combining all the members of the sets. A member is listed only once.

- 2. Determine whether each set is disjoint or intersecting. Explain your reasoning.
 - a. Let *E* represent the set of even integers. Let *O* represent the set of odd integers.
 - b. Let *T* represent the set of multiples of 2. Let *F* represent the set of multiples of 5.
- Independent events 3.

are events for which the occurrence of one

event has no impact

on the occurrence of the other event. **Dependent events** are events for which

the occurrence of one

event has an impact on the occurrence of subsequent events.

- 3. Consider the letters in the words *crafty* and *crate*.
 - a. What set would be formed by taking the intersection of the letters in the two words?
 - b. What set would be formed by taking the union of the letters in the two words?

Consider the examples of independent events and dependent events.

Worked Example

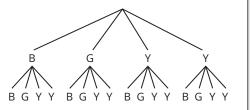
A jar contains 1 blue marble, 1 green marble, and 2 yellow marbles.

Independent Events

You randomly choose a yellow marble, replace the marble in the jar, and then randomly choose a yellow marble again.

The event of choosing a yellow marble first does not affect the event of choosing a yellow marble second because the yellow marble chosen first is replaced in the jar.

The events of randomly choosing a yellow marble first and randomly choosing a yellow marble second are independent events because the first yellow marble was replaced in the jar. You can see this visually using a tree diagram.



M5-16 • TOPIC 1: Independence and Conditional Probabilities

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Worked Example

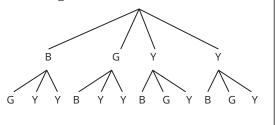
Dependent Events

A jar contains 1 blue marble, 1 green marble, and 2 yellow marbles. You randomly choose a yellow marble without replacing the marble in the jar, and then randomly choose a yellow marble again.

The event of choosing a yellow marble first does affect the event of choosing a yellow marble second because the yellow marble chosen first is not replaced in the jar.

You can see this visually using a tree diagram.

The events of randomly choosing a yellow marble first and randomly choosing a yellow marble second are dependent events because the first yellow marble was not replaced in the jar.



4. Explain why Sia's statement is incorrect.

Sia

I think that choosing the first marble and choosing the second marble are dependent events.

5. Identify one outcome from *Pizza Special* and *Student Council Election*. Then, state whether the events that result in that outcome are independent or dependent. Explain your reasoning.

a. Pizza Special

b. Student Council Election

The Counting Principle

ΑCTIVITY

1.4

Paula's aunt owns an ice cream shop. She offers her customers a choice of chocolate, vanilla, or strawberry ice cream in a cone or cup with or without sprinkles. Her aunt was trying to determine the number of ways that a customer could order ice cream. Paula said, "There are 12 ways!" Paula used a mathematical principle called the *Counting Principle*. The principle is used to determine the number of outcomes in the sample space.

The **Counting Principle** states: "If an action *A* can occur in *m* ways and for each of these *m* ways an action *B* can occur in *n* ways, then actions *A* and *B* can occur in $m \cdot n$ ways."

The Counting Principle can be generalized to more than two actions that happen in succession. If for each of the *m* and *n* ways *A* and *B* occur there is also an action *C* that can occur in *s* ways, then Actions *A*, *B*, and *C* can occur in $m \cdot n \cdot s$ ways.

- 1. Devin has an all-day pass for Scream amusement park. His favorite rides are the Bungee-Buggy, Head Rush roller coaster, Beep Beep go-karts, and Tsunami Slide water roller coaster. He never rides any other rides, and he can ride each of his favorite rides as many times as he wants.
 - a. Describe the type of event for selecting ride order. Explain your reasoning.
 - b. Use the Counting Principle to determine the number of possible ride orders for Devin's next two rides. Explain your reasoning.
 - c. How many ride order possibilities are there for Devin's next five rides?



What is the difference between an event and an action?

A situation can involve independent events from disjoint sets, independent events from the same set with repetitions allowed, or dependent events from the same set without repetitions.

- 2. Sherry stayed home from school Wednesday because she was ill. She watched a television program from 12:00 p.m. until 12:30 p.m., and another program from 12:30 p.m. until 1:00 p.m. From 12:00 p.m. until 12:30 p.m., her program choices were the news, cartoons, or a talk show. From 12:30 p.m. until 1:00 p.m., her program choices were a comedy, a soap opera, a game show, or a cooking show.
 - a. Describe the type of event for Sherry's television program selections. Explain your reasoning.
 - b. How many program selections can Sherry watch from 12:00 p.m. until 1:00 p.m?

- 3. A student's daily schedule includes math, English, science, social studies, foreign language, art, and physical education. Students are enrolled in each class for one period per day.
 - a. Describe the type of event for creating a student's daily schedule. Explain your reasoning.
 - b. Determine how many different orders the classes can be arranged to fill a seven-period daily schedule.
 - c. Lunch period is directly after fourth period. How many different class schedule arrangements are possible before lunch period? Explain your reasoning.

- 4. The cell phone PIN to access voicemail is a 4-digit number. Each digit can be a number from 0 to 9, including 0 and 9.
 - a. How many 4-digit numbers are possible? Repetition of numbers is allowed. Explain your calculation.
 - b. If repeating digits is not permitted, how many different 4-digit PINs are possible?
- 5. A typical license plate number for a car consists of three letters followed by four numbers ranging from 0 through 9, including 0 and 9.
 - a. How many different license plate numbers are possible if letters and numbers can be repeated? Explain your calculation.
 - b. How many different 3-letter, 4-digit license plate numbers are possible if letters and digits cannot be repeated?

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Counting Without Counting

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The Counting Principle is used to determine the number of outcomes in a sample space. The calculations vary depending upon the situation.

1. For each given type of event and type of set, write a scenario and sample space calculation that represents the type of event and type of set.

Type of Event (independent or dependent)	Type of Set (disjoint or intersecting)	Scenario	Sample Space Calculation
independent	three disjoint sets		
dependent	intersecting sets		
dependent	two disjoint sets		

NOTES

2. Efi and Areti each describe a scenario with a sample space of $4 \cdot 3 \cdot 2 = 24.$

Efi

The scenario has independent events and disjoint sets.

Aveti

The scenario has dependent events and intersecting sets.

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- a. Based on Efi's description, write an example scenario involving 3 disjoint sets and 24 outcomes in the sample space.
- b. Based on Areti's description, write an example scenario involving 3 intersecting sets and 24 outcomes in the sample space.
- 3. Describe how to calculate the number of outcomes in the sample space of situations involving either independent or dependent events.
- 4. List advantages and disadvantages of using a tree diagram or an organized list to represent a sample space.

Assignment

Write

1. A ______ is a collection or group of items and each item within it is called an

- 2. The ______ is a set formed by combining all the members of the sets, such that all the members are only listed once.
- 3. Sets that do not have common elements are called ______.
- 4. Sets that do have common elements are called ______.
- 5. ______ and _____ are two types of visual models that display sample space.
- 6. Events for which the occurrence of one event has no impact on the occurrence of the other event are
- 7. Events for which the occurrence of one event has an impact on the following events are
- 8. The _______ states that if an action *A* can occur in *m* ways and for each of these *m* ways, an action *B* can occur in *n* ways, then Actions *A* and *B* can occur in $m \cdot n$ ways.

Remember

The Counting Principle states: "If an action *A* can occur in *m* ways and for each of these *m* ways, an action *B* can occur in *n* ways, then actions *A* and *B* can occur in $m \cdot n$ ways." The values for *m* and *n* are determined by whether the events are independent or dependent events.

Practice

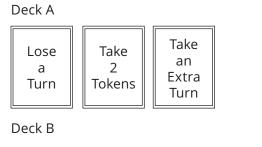
- 1. Suppose you roll a number cube once.
 - a. Identify the sample space.
 - b. What is the probability of rolling a 5, *P*(5)?
 - c. What is the probability of rolling an even number, *P*(even)?
 - d. What is the probability of rolling a number greater than 2, P(greater than 2)?
 - e. Construct the probability model for rolling a number cube.

Outcomes			
Probability			

- f. Is the probability model from part (e) a uniform or non-uniform probability model? Explain your reasoning.
- g. What is the probability of rolling a number that is not a multiple of 3, *P*(not a multiple of 3)?

2. For each scenario,

- Determine the actions.
- Determine the outcomes of each action.
- Determine whether the outcomes of each action belong to disjoint sets or intersecting sets.
 Explain your reasoning.
- Sketch a tree diagram or write an organized list to represent the sample space.
- Determine whether the events in each outcome of the sample space are independent or dependent.
- Determine the size of the sample space using the Counting Principle. Show your calculation.
- a. While playing a board game, a player randomly chooses one card from each of the two decks, and then replaces the cards in the decks.



Go Back 2 Spaces	Go Back 1 Space	Go Ahead 2 Spaces	Go Ahead 1
Spaces	Space	Spaces	Space

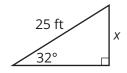
b. Amanda randomly chooses a card from a deck of six cards, without replacing it, then chooses another card. The cards are numbered 1 through 6.

Stretch

- 1. Jacinta rolls two number cubes. Both number cubes are numbered from 1 to 6.
 - a. What are the actions?
 - b. What are the outcomes of each action?
 - c. Determine the size of the sample space using the Counting Principle. Show your calculation.
 - d. Write an organized list that represents the sample space.
 - e. What is the probability of rolling two dice with a sum greater than 9, *P*(sum greater than 9)?
- 2. Jalen rolls a number cube that is numbered 1 through 6. He then flips a coin with heads on one side and tails on the other side.
 - a. Are the events in each outcome of the sample space independent or dependent? Explain.
 - b. Write an organized list that represents the sample space.
 - c. What is the probability that the number on the cube is even and the result of the coin flip is tails, *P*(even number and tails)?
 - d. If just the cube is rolled, what is the probability that the number rolled on the cube is an even number, *P*(even number)?
 - e. If just the coin is flipped, what is the probability that it is tails, P(tails)?
 - f. How do the answers to parts (c), (d), and (e) relate to each other?

Review

- 1. Determine the vertex, axis of symmetry, the value of *p*, the directrix, the focus, and the concavity for the parabola $(x 1)^2 = 8(y + 3)$. Then graph the parabola.
- 2. Determine the equation of the parabola with focus (0, -1) and directrix y = 3. Let (x, y) represent a point on the parabola.
- 3. Write an equation in standard form for each.
 - a. A circle with a center at M(-2, 15) and a radius of $\sqrt{11}$
 - b. A circle with the same center as circle *M*, but whose area is3 times that of circle *M*
- 4. Given sin $\theta = \frac{\sqrt{2}}{2}$ in Quadrant II, use the Pythagorean identity to determine cos θ .
- 5. Use a trigonometric ratio to solve for the value of *x*. Round your answer to the nearest tenth.



And? Compound Probability with And

Warm Up

Determine each product.

1. $\frac{4}{5} \cdot \frac{1}{4}$

2. $\frac{1}{6} \cdot \frac{3}{5}$

•

• •

3. $\frac{5}{8} \cdot \frac{3}{7}$

4. $\frac{1}{4} \cdot \frac{2}{3} \cdot \frac{1}{2}$

Learning Goals

- Determine the probability of two or more independent events.
- Determine the probability of two or more dependent events.

Key Terms

- compound event
- Rule of Compound Probability involving and
- conditional probability

You have used tree diagrams and organized lists to determine the sample space and calculate the probability of events. How can you calculate the probability of compound events that are combined by the word *and* using a mathematical rule?

Frundaes!

Stan's Frozen Yogurt Shop offers frundaes, which are frozen yogurt sundaes. The shop advertises different frundae options for customers.

•

. .

BUILD YOUR OWN FRUNDAE				
Choose one yogurt flavor and one topping.				
Frozen Yogurt Flavors	Toppings			
vanilla	nuts			
chocolate	sprinkles			
strawberry	granola			
peach				

- 1. Write the sample space of different frundae options consisting of one yogurt flavor and one topping using an organized list.
- 2. How many different frundaes can be created by first selecting one frozen yogurt flavor and then one topping?

Alec and Ella each order a single flavor cone with no toppings.

3. Write an organized list for the sample space of the single flavor cones that Alec and Ella could buy. Describe the sample space.

- 4. A Triple-Decker Froyanza is a frozen yogurt cone with three servings of yogurt. Tamara orders a Triple-Decker Froyanza with one serving of chocolate, one serving of vanilla, and one serving of strawberry frozen yogurt.
 - a. Write an organized list for the sample space that represents the order in which the server could stack the three servings of frozen yogurt on Tamara's cone.
 - b. How many different stacking orders are possible for the frozen yogurt flavors of Tamara's Triple-Decker Froyanza?
 Explain how you determined your answer.
- 5. Compare and contrast the sample spaces from Questions 1, 3, and 4.
 - a. How are the sample spaces alike?
 - b. How is Question 1 and its sample space different from Question 3 and its sample space?

c. How is Question 4 and its sample space different from Questions 1 and 3 and their sample spaces?





Frozen Yogurt Flavors

vanilla chocolate strawberry peach

Toppings

nuts sprinkles granola A **compound event** is an event that consists of two or more events.

- 1. Consider the different ordering situations of frozen yogurt from the Getting Started.
 - a. Which situations represent compound events? Explain your reasoning.
 - b. Describe the events that make up the compound event in ordering a frundae. Then list the outcomes for each event.

Suppose you decide to build your next frundae by randomly selecting a yogurt flavor and topping.

Ask • yourself:

How can you use the sample spaces you created to determine each probability?

- 2. What is the probability of choosing a frundae that does not have chocolate yogurt and does have a granola topping?
 - a. Let A represent the event of choosing a flavor that is not chocolate. What is *P*(*A*), the probability of choosing a flavor that is not chocolate?
 - b. Let B represent the event of choosing granola as a topping.What is P(B), the probability of choosing granola as a topping?

c. What is *P*(*A* and *B*), the probability of choosing a flavor other than chocolate that has granola as a topping? Explain how you determined your answer.

- 3. What is the probability of choosing a frundae with chocolate flavored yogurt and a topping that is not granola?
 - a. Let A represent the event of choosing a frundae with chocolate flavored yogurt. What is *P*(*A*), the probability of choosing a frundae with chocolate flavored yogurt?

b. Let *B* represent the event of choosing a topping that is not granola. What is *P*(*B*), the probability of choosing a topping that is not granola?

c. What is *P*(*A* and *B*), the probability of choosing a frundae with chocolate flavored yogurt and a topping that is not granola? Explain how you determined your answer.

P(A and B) can be written as $P(A \cap B)$, where $A \cap B$ represents an intersection of Events A and B. The intersection of Events A and B is the set of all of the outcomes where both Event A and Event B occur.



4. Compare the probabilities you determined in Questions 2 and 3. What mathematical relationship exists between P(A), P(B), and P(A and B)?

5. Why do you think that the probability of both events occurring is less than the probability of either event occurring by itself?

6. Why do you think multiplication is performed in compound probability problems using the word *and*?

2.2



You just calculated probabilities for a compound event comprised of two events. Now, let's consider a compound event comprised of more than two events.

- 1. Suppose you flip 3 coins and record the result of each flip.
 - a. What is the probability that all 3 coins land heads up?

b. What is the probability that the first 2 coins land heads up and the third coin lands tails up?

- c. What is the probability of the second coin landing tails up? Explain how you determined your answer.
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- d. What is the probability of flipping heads on the first coin and tails on the third coin? Explain how you determined your answer.

Some calculators display a maximum of 10 digits. Very large numbers are often displayed using scientific notation. 2. Suppose you flip 50 coins. What is the probability of flipping heads on the first and second coins? Derrick and Sarina each answered this question differently.

Derrick

To calculate the number of total possible outcomes, I multiply 2 by itself 50 times, which is 2^{50} , or I,I25,899,906,842,624. There is I desired outcome for each of the first 2 coins, or I × I. For the other 48 coins, there are 2 desired outcomes, because they can be heads or tails. This is 2^{48} . So, the number of desired outcomes is I × I × 2^{48} , or 281,474,976,710,656.

The probability of flipping heads on the first and second coins, then, is

 $\frac{281,474,976,710,656}{1,125,899,906,842,624} = \frac{2^{48}}{2^{50}} = \frac{1}{2^2} = \frac{1}{4}.$

Savina

l only need to do calculations with the probabilities for the first 2 coins because the probabilities for the other 48 coins are each $\frac{2}{2}$, or l. The probability of flipping heads on the first two of 50 coins is $\frac{1}{2} \times \frac{1}{2}$, or $\frac{1}{4}$.

Which strategy is more efficient? Why?



If Events *A* and *B* are independent, does the occurrence of Event *A* affect the probability of the occurrence of Event *B*? The **Rule of Compound Probability involving** *and* states: "If Event *A* and Event *B* are independent events, then the probability that Event *A* happens and Event *B* happens is the product of the probability that Event *A* happens and the probability that Event *B* happens, given that Event *A* has happened."

$$P(A \text{ and } B) = P(A) \cdot P(B)$$



You have 2 red, 1 blue, and 3 green socks in a drawer.

Suppose you reach into the drawer without looking and choose a sock, replace it, and then choose another sock. You choose a total of 2 socks.

- 1. Use this information to answer each question.
 - a. Does the action "choosing the first sock" affect the outcomes of "choosing the second sock"? If so, how? Explain your reasoning.
 - b. Use a tree diagram or organized list to represent the sample space for this situation.
 - c. How can you use the Counting Principle to determine the total number of possible outcomes? Explain your reasoning.

You can use small numbers called subscripts to indicate the different red or green socks. For example, R₁ and R₂ can represent the two red socks.



How can a tree diagram or organized list be used to check your answers?

- d. Calculate the probability of choosing:
 - A blue sock and then a red sock.
 - A red sock and then a sock that is not blue.
 - Two socks with the first sock being green.

Suppose you reach into the drawer without looking and choose a sock, do not replace it, and then choose another sock. You choose a total of 2 socks. Remember, there are 2 red, 1 blue, and 3 green socks in a drawer.

- 2. Use this information to answer the questions.
 - a. Does the action "choosing the first sock" affect the outcomes of "choosing the second sock"? If so, how? Explain your reasoning.
 - b. Use a diagram or organized list to represent the sample space for this situation.
 - c. How can you use the Counting Principle to determine the total number of possible outcomes? Explain your reasoning.
 - d. Calculate the probability of choosing:
 - A blue sock and then a red sock.
 - A red sock and then a sock that is not blue.
 - Two socks with the first sock being green.
- 3. What's different about the probability calculations in Question 1, part (d) and Question 2, part (d)?

If Event *A* and Event *B* are dependent, then the probability that Event *A* happens and Event *B* happens is the product of the probability that Event *A* happens and the probability that Event *B* happens, given that Event *A* has already occurred.

If Events *A* and *B* are dependent, then the probability of Event *B* occurring is affected by the occurrence of the first event. Therefore, the notation for the Rule of Compound Probability involving *and* now states that $P(A \text{ and } B) = P(A) \cdot P(B|A)$.

4. Two red socks, 1 blue sock, and 3 green socks are in a drawer. One sock is randomly chosen without replacing it in the drawer, then a second sock is randomly chosen. What is the probability that the second sock is red?

Juan explained his solution method.

Juan

We want the second sock to be red, but the first sock can be red or not red. The desired outcomes are "red and red" or "not red and red."

Calculate the probability of choosing a red sock second.

- 5. Two red socks, 1 blue sock, and 3 green socks are in a drawer. One sock is randomly chosen without replacing it in the drawer, and then a second sock is randomly chosen. Use Juan's method to answer each question.
 - a. What is the probability that the second sock is blue? Explain your reasoning.
 - b. What is the probability that the second sock is green? Explain your reasoning.

Conditional probability is the

probability of an event which assumes the occurrence of some other event. P(B|A) means "the probability of the occurrence of Event *B* given the occurrence of Event *A*."



There are two cases that you should consider, depending on whether the first sock was red or not.

NOTES

TALK the TALK

That Depends

Consider the situations that you analyzed in this lesson.

1. Compare the methods you used to determine the compound probability of two independent events both occurring and the compound probability of two dependent events both occurring. Describe the similarities and differences between the methods.

2. What rules could you write to determine the compound probability of three or more independent events? Three or more dependent events? Include examples to support your conclusions.

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Assignment

Write

Describe the difference between the Rule of Compound Probability involving *and* for independent and dependent events in your own words.

Remember

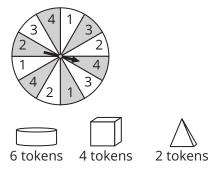
A compound event is an event that consists of two or more events. If the events are combined by the word *and*, you can multiply the probability of each event to determine the compound probability.

Practice

- 1. Suppose a player chooses cards from the two decks shown. The subsets of cards are labeled C1 to C7 (see figure).
 - a. A player chooses one card from Deck A and one card from Deck B.

What is the probability that the player will choose cards C1 and C4?

- b. A player chooses one card from Deck A and replaces
 it. Then the next player chooses one card from
 Deck A. What is the probability that both players
 will choose a C2 card?
- c. A player chooses two cards at the same time from Deck B. What is the probability that the player will choose two C5 cards?
- d. A player chooses one card from Deck A and one card from Deck B. What is the probability of not choosing a C1 card from Deck A and the probability of not choosing a C7 card from Deck B?
- Deck A Take Lose Take an 2 а Extra Turn Tokens Turn 4 cards 5 cards 3 cards C1 C2 C3 Deck B Go Go Go Go Ahead Back Back Ahead 2 2 Spaces Space Spaces Space 5 cards 4 cards 3 cards 2 cards C4 C5 C6 C7
- e. A player chooses one card from Deck A and then, without replacing it, chooses another card from Deck A. What is the probability that the first card will be a C2 and the second card will not be a C2?
- 2. The board game includes both the spinner and the set of tokens shown in the figure.
 - a. A player spins the spinner once and then randomly chooses a token. What is the probability that the spinner will land on a 4 and the player will choose a cube token?
 - b. A player spins the spinner twice. What is the probability that the second spin will land on a 3?
 - c. A player chooses a token from the set, replaces it, and then chooses another token from the set. What is the probability that the first token chosen will be a cube and the second will be a disk?



- d. A player chooses two tokens from the set at the same time. What is the probability that both will be pyramids?
- e. A player spins the spinner once and then randomly chooses a token. What is the probability that the spinner will not land on a 3 and the player will choose a disk token?
- f. A player randomly chooses three tokens at once from the set. What is the probability that the first two tokens are cubes?

Stretch

- A batch of 100 calculators are manufactured in a day on a factory line. There are 5 calculators that are defective in the batch. On another line, a batch of 5000 computers are manufactured. There are 50 computers that are defective in the batch. On the third line, a batch of 1000 fitness watches are manufactured. There are 25 watches that are defective in the batch.
 - a. A quality control inspector randomly picks a calculator, a computer, and a fitness watch from the three batches. What is the probability all of them are defective?
 - b. A quality control inspector randomly picks 3 calculators from the batch without replacing any of them. What is the probability the first is defective and the second two are not defective?
 - c. A quality control inspector randomly picks 2 calculators, 1 computer, and 2 watches without replacing any of them. What is the probability none of the products are defective?
- 2. Tushar has a bag of candy that contains 4 lollipops, 8 chocolate bars, and 5 pieces of taffy.
 - a. If Tushar randomly picks a piece of candy, what is the probability it is a lollipop?
 - b. If Tushar randomly picks a piece of candy, what is the probability it is a chocolate bar?
 - c. If Tushar randomly picks a piece of candy, what is the probability it is a lollipop or a chocolate bar?
 - d. What is the mathematical relationship between the answers to parts (a), (b), and (c)?

Review

- 1. Suppose you roll a number cube once. The number cube is numbered 1 through 10.
 - a. Identify the sample space.
 - b. Determine the probability of rolling an odd number, *P*(odd).
 - c. Determine the probability of rolling a number that is not a multiple of 5, *P*(not a multiple of 5).
- 2. Determine whether $4x^2 + 4y^2 16x 24y + 16 = 0$ represents a circle. If so, describe the location of the center and radius.
- 3. Write an equation in standard form for a parabola with a vertex of (-2, 3) and a focus of (-2, 1). Then graph and label the parabola.
- 4. Write the equation for the function that results when the basic function $f(x) = x^2$ is translated up four units and is vertically stretched by a factor of 3.
- 5. Determine the solutions for $x^2 + 13x 20 = 0$.

3

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Compound Probability with Or

Warm Up
Determine the value of each
expression.
1. $\frac{1}{2} + \frac{1}{3} - \frac{1}{4}$

 $2.\,\frac{1}{6} + \frac{3}{4} - \frac{2}{5}$

 $3.\,\frac{2}{3} + \frac{1}{8} - \frac{1}{2}$

Or?

Learning Goals

- Determine the probability of one or another independent event.
- Determine the probability of one or another dependent event.

Key Term

Addition Rule for Probability

You have determined the probability of compound events related by the word *and*. How do the methods for determining the probability of compound events related by the word *or* compare?

Making Heads or Tails of It

Suppose you flip two coins. What is the probability of the first coin landing heads up or the second coin landing tails up?

- 1. Describe the events in this probability situation.
- 2. Complete the table to construct the sample space for this situation.

		Second Coin		
		Н	Т	
First Coin	Н			
	Т			

- a. Draw a circle around the outcomes that match the first event.
- b. Draw a rectangle around the outcomes that match the second event.
- 3. How can you describe the outcome that is circled and has a rectangle around it in the sample space?

4. Kirk and Damon described the probability of a heads up result for the first coin or a tails up result for the second coin.

KirK

I circled 2 outcomes and drew a rectangle around 2 outcomes, and there are 4 possible outcomes. So, the probability of flipping a heads on the first coin or a tails on the second is

 $\frac{2+2}{4} = \frac{4}{4} = 1.$

Damon

I marked 4 outcomes, and there are 4 possible outcomes. But I marked I of the outcomes twice. I can count each outcome only once. So, the probability of a heads up result for the first coin or a tails up result for the second coin is $\frac{3}{4}$.

Explain in your own words why Damon is correct and Kirk is incorrect.

ACTIVITY

3.1



In a compound event that is related by the word *or*, there can be possible outcomes that are in the sample space for each event. These outcomes should be counted only once when determining the compound probability.

- 1. Use the sample space and what you know about probability to answer each question.
 - a. What is the probability of a heads up result for flipping the first coin, *P*(*A*)?
 - b. What is the probability of a tails up result for flipping the second coin, *P*(*B*)?
 - c. What is the probability of a heads up result for the first coin flip AND a tails up result for the second coin flip, *P*(*A* and *B*)?
 - d. What is the probability of a heads up result for the first coin flip OR a tails up result for the second coin flip *P*(*A* or *B*)?
- 2. Create a formula you could use to relate the probability of each event by itself, *P*(*A*), *P*(*B*), and the probability of the first event OR the second event *P*(*A* or *B*). Explain why your formula works.

3.2

Calculating Compound Probabilities with *Or*



A new holiday—Probability Day—is going to be celebrated at your school. It may be celebrated on any of the first 3 days of any month. The problem now is to choose which day it will fall on. Of course, the day will be selected at random. First the month will be selected and then the day.

- 1. How many dates for Probability Day are in the sample space? Explain how you determined the answer.
- 2. Construct a model to represent the sample space for this situation.
- 3. Determine the probability that each day is randomly chosen. Explain your reasoning.
 - a. January 3rd

b. May 2nd

c. Any specific day and month

The summer months are June, July, and August. 4. Study the sample space. Let *P*(*A*) represent the probability of randomly choosing a summer month, and let *P*(*B*) represent the probability of randomly choosing the first day of the month.

a. Calculate P(A).

b. Calculate P(B).

c. Calculate *P*(*A* and *B*).

P(A or B) is also known as $P(A \cup B)$, where $A \cup B$ B represents a union of Events A and B. The union of Events Aand B is the set all of the outcomes where Event A or Event Boccurs.

- d. Calculate *P*(*A* or *B*). Use the organized list you created to explain your answer.
- 5. Use your answers from Question 4. Describe how you can calculate the probability of randomly choosing a summer month or the first day of a month without using a tree diagram or organized list.

The **Addition Rule for Probability** states: "The probability that Event *A* occurs or Event *B* occurs is the probability that Event *A* occurs plus the probability that Event *B* occurs minus the probability that both *A* and *B* occur."

P(A or B) = P(A) + P(B) - P(A and B)

6. What is the probability of randomly choosing a summer month or a winter month?

The winter months are December, January, and February.

7. Jereld says that because the summer month outcomes and the winter month outcomes are disjoint sets, the probability that one event or the other occurs is just the sum of the probabilities. It's not necessary to subtract the probability of both events. Is Jereld correct? Explain why or why not.

> Disjoint sets are sets with no outcomes in common.

Remember:

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Dependent Events with Or



You have seen that you can use the Addition Rule for Probability to determine the probability that one or another of two independent events occurs. Can you also use this rule to determine the probability of one or another of two dependent events occurring? Let's find out!

Suppose six cards are taken from a set of cards and that 3 of the cards have a yellow dot on the back, 1 of the cards has a purple dot on the back, and 2 of the cards have a blue dot on the back. You are asked to randomly select two cards, one at a time.

1. Does the action "choosing the first card" affect the action of "choosing the second card"? If so, how? Explain your reasoning.

2. Write an organized list to represent the sample space for this situation.

- 3. Use the sample space to determine the probability of randomly choosing a yellow card first or a blue card second.
 - a. Describe the events in this probability situation.

b. Draw a circle around the outcomes that match the first event and a rectangle around the outcomes that match the second event. How can you describe the outcomes that are circled and have a rectangle around them in the sample space?

c. What is the probability of randomly choosing a yellow card first, *P*(*A*)?

d. What is the probability of randomly choosing a blue card second, *P*(*B*)?

e. What is the probability of randomly choosing a yellow card first AND a blue card second, *P*(*A* and *B*)?

f. What is the probability of randomly choosing a yellow card first OR a blue card second, *P*(*A* or *B*)?



If only the second event is specified, you can consider it as an independent event and determine its probability without considering the first event. 4. Beth wrote an explanation for randomly choosing a blue card second. Explain why Beth's reasoning is incorrect.

Beth

Because the actions are dependent in this problem, the probability of choosing a blue card second is $\frac{2}{5}$. There are 5 cards left after the first pick, and 2 of the cards left are blue.

5. Pedro wrote an explanation for randomly choosing a yellow card first and a blue card second. Explain why Pedro's reasoning is incorrect.

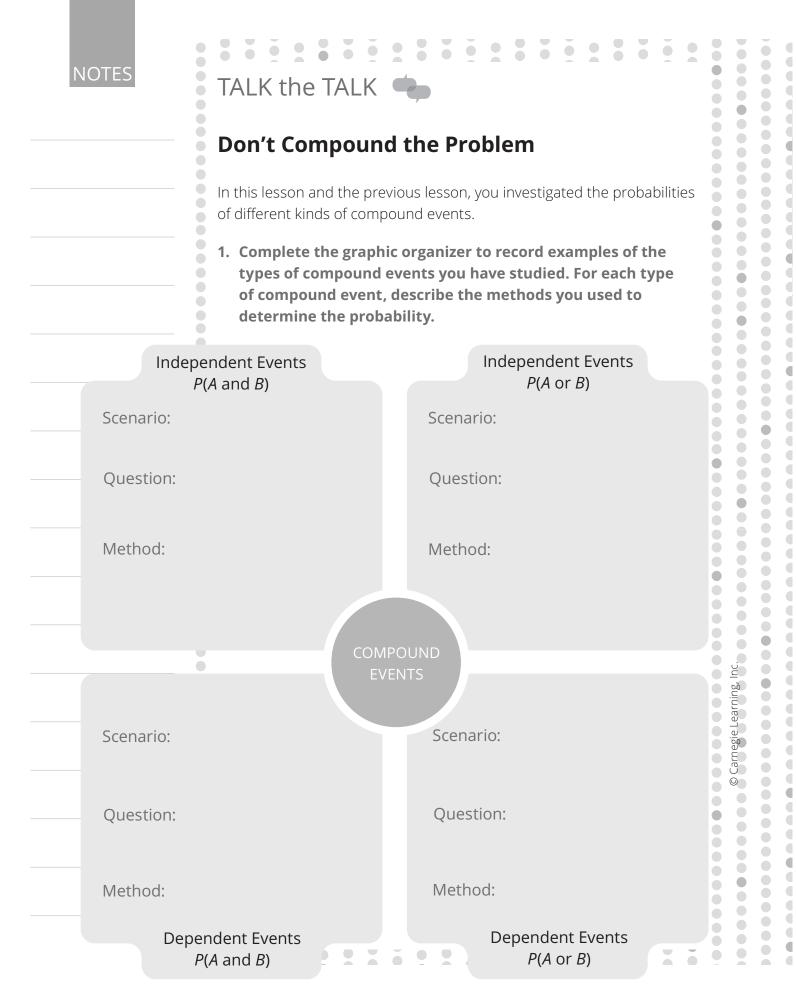
Pedro

In this problem, the probability of choosing a yellow card first is $\frac{1}{2}$, and the probability of choosing a blue card second is $\frac{1}{3}$. So, the probability of choosing both a yellow card first and a blue card second is $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$.

6. Calculate the probability of randomly choosing a yellow card first or a blue card second, *P*(*A* or *B*), using the Addition Rule. Compare this to your answer in Question 3, part (f). What do you notice?

7. Determine the probability of choosing a yellow card first or a yellow card second using the Addition Rule. Verify your answer using the sample space in Question 2.

8. Does the Addition Rule apply to independent events as well as dependent events? Explain your reasoning.



Assignment

Write

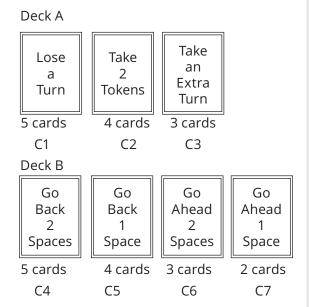
- 1. In symbols, what is the Addition Rule for Probability?
- 2. When should you use the Addition Rule for Probability?

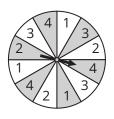
Practice

- 1. Two decks of cards are used for a game.
 - a. A player chooses one card from Deck A and one card from Deck B. What is the probability that the player will choose a C2 card from the first deck or a C6 card from the second deck?
 - b. A player chooses one card from Deck A and one card from Deck B. What is the probability that the player will choose a C3 card from the first deck or a C5 card from the second deck?
 - c. A player chooses two cards from Deck A. What is the probability that the player will choose a C1 card first or a C2 card second?
 - d. A player chooses two cards from Deck B. What is the probability that the player will choose a C5 card first or a C4 card second?
- 2. Consider the spinner and the set of tokens shown in the figure.
 - a. A player spins the spinner one time and then randomly chooses a token. What is the probability that the spinner will land on a 2 or the player will choose a pyramid?
 - b. A player spins the spinner two times. What is the probability that the spinner will land on a number greater than 1 the first time or on a number greater than 2 the second time?
 - c. A player spins the spinner one time and then randomly chooses a token. What is the probability that the spinner will not land on a 2 or the player will not choose a disk?
 - d. A player spins the spinner two times. What is the probability that the spinner will land on a 1 the first time or on a 4 the second time?
 - e. A player spins the spinner one time and then randomly chooses a token. What is the probability that the spinner will land on a 2 or the player will choose a cube?

Remember

If two compound events are combined by the word *or*, you can add the probabilities of each event occurring separately and subtract the probability of both events occurring.





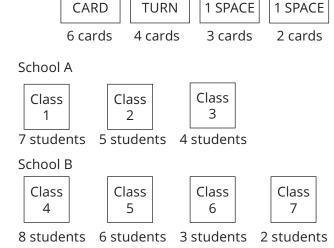


Stretch

- 1. Two decks of cards are used for a game.
 - a. A player chooses one card from Deck A and one card from Deck B. Write an organized list to represent the sample space in this situation.
 - b. Use the sample space to determine the probability that a Queen is selected from Deck A or a 10 is selected from Deck B.
 - c. Use the Addition Rule for Probability to determine the probability that a Queen is selected from Deck A or a 10 is selected from Deck B. Show your work.
- 2. A deck of cards contains only face cards. There are four kings, four queens, and four jacks.
 - a. A card is randomly selected. What is the probability the card is a queen?
 - b. Two cards are randomly selected. If the first card selected is a queen and the card is replaced in the deck, what is the probability the second card is a queen?
 - c. Two cards are randomly selected. If the first card selected is a queen and the card is not replaced in the deck, what is the probability the second card is a queen?
 - d. Two cards are randomly selected. If the first card selected is a queen and the card is replaced in the deck, what is the probability the second card is a king?
 - e. Two cards are randomly selected. If the first card selected is a queen and the card is not replaced in the deck, what is the probability the second card is a king?

Review

- A board game includes a spinner and a deck of cards. A player spins the spinner once and then randomly chooses a card. What is the probability that the spinner will land on a 3 and the player will choose a card that says, "Go Back 1 Space"?
- 2. A school district has two schools, School A and School B. The drawing shows the number of students in each class that had perfect attendance last year. The superintendent of the schools randomly chooses two students from School B. What is the probability that both students are from Class 6?



LOSE

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PICK

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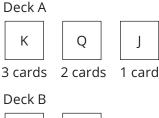
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GO

BACK

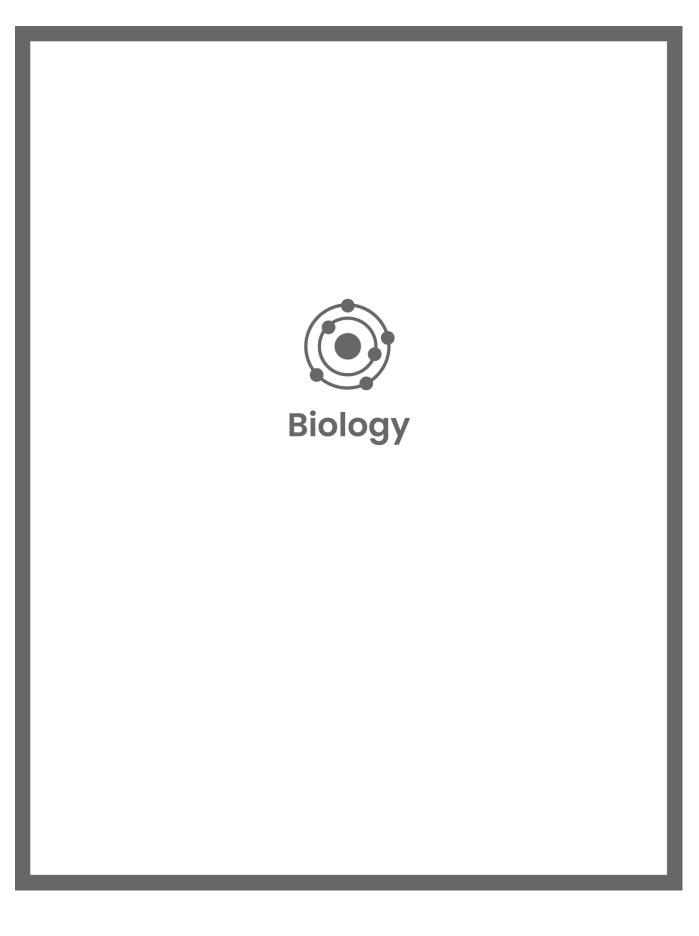
GO

AHEAD





- 3. Given sin $\theta = -\frac{5}{8}$ in Quadrant III, determine cos θ and tan θ .
- 4. Given the equation $x = 2(y + 1)^2 4$. Determine the value of *p*, the coordinates of the vertex and focus, and the equations for the axis of symmetry and directrix. Then graph the parabola and describe the concavity.
- 5. Determine the solution(s) for each equation.
 - a. $2w^2 + 7w + 6 = 0$
 - b. $x^2 8x 9 = 0$





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How bread works

By Marshall Brain, How Stuff Works, adapted by Newsela staff on 08.18.19 Word Count **646**





A woman kneads dough to make bread. Photo by: Karin Dreyer/Getty Images

You probably eat bread every day. You may even know how to make your own bread. But have you ever thought about bread as a technology?

Why do we have bread? That's a great place to start. We could just as easily munch on dry wheatkernels instead. Or we could grind the wheat into flour, mix the flour with water and eat it as a wet mush. Or we could pour the mush out on a table and dry the mush into thin brittle sheets. But we don't do that, mainly because bread tastes a lot better, and it also works a lot better for sandwiches. Bread is moist (not wet like mush or dry like dried mush), soft (unlike wheat kernels), spongy and delicious. Bread is a bio-chemical technology for turning wheat flour into something tasty!

In this article, we will examine the technology of bread in detail.

Bread Basics

If you pick up a slice of bread and examine it closely, you can see that it is full of air holes. This makes it spongy and soft. You will also see that bread is moist. If you let a slice of bread sit out on

the counter for a day, you will realize just how moist fresh bread is! Bakers use two simple facts of life to create soft, spongy, moist bread.

First, they use the fact that yeast (a single-cell fungi) will eat sugar, and from the sugar create alcohol and carbon dioxide gas as waste products. The carbon dioxide gas created by yeast is what gives bread its airy texture, and the alcohol, which burns off during baking, leaves behind an important component of bread's flavor.

Second, wheat flour, if mixed with water and kneaded, becomes very elastic. The flour-and-water mixture in bread becomes stretchy like a balloon because of a protein in wheat known as gluten. Gluten gives bread dough the ability to capture the carbon dioxide produced by yeast in tiny flour balloons.

Yeast cells do a really good job of creating carbon dioxide. A yeast cell can process approximately its own weight of glucose (sugar) per hour, and from the glucose (C6H12O6), yeast produces carbon dioxide (CO2) and ethanol (C2H5OH) — two molecules of each.

To make bread, you need flour. It turns out that, in the mixture of flour and yeast, there are enzymes that turn the starch in the flour into maltose, another sugar. The yeast uses this sugar in the same way it uses the glucose in white sugar. It takes time for the enzymes to convert starch to maltose. However, the yeast is able to produce some carbon dioxide, and that's how you know the enzymes are working. In a loaf of bread, it is this flour-to-maltose reaction that actually drives the expansion of the bread for the most part — the small amount of sugar you mix into the bread dough is used up by the yeast fairly quickly.

Yeast cells produce plenty of carbon dioxide. The reason why bread bakes up so airy is because the bread dough captures and holds the carbon dioxide that the yeast produces. It does this because flour contains a protein called gluten.

Bread's elasticity is caused by the gluten in the flour. This is because gluten forms thread-like chains. By stirring (or more commonly, kneading) the dough, the gluten develops into long, interlaced chains. Kneading is better for developing these chains because kneading is gentle — it does not cut the chains up. When you knead bread dough, you are creating gluten chains. If you were to skip the kneading part, your bread would not rise very well — all the carbon dioxide in the yeast would bubble up to the top and escape, rather than being captured inside the elastic dough.

Now, you understand a whole lot more about the technology of bread!

Quiz

1

- Which option BEST explains how yeast interacts with sugar?
 - (A) Yeast creates both taste and texture when bread bakes.
 - (B) Yeast is a fungi that eats sugar, letting off carbon dioxide and alcohol.
 - (C) Yeast creates carbon dioxide, which is captured by gluten strands in the dough.
 - (D) Yeast is able to consume its own weight in sugars in only an hour.
- 2 How does the author distinguish between stirring dough and kneading dough?
 - (A) by explaining how kneading and stirring are different processes
 - (B) by comparing bread that has been stirred to bread that has been kneaded
 - (C) by explaining why kneading dough is more effective than stirring it
 - (D) by comparing the science of kneading dough to stirring dough
- 3 Read the sentence from the section "Bread Basics."

If you were to skip the kneading part, your bread would not rise very well — all the carbon dioxide in the yeast would bubble up to the top and escape, rather than being captured inside the elastic dough.

The author uses the word "elastic" to mean:

- (A) stretchy
- (B) springy
- (C) hard
- (D) breakable
- 4 Read the following selection from the section "Bread Basics."

If you pick up a slice of bread and examine it closely, you can see that it is full of air holes. This makes it spongy and soft. You will also see that bread is moist.

Which of the following phrases from the selection provides context clues to the meaning of the word "spongy"?

- (A) slice
- (B) full
- (C) air holes
- (D) moist

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All about cellular respiration

By ThoughtCo., adapted by Newsela staff on 08.09.19 Word Count **666** Level **1130L**

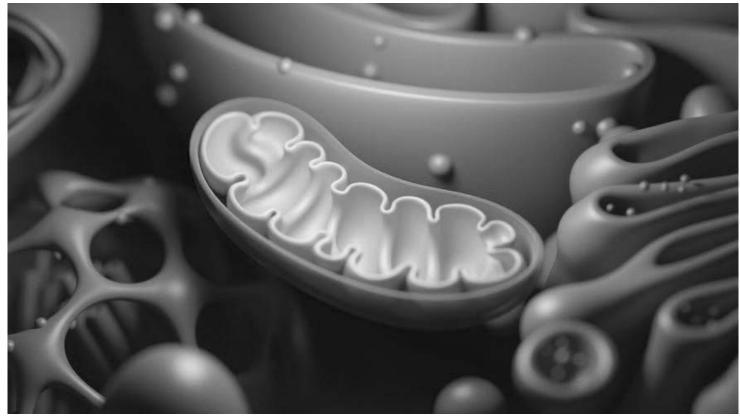


Image 1. This image shows a mitochondrion. In eukaryotic cells, most cellular respiration reactions occur in the mitochondria. Photo by: SciePro/Science Photo Library/Getty Images

We all need energy to function, and we get that energy from the foods we eat. Our cells extract those nutrients needed to keep us going and then convert them into usable energy. This complex yet efficient process is called cellular respiration. It converts the energy derived from sugars, carbohydrates, fats and proteins into adenosine triphosphate, or ATP. This is a high-energy molecule that drives important processes in your body, like muscle contraction and nerve impulses.

Cellular respiration occurs in both eukaryotic and prokaryotic cells. A eukaryotic cell has a nucleus that is surrounded by a membrane (these cells are found in eukaryotes, like animals and plants). Unlike a eukaryotic cell, the nucleus of a prokaryotic cell is not surrounded by a membrane (these cells are found in prokaryotes, like bacteria).

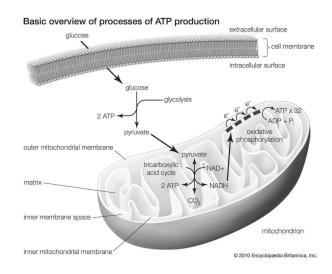
Most cellular respiration reactions take place in the mitochondria of eukaryotes, while the reactions take place in the cytoplasm of prokaryotes.

The three main stages of cellular respiration are glycolysis, the citric acid cycle and electron transport and oxidative phosphorylation.

Sugar Rush

The first stage of cellular respiration is glycolysis, which literally means "splitting sugars." Glycolysis is the 10-step process by which sugars are released for energy in organisms. It occurs when glucose, a simple sugar, and oxygen are supplied to the cells by the bloodstream. It takes place in the cell's cytoplasm, the material outside the nucleus.

Glycolysis can also happen without oxygen, a process called anaerobic respiration, or fermentation. When this happens, cells make small amounts of ATP as well as lactic acid, which can build up in muscle tissue and



cause soreness and a burning sensation for humans, especially after exercising.

Carbs, Proteins And Fats

The second stage of cellular respiration is known as the citric acid cycle, or the Krebs cycle. Before this stage occurs, glycolysis produces two molecules of a sugar. These molecules are converted into a slightly different compound, which is known as acetyl coenzyme A (acetyl CoA). Then, the citric acid cycle can begin.

The cycle allows us to use the energy found in carbohydrates, proteins and fats. Although the citric acid cycle does not use oxygen directly, it only works when oxygen is around. This cycle takes place in the mitochondria of the cell.

During the citric acid cycle, two ATP molecules are produced, along with two compounds that are known as NAD and FAD. The compounds are converted into other forms (NADH and FADH2) that help carry high-energy electrons to the next stage of cellular respiration.

Aboard The Electron Transport Train

The electron transport chain is part of the third and final stage of cellular respiration. The highenergy electrons that are produced in the citric acid cycle are used during this stage.

The electron transport chain is located in the mitochondrial membrane in eukaryotic cells. The chain is made up of molecules and large proteins. First, high-energy electrons get passed down the chain, moving from higher to lower energy levels. This process releases energy, which is then used to pump hydrogen ions across the mitochondrial membrane. The pumping of hydrogen ions creates an electrochemical gradient. This gradient is important, because the energy stored in the gradient is eventually used to make ATP.

Ultimately, ATP is produced by oxidative phosphorylation, a process by which enzymes (substances that speed up reactions) combine with oxygen. During this process, hydrogen ions flow down the gradient and get passed to an enzyme. This particular enzyme is called ATP synthase. It uses the energy produced by the electron transport chain for a process called

phosphorylation. This is when a phosphate group (which contains an atom of the element phosphorus) is added to a molecule. In this case, a phosphate group is added to a molecule to create ATP.

Most ATP production occurs during the electron transport chain and oxidative phosphorylation stage of cellular respiration.

1 Read the following paragraph from the section Carbs, Proteins And Fats."

The cycle allows us to use the energy found in carbohydrates, proteins and fats. Although the citric acid cycle does not use oxygen directly, it only works when oxygen is around. This cycle takes place in the mitochondria of the cell.

Which idea is BEST supported by this paragraph?

Quiz

2

3

- (A) The presence of oxygen can sometimes impede the citric acid cycle of cellular respiration.
- (B) Carbohydrates, proteins and fats do not contain oxygen molecules needed for the citric acid cycle.
- (C) The citric acid cycle will not occur unless oxygen is present within the mitochondria of the cell.
- (D) Oxygen is the main ingredient that the citric acid cycle converts and uses to make its final product.
- Is the author of the article suggesting that ATP is only generated in the third stage of cellular respiration? Which selection from the article BEST supports your answer?
 - (A) Yes; "When this happens, cells make small amounts of ATP as well as lactic acid, which can build up in muscle tissue and cause soreness and a burning sensation for humans, especially after exercising."
 - (B) No; "During the citric acid cycle, two ATP molecules are produced, along with two compounds that are known as NAD and FAD."
 - (C) No; "Ultimately, ATP is produced by oxidative phosphorylation, a process by which enzymes (substances that speed up reactions) combine with oxygen."
 - (D) Yes; "Most ATP production occurs during the electron transport chain and oxidative phosphorylation stage of cellular respiration."
- Read the following phrases from the section "Aboard The Electron Transport Train."
 - 1. passed down the chain
 - 2. releases energy
 - 3. pump hydrogen ions
 - 4. flow down the gradient

How do these words contribute to the tone of the section?

- (A) They convey a sense of how much more confusing the final stage of cellular respiration is over the other stages.
- (B) They convey a sense of how simple and straightforward the final stage of cellular respiration is.
- (C) They convey a sense of how much more important the final stage of cellular respiration is over the other stages.
- (D) They convey a sense of how complex and productive the final stage of cellular respiration is.

Read the following paragraph.

4

We all need energy to function, and we get that energy from the foods we eat. Our cells extract those nutrients needed to keep us going and then convert them into usable energy. This complex yet efficient process is called cellular respiration. It converts the energy derived from sugars, carbohydrates, fats and proteins into adenosine triphosphate, or ATP. This is a high-energy molecule that drives important processes in your body, like muscle contraction and nerve impulses.

Which phrase from the paragraph helps to explain what "derived" means?

- (A) energy to function
- (B) get that energy from
- (C) convert them into
- (D) drives important processes

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The way kids use energy pathways helps them keep going, going, going

By The Conversation, adapted by Newsela staff on 08.28.19 Word Count **894** Level **1040L**



Image 1. Children run on the playground at the Comprehensive Child Development center in Long Beach, California. A recent study set out to answer the question: Why can children run and play for hours on end, while adults get tired so quickly? Photo by: Scott Varley/Digital First Media/Torrance Daily Breeze via Getty Images

Most of us know children who can run and play for hours, taking only short rests.

As a parent or caregiver, it can be exhausting. For scientists, this behavior has long been the source of debate. Is it due to fitness, or something else?

Our recently published study looked at performance and recovery of children and adults doing strenuous, or physically demanding, cycling. The results show that children do not only out-perform most adults. They can also perform as well as highly trained adult endurance athletes. In addition, children recover even faster than the athletes afterward.

Experiments have shown children's muscles tend to fatigue more slowly than adults' muscles.

This seems to disagree with what science would predict. For example, children have shorter limbs, so they have to take more steps. Therefore, they should use more energy.

Children are also less able to use tendon energy return systems. Because they store less energy in their tendons, children can't reuse energy to propel themselves during movement.

Anaerobic Versus Aerobic Pathways

Less developed skills may require children to use more energy to complete many physical tasks. This effort results in greater activity in muscles that control movement.

So how do their muscles stay fresh?

One explanation for the remarkable muscle endurance of children could be their different use of energy pathways.

Anaerobic pathways produce large amounts of energy without the need for oxygen. These pathways tend to cause rapid fatigue. Sprinters rely on anaerobic metabolism to run fast for short distances. Metabolism is the process by which the body converts calories from food into energy.

Aerobic pathways tend to produce energy at a slower rate, using oxygen and calories. Aerobic pathways allow us to work for hours without muscle shutdown. Marathon runners rely on these pathways to run such long distances.

Research reveals that children seem to get more energy from aerobic pathways than adults do. This helps them avoid the fatigue of anaerobic pathways. Children's aerobic metabolism also kicks into gear faster when exercise first starts.

These benefits are partly due to children having more so-called "slow-twitch" muscle fibers. These "slow-twitch" fibers have a greater activity of important enzymes that drive release of energy from aerobic pathways.

Such findings led us to think that children's muscles might actually respond to exercise much like adult endurance athletes.

Putting Them To The (Bike) Test

We tested our ideas in a study with researchers at Université Clermont Auvergne, in France.

We compared the performance of children, young adults and endurance-trained athletes on cycling tests on a stationary bicycle.

The children's average age was 10 and a half years. The young adults' average age was just over 21 years. These two groups had similar physical activity levels. The endurance-trained athletes matched the age and height of the young adults.

In the first test, power output was continually increased until the riders were exhausted. In the second test, the riders completed a 30-second all-out sprint. These tests allowed us to measure the physical responses to exercise, and to assess the rate of fatigue and recovery during brief, maximal-intensity exercise.

We found that the children fatigued at the same level in the all-out cycling as the endurancetrained athletes. Both groups experienced about 40 percent loss of power, which was much less than the untrained adults. That group experienced a loss of about 50 percent. Data also show that the energy gained from aerobic pathways in the 30-second cycle sprint was similar in the children and athletes, and more than in the untrained adults.

These results show that fatigue rates in response to high-intensity exercise may be the same in children as in highly trained adult endurance athletes. The results are associated with an incredible generation of energy from aerobic energy pathways.

Kids Recover Quickly From Exercise

Data collected during recovery from the exercise also revealed startling outcomes. The rate at which oxygen use declined after exercise was the same in children and athletes. The rates at which heart rate returned to normal and lactate, a compound associated with muscle fatigue, cleared from the blood were even faster in the children.

These data show that children's muscles recover rapidly from high-intensity exercise. They may explain why children can continue to exercise when most adults feel exhausted.

The data also provide strong hints as to how to increase exercise and sports ability in children.

Children might benefit from short, high-intensity exercise to boost anaerobic capacity. Developing movement skill and muscle strength would also increase children's physical performance.

Adults and adolescents, on the other hand, may need to place greater emphasis on improving their muscle aerobic capacity.

The findings may also have important health implications. Metabolic disorders disrupt the process of metabolism. Examples include diabetes and many forms of cancer. Rates of these diseases are rising among adolescents and younger adults. However, these diseases are still rare in children. It might be the case that the loss of muscle aerobic capacity between childhood and early adulthood allows metabolic diseases to take hold.

It will be interesting to examine the link between muscle maturation and disease, and test whether maintaining childhood muscles through exercise might be the best medicine to prevent disease.

Either way, at least we now have some idea why children are able to play, and play, and play, when adults need to take a break. Kids are already elite.

Quiz

1

3

Which section from the article BEST explains why children are able to run and play for hours?

- (A) the Introduction [paragraphs 1-6]
- (B) "Anaerobic Versus Aerobic Pathways"
- (C) "Putting Them To the (Bike) Test"
- (D) "Kids Recover Quickly From Exercise"

2 Read the following selection from the section "Kids Recover Quickly From Exercise."

Data collected during recovery from the exercise also revealed startling outcomes. The rate at which oxygen use declined after exercise was the same in children and athletes. The rates at which heart rate returned to normal and lactate, a compound associated with muscle fatigue, cleared from the blood were even faster in the children.

These data show that children's muscles recover rapidly from high-intensity exercise. They may explain why children can continue to exercise when most adults feel exhausted.

What conclusion is BEST supported by the selection above?

- (A) The researchers conducting the cycling tests distrust the outcomes the tests.
- (B) The researchers still do not know if children and adult athletes have anything in common.
- (C) The researchers are now able to confidently explain why children can exercise longer than adults.
- (D) The researchers conducting the cycling tests were not expecting the outcomes they got from the tests.

What is the author's purpose for writing this article?

- (A) to make the argument that adults and children need more aerobic exercise
- (B) to help parents and caregivers better understand why children can run and play for hours and hours
- (C) to describe the findings and implications of a study that looked at the muscle endurance of children
- (D) to explain how scientists set up a study to examine how children get energy from aerobic pathways
- 4 Read the following claim.

Anaerobic exercise is the best type of exercise for children.

How would the author MOST likely respond to this claim?

- (A) Anaerobic exercise is absolutely the best type of exercise for children.
- (B) Anaerobic exercise is only good for children who plan to be marathon runners.
- (C) Anaerobic exercise is actually the worst type of exercise for children.
- (D) Anaerobic and aerobic exercise can be of benefit to children.

🔲 newsela

Why do apple slices turn brown after being cut?

By Scientific American, adapted by Newsela staff on 09.25.19 Word Count **527** Level **1020L**



Image 1. What causes the inside of a cut apple to turn brown? Photo: iStock / Getty Images Plus

Have you ever wondered why apple slices turn brown when they sit out too long? It's due to a chemical process called enzymatic browning.

Enzymatic browning is a series of chemical reactions caused by a combination of enzymes and oxygen. Enzymes are substances in the cells of living things that trigger chemical reactions. The cells of many fruits, including apples, contain an enzyme called polyphenol oxidase (PPO).

Oxidation Reactions

When an apple is cut or bruised, the fruit's cells are damaged. This exposes the PPO to oxygen in the air. This oxygen exposure triggers the PPO enzymes to oxidize chemical compounds in the fruit called phenols. When a substance is oxidized, it gains oxygen atoms, which changes its chemical makeup. The oxidized phenols are called o-quinones, which are another type of chemical compound. These compounds are colorless but they react with amino acids and proteins to produce a brown color on the fruit's surface.

You may also have noticed that some apples seem to brown faster than others. This is because the level of PPO activity can vary between varieties of fruits (say, between a Granny Smith apple and a Red Delicious apple). The concentration of phenols can differ as well. In addition, the PPO levels can vary depending on growing conditions and fruit maturity.

Enzymatic browning is a big problem in the food industry. People do not want to buy or eat brown fruit. However, it can be difficult to avoid damaging the fruit in transit and causing brown bruises to form. One approach the food industry takes to prevent enzymatic browning is to select fruit varieties that turn brown less easily. This may be due to lower PPO activity or lower phenol concentration in those varieties. This approach, however, may not be practical for the home cooks who want to stop their healthy snack from turning brown.

Preserving Apples At Home

There are other ways to prevent enzymatic browning at home. The key is to do something that will reduce PPO oxidation activity or lower the amount of substrate in the fruit. The substrate is the substance that the enzyme acts upon; in this case, it's the phenols. Coating freshly cut apples in sugar or syrup can reduce oxygen exposure and slow the browning reaction. Lemon and pineapple juices contain natural antioxidants. This means that coating apple slices in their juices can also slow enzymatic browning. In addition, both of these fruit juices are acidic, and their lower pH causes PPO to become less active. Heating can also cause PPO enzymes to go inactive. Apples can be boiled for four to five minutes to nearly stop PPO activity. However, keep in mind that cooking will affect the fruit's texture. You may decide you prefer a brown apple to a mushy one.

Enzymatic browning is not unique to apples. As a matter of fact, PPO can be found in nearly all plant tissues as well as in bacteria, animals and fungi. Neither is browning by PPO always an undesirable reaction. In fact, the familiar brown color of tea, coffee and cocoa comes from PPO enzymatic browning that occurs during the processing of these goods.

Quiz

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2

4

- According to the article, WHY does lemon reduce browning of cut apples?
 - (A) Lemon increases the pH of PPO, which makes apples brown slowly.
 - (B) Lemon reduces the pH of enzymes in apples that causes its browning.
 - (C) Adding lemon to an apple helps to reduce its oxygen exposure.
 - (D) Adding lemon to an apple makes it mushy, which prevents browning.
- How does the browning of apples affect the food industry?
 - (A) The food industry is only able to grow apples because most shipped apples turn brown while in route.
 - (B) The food industry selects specific types of apples that brown more slowly than other types of apples.
 - (C) The food industry only sells apples that have high quantities of phenols.
 - (D) The food industry throws away apples that have low quantities of PPO.
- 3 Read the following selection from the section "Oxidation Reactions."

The concentration of phenols can differ as well. In addition, the PPO levels can vary depending on growing conditions and fruit maturity.

Which two words would BEST replace "concentration" and "maturity" in the selection above?

- (A) mixture; origin
- (B) makeup; growth
- (C) amount; age
- (D) type; variety
- Read the following sentence from the section "Preserving Apples At Home."

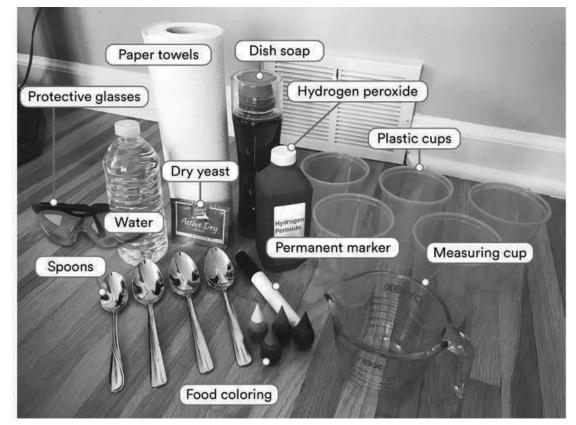
In fact, the familiar brown color of tea, coffee and cocoa comes from PPO enzymatic browning that occurs during the processing of these goods.

Which answer choice is the BEST definition of the word "processing" as used in the sentence?

- (A) understanding the meaning of something
- (B) using logic or a code to solve a problem
- (C) completing important paperwork related to something
- (D) manufacturing or production of an item

Exploring Enzymes

By Svenja Lohner, Science Buddies, Scientific American on 04.01.20 Word Count **849** Level **MAX**



Newsela staff

Have you ever wondered how all the food that you eat gets digested? It is not only the acid in your stomach that breaks down your food — many little molecules in your body, called enzymes, help with that, too. Enzymes are special types of proteins that speed up chemical reactions, such as the digestion of food in your stomach. In fact, there are thousands of different enzymes in your body that work around the clock to keep you healthy and active. In this science activity you will investigate one of these enzymes, called catalase, to find out how it helps to protect your body from damage.

Materials

Safety goggles or protective glasses

5 teaspoons of dish soap

One package of dry yeast (this will be your enzyme)

Hydrogen peroxide, 3 percent (at least 100 mL)

Three tablespoons

One teaspoon

Five 16-ounce disposable plastic cups

Tap water

Measuring cup

Permanent marker

Paper towel

Workspace that can get wet (and won't be damaged by any spilled hydrogen peroxide or foodcolored water)

Food coloring (optional)

Preparation

1. Take one cup and dissolve the dry yeast in about 1/2 cup of warm tap water. The water shouldn't be too hot but close to body temperature (37 degrees Celsius or 98.6 degrees Fahrenheit). Let the dissolved yeast rest for at least 5 minutes.

2. Use the permanent marker to label the remaining four cups from 1 to 4.

3. To all the labeled cups, add 1 teaspoon of dish soap.

4. To cup 1 no further additions are made at this point.

5. Before using the hydrogen peroxide, put on your safety goggles to protect your eyes. If you spill hydrogen peroxide, clean it up with a wet paper towel. If you get it on your skin, make sure to rinse the affected area with plenty of water.

6. To cup 2, add 1 tablespoon of 3 percent hydrogen peroxide solution. Use a fresh spoon for the hydrogen peroxide.

7. To cup 3, add 2 tablespoons of the hydrogen peroxide.

8. To cup 4, add 3 tablespoons of the hydrogen peroxide.

Optionally, you can add a drop of food color to each of the labeled cups. (You can choose a different color for each one for easy identification.)

Procedure

1. Take cup number 1 and place it in front of you on the work area. With a fresh tablespoon, add 1 tablespoon of the dissolved yeast solution to the cup and swirl it slightly. What happens after you add the yeast? Do you see a reaction happening?

2. Place cup number 2 in front of you and again add 1 tablespoon of yeast solution to the cup. Once you add the enzyme, does the catalase react with the hydrogen peroxide? Can you see the reaction products being formed?

3. Add 1 tablespoon of yeast solution to cup number 3. Do you see the same reaction taking place? Is the result different or the same compared to cup number 2?

4. Finally, add 1 tablespoon of yeast solution to cup number 4. Do you see more or fewer reaction products compared to your previous results? Can you explain the difference?

5. Place all four cups next to each other in front of you and observe your results. Did the enzymatic reaction take place in all of the cups or was there an exception? How do the results in each cup look different? Why do you think this is the case?

6. Now, take cup number 1 and add 1 additional tablespoon of 3 percent hydrogen peroxide to the cup. Swirl the cup slightly to mix the solution. What happens now? Looking at all your results, what do you think is the limiting factor for the catalase reaction in your cups?

Extra: Repeat this activity, but this time do not add dish soap to all of the reactions. What is different once you remove the dish soap? Do you still see foam formation?

Observations and results

You probably saw lots of bubbles and foam in this activity. What made the foam appear? When the enzyme catalase comes into contact with its substrate, hydrogen peroxide, it starts breaking it down into water and oxygen. A substrate is a molecule that the enzyme binds to temporarily. Then, the substrate goes through another chemical reaction to create a product.

Oxygen is a gas and therefore wants to escape the liquid. However, the dish soap that you added to all your solutions is able to trap the gas bubbles, which results in the formation of a stable foam. As long as there is enzyme and hydrogen peroxide present in the solution, the reaction continues and foam is produced. Once one of both compounds is depleted, the product formation stops. If you do not add dish soap to the reaction, you will see bubbles generated but no stable foam formation.

Cleanup

Pour all the solutions into the sink and clean all the spoons with warm water and dish soap. Wipe your work area with a wet paper towel and wash your hands with water and soap.

Quiz



Extremophiles have extraordinary uses in medical, engineering fields

By How Stuff Works, adapted by Newsela staff on 10.20.19 Word Count **456** Level **1130L**



Microbiologist Tom Brock in Yellowstone Park in the United States. Brock discovered the bacterium Thermus aquaticus (TaqI). The bacterium is found in hot springs, and so is a good source of heat-stable DNA polymerase. Photo by: Peter Menzel/Science Source

In the 1960s, biologist Dr. Thomas Brock was investigating bacteria in Yellowstone National Park's hot springs. He was surprised to discover that the bacteria were thriving despite extraordinarily high temperatures. The organisms, called Thermus aquaticus (T. aquaticus), lived in water that was nearly 212 degrees Fahrenheit — practically boiling.

Few organisms can survive in conditions of extreme temperature, pH and radiation, and those that can survive in these conditions are known as extremophiles. These species have proved to be valuable to scientists. In fact, T. aquaticus provided the basis for two groundbreaking discoveries in biology. It was the first archaea, which are a group of single-celled organisms. They are similar to bacteria in size and structure, yet different than bacteria in their molecular composition.

Multiple Scientific Applications

T. aquaticus also produces an enzyme known as TAQ polymerase, which scientists use in polymerase chain reactions (PCRs). This is a method that allows scientists to replicate a piece of

DNA billions of times over a span of a few hours. Without the process, nearly all work requiring DNA replication, from forensic science to genetic testing, wouldn't be possible.

Other extremophiles have proved useful to medical research. Scientists have examined at least one extremophile that produces a protein similar to one found in humans. This protein appears to play a role in various conditions, including arthritis, which is an inflammation of the joints. It also plays a role in autoimmune diseases, which are diseases that arise when the body's immune system mistakenly attacks healthy cells.

Another type of extremophile that has proved useful is the alkaliphile, which is a microbe that can survive in high pH environments. Enzymes from alkaliphiles are used for making laundry and dishwashing detergents. They are also used for removing hair from animal hides. Another alkaliphile from Yellowstone is used in making paper and treating waste. This extremophile produces a protein that breaks down hydrogen peroxide, which is a chemical compound that can be toxic.

Understanding How Extremophiles Work

NASA is studying one extremophile, Deinococcus radiodurans (D. radiodurans), which is extremely resistant to radiation. This microbe can withstand doses of radiation 500 percent higher than radiation that is lethal to humans. Interestingly, the radiation still breaks the microbe's DNA into pieces; however, in many cases, the DNA can reassemble and work normally again. D. radiodurans accomplishes this by shedding broken parts of DNA and using a special enzyme to attach good DNA to other still-healthy pieces of DNA. Then, it creates the necessary pieces to bond to these newly formed long DNA strands.

Understanding how D. radiodurans works could allow scientists to bring dead cells back to life. For NASA, harnessing this DNA resistance could offer clues for building better spacesuits or spacecraft. Quiz

1

According to the article, some extremophiles can help to create products that people use on a daily basis.

Which paragraph BEST supports the idea outlined above?

- (A) Other extremophiles have proved useful to medical research. Scientists have examined at least one extremophile that produces a protein similar to one found in humans. This protein appears to play a role in various conditions, including arthritis, which is an inflammation of the joints. It also plays a role in autoimmune diseases, which are diseases that arise when the body's immune system mistakenly attacks healthy cells.
- (B) Another type of extremophile that has proved useful is the alkaliphile, which is a microbe that can survive in high pH environments. Enzymes from alkaliphiles are used for making laundry and dishwashing detergents. They are also used for removing hair from animal hides. Another alkaliphile from Yellowstone is used in making paper and treating waste. This extremophile produces a protein that breaks down hydrogen peroxide, which is a chemical compound that can be toxic.
- (C) NASA is studying one extremophile, Deinococcus radiodurans (D. radiodurans), which is extremely resistant to radiation. This microbe can withstand doses of radiation 500 percent higher than radiation that is lethal to humans. Interestingly, the radiation still breaks the microbe's DNA into pieces; however, in many cases, the DNA can reassemble and work normally again. D. radiodurans accomplishes this by shedding broken parts of DNA and using a special enzyme to attach good DNA to other still-healthy pieces of DNA. Then, it creates the necessary pieces to bond to these newly formed long DNA strands.
- (D) Understanding how D. radiodurans works could allow scientists to bring dead cells back to life. For NASA, harnessing this DNA resistance could offer clues for building better spacesuits or spacecraft.
- 2 Read the list of sentences from the article.
 - 1. In the 1960s, biologist Dr. Thomas Brock was investigating bacteria in Yellowstone National Park's hot springs.
 - 2. It was the first archaea, which are a group of single-celled organisms.
 - 3. Without the process, nearly all work requiring DNA replication, from forensic science to genetic testing, wouldn't be possible.
 - 4. This extremophile produces a protein that breaks down hydrogen peroxide, which is a chemical compound that can be toxic.

Which two sentences taken together provide the BEST evidence to support the idea that Dr. Thomas Brock's discovery of T. aquaticus was groundbreaking?

- (A) 1 and 2
- (B) 1 and 4
- (C) 2 and 3
- (D) 3 and 4

3

Which of the following answer choices would BEST describe NASA's reaction to D. radiodurans?

- (A) NASA views it as an impractical approach to the problem of how DNA is destroyed in outer space.
- (B) NASA views it as an interesting microbe that could teach astronauts about bringing dead cells to life.
- (C) NASA views it as a potentially harmful microbe that could cause radiation problems for astronauts.
- (D) NASA views it as a useful microbe that could help to improve spacesuits or spacecraft.

- Which characterization accurately describes BOTH T. aquaticus and some alkaliphiles ?
 - (A) They are very resistant to heat and can live in nearly boiling temperatures.
 - (B) They produce enzymes that are valuable to scientists in certain fields.
 - (C) They are able to survive in high pH environments and have important industrial uses.
 - (D) They help scientists make important advances in forensic science and genetic testing.

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Scientists grow heart tissue using spinach veins

By Washington Post, adapted by Newsela staff on 09.09.19 Word Count **801** Level **1120L**



A spinach leaf was transformed into beating human heart tissue by scientists at Worcester Polytechnic Institute in Massachusetts. Photo by: Worcester Polytechnic Institute

Spinach was an overhyped vegetable long before marketers started using the term "superfood" to sell shoppers on the year's trendiest fruits and veggies. Despite what Popeye might say, spinach alone won't pump anyone up. However, the leafy green does have a few physical properties that excite biomedical engineers. Spinach grows a network of veins, for instance, that thread through its leaves in a way similar to blood vessels through a human heart.

These leafy veins allowed researchers at Massachusetts' Worcester Polytechnic Institute (WPI) to give new meaning to the phrase "heart-healthy spinach." The tissue engineers stripped green spinach leaves of their cells. The spinach turned translucent. The scientists then seeded the gaps that the plant cells left behind with human heart tissue. Heart cells, in clusters, beat for up to three weeks in this unusual environment. The scientists reported their findings in the science journal Biomaterials.

The inspiration for the human-plant blend came over lunch -- and, yes, the leafy greens were involved. WPI bioengineers Glenn Gaudette and Joshua Gershlak were brainstorming new ways to tackle a deadly medical problem, the lack of donor organs. There are more than 100,000 people on the organ donor list. Nearly two dozen people die each day while waiting for an organ transplant.

How To Create Organs

To meet the demand, scientists have tried to create organs in a lab through innovations such as 3D-printing tissue. So far, however, no one has been able to print a perfect heart.

"One of the big problems in engineering heart muscle is getting blood flow to all of the cells," said Gaudette, who is a professor of biomedical engineering at WPI. "Heart muscle is pretty thick." Current technology cannot construct tissue dense enough to replace a damaged heart while also allowing for the tiny blood vessels needed to deliver life-giving oxygen.

Rather than creating tiny blood vessels, the scientists decided to borrow from what nature already evolved. First, they removed the cells from spinach leaves purchased at a local market. "We use detergent -- soaps -- which strips away the cellular material of tissues," said Gershlak, a WPI graduate student in Gaudette's lab. "This leaves behind the protein matrix and structure." The soap punctured plant cell membranes and washed the deflated cells away. The overall effect was not unlike turning over a garden before planting new crops.

Creating Cardiac Muscle Cells?

Left behind was cellulose, a plant material known to be compatible with mammal tissue, as well as the whole leaf veins. The scientists seeded the now-empty cellulose matrix with cardiac muscle cells. After five days, the muscle cells began to beat.

It was not quite as if researchers grew an entire slab of quivering muscle from spinach. Although the scientists watched red liquid course through the spinach veins, this was dye, not blood. Still, witnessing individual human cells contracting on a spinach leaf, via microscope, was exciting enough for Gaudette to whip out his cellphone and begin recording.

"It was definitely a double-take," Gershlak said of the moment he discovered the beating muscle cells. "All of a sudden you see cells moving."

This was not the only instance in which researchers cultivated human tissue on a plant scaffold. Recently, a team of Ottawa scientists stripped an apple of its plant cells, carved a fruit slice to look like a human ear and filled its extracellular matrix with cervical tissue.

Flowing Through Plant Veins

But Gershlak, Gaudette and their co-workers were the first, they said, to use the technique in an attempt to repurpose plant veins. They poured tiny spheres through the spinach leaves. Beads 10 microns in diameter, a size on par with red blood cells, successfully flowed through the vein network.

These early experiments served as proof-of-concept work. However, Gaudette said the study could be the foundation for stitching the veins of spinach leaves to human blood vessels. "Long term, we're definitely envisioning implanting a graft in damaged heart tissue," he said.

The researchers first need to make sure that the plant scaffold would not be rejected, once inside a host. They also plan to make their heart-spinach hybrids stronger. "If we stack decellularized leaves, can we create a large thickness," Gaudette wondered, "more along the thickness of a human heart wall?"

Huge Variety Of Plants To Work With

One advantage of working with plants was the huge variety of options at the scientists' disposal. In the new report, the biomedical engineers also successfully stripped plant cells from parsley, peanut hairy roots, and a species of wormwood. The biomedical engineers imagined that a piece of broccoli or cauliflower, once stripped of its cells, could be a foundation for growing lung tissue. Researchers in Wisconsin are working with the WPI lab. They recently strolled through their campus arboretum, plucking unique leaves to test.

Quiz

1

2

- The central idea of the article is developed by which of the following?
 - (A) explaining the reason for the experiment with the spinach leaves, then describing the steps of the experiment and finally describing the experiment's results and what they might mean for the future
 - (B) providing a brief overview of the history of spinach, then describing some physical properties of spinach and finally explaining where scientists purchased spinach for use in a human-plant experiment
 - (C) describing the goal scientists hoped to achieve by experimenting with spinach leaves, then explaining where scientists got their spinach leaves and finally explaining where scientists reported their findings
 - (D) comparing spinach leaves to human heart blood vessels, then explaining why spinach leaves are easier to use in experiments and finally describing the experiment scientists did with spinach leaves
- Which of these statements would be MOST important to include in an objective summary of the article?
 - (A) The amazing outcome of the spinach leaf experiment is that heart cells were able to beat for up to three weeks in the leaves.
 - (B) The most extraordinary part of the spinach leaf experiment was inserting heart cells into the spinach leaves.
 - (C) Scientist Gaudette was very excited when he saw through a microscope that the inserted heart cells were beating in the spinach leaves.
 - (D) Scientist Gaudette has ambitious plans for making heart-spinach hybrids strong enough to use in human bodies.
- 3 Read the following selection from the introduction [paragraphs 1-3].

Spinach grows a network of veins, for instance, that thread through its leaves in a way similar to blood vessels through a human heart.

The author uses the word "network" to mean which of the following?

- (A) a station
- (B) a group
- (C) a meeting
- (D) an interaction

In the new report, the biomedical engineers also successfully stripped plant cells from parsley, peanut hairy roots, and a species of wormwood. The biomedical engineers imagined that a piece of broccoli or cauliflower, once stripped of its cells, could be a foundation for growing lung tissue. Researchers in Wisconsin are working with the WPI lab. They recently strolled through their campus arboretum, plucking unique leaves to test.

What does the author convey by referring to other studies?

4

- (A) The author strengthens their argument by noting how food is being used for other medical research purposes.
- (B) The author weakens their argument by suggesting that spinach may not be the best food to use in medical experiments.
- (C) The author recommends more studies for the reader to research to gain knowledge about how food is helping the medial field.
- (D) The author contradicts themselves by suggesting other foods are having a greater effect on medical experiments.

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Why do you have two lungs but only one heart?

By Josh Clark, How Stuff Works on 09.11.19 Word Count **1,168** Level **MAX**

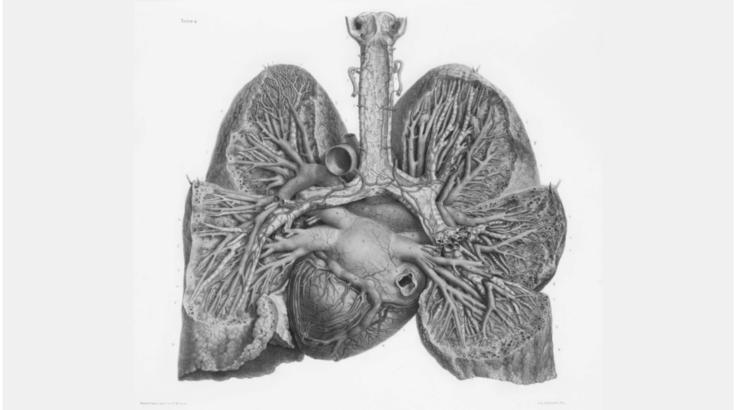


Image 1. This illustration by Nicolas-Henri Jacob from the 19th century shows the lungs on either side of the heart. Image from: SPL/Science Source

Your body is pretty amazing. At any given point you have a great many biological processes going on, such as digestion, respiration, metabolism, and fighting off invading bacteria. Different regions and systems within your body work together to create a state of balance -- just the right amount of blood sugar here, just enough electrolytes there -- to keep you working at peak performance.

But have you ever asked yourself how your body got to be the way it is? Why do you have two of some organs and just one of others? Take the heart and lungs, for instance -- why do you have two lungs but just one heart? Wouldn't it be better to have two hearts?

Your vital organs -- like your lungs, your heart, your pancreas, brain and liver -- are just that, vital. Not only are they vital to life, they are also vital to one another. Your lungs, for example, breathe in oxygen and exhale carbon dioxide (one of your body's waste products). The lungs transfer oxygen to the blood, which is carried to the heart for distribution throughout the rest of the body. The blood carries waste carbon dioxide back to the lungs, where it is absorbed and exhaled. It's a beautiful system. But how did it come about? It's a very ancient system, says Rutgers University anthropologist Susan Cachel -- and it's not unique to humans. The organ systems we find in most animals contain one heart and two lungs. That is, with the exception of earthworms and cephalopods -- the invertebrate class that includes octopi and squid. Earthworms have five heart-like structures. Cephalopods have three hearts (two to send blood to the gills, and one to send blood to the rest of the body) and no lungs.



Cachel says that the one heart/two lungs system began to emerge about 300 million years ago, when animals first moved from sea to land to escape predators and find new sources of food. From that point on, it's been the norm. But why didn't it continue to change?

In this case, Occam's razor provides the key -- the simplest explanation is usually the right one. Ultimately most animals developed a system of two lungs and one heart (along with the rest of their organs) because that's what was needed to survive and thrive on Earth. People didn't develop two hearts or eight legs or wings because we didn't need them for survival. And we developed two lungs because we need them.

Phylogeny is the study of how the first ribonucleic acid (RNA) strands in Earth's primordial soup developed into humans and other animals. As these animals evolved into such divergent species as birds, insects and humans, the organ systems in those animals remained similar to one another. We still have stomachs to digest food, lungs to breathe air, and kidneys to filter waste. All of this indicates that species -- including humans -- have been shaped and molded specifically to live on Earth.

So does this mean that our system of internal organs is perfect? We know through our study of disease that going from two lungs to one is detrimental to our health, but what about adding an extra heart? Wouldn't that make us better able to survive? Read on to find out about what it would be like to have two hearts.

Life With Two Hearts

You might imagine that having two of some organs is redundant. We have two lungs, two kidneys, two eyes -- each doing the same job at the same time. But Dr. Tony Neff, a professor of anatomy and cell biology at Indiana University-Bloomington, warns against downplaying the role of duplicate organs. It takes both organs in those sets to carry out their job fully; Although one can function alone, the process it carries out will not be done at full capacity, and the rest of the body suffers. For example, you can see with only one eye, but the eyes' function of providing depth perception will suffer and you'll bump into things much more frequently seeing with one eye than you would with two.

So if you need both lungs to function at full capacity, what would happen if you had an extra heart? Would the performance of the processes it carries out double?

Not at first, says physiologist Bruce Martin, a colleague of Dr. Neff's at Indiana University. Your body is a system, and it's built so that the system is always functioning at its full capacity. When

the system is attacked -- for example, through starvation -- all parts of the system suffer at the same rate. Conversely, when one part breaks down, the whole system suffers. If your lungs become irreparably damaged -- say, through emphysema -- the rest of the system will slow down to accommodate the broken part.

So since your system is already functioning at full bore, the addition of an extra heart wouldn't do much. But your system also possesses potential function, as seen in the muscles, when they're called upon to act beyond their normal capacity, like in the case of hysterical strength. We can train our bodies to function at higher levels, the way athletes do. Since the heart pumps blood to the muscles, with a second heart your muscles would eventually grow stronger with time. Once the rest of the system is used to having a second heart, a person could grow stronger and have more endurance.

But the same can't be said for your brain. The brain is already getting more than enough blood to it, so it wouldn't function at a higher level, theorizes Dr. Martin.

Interestingly, when we are in the embryonic stage of development, we actually do have two hearts. The heart primordia (which describes the stage of the heart's development) in the embryonic stage is actually two hearts, which eventually fuse together into one heart with four chambers. Embryologists in the 1920s and '30s kept the heart primordia from fusing in embryonic frogs, and the frogs that grew up developed two hearts. The same also goes for our eyes. We begin with one primordia of the eye, which eventually separates to form two. If the primordia is kept from splitting, one central eye develops, like a cyclops, says Dr. Neff.

So it's theoretically possible for us to develop two hearts. And if we could determine how to use both fully, we could also advance ourselves into a species of super-strong, intellectually average beings. But wouldn't tampering with our own evolution as a species be dangerous?

"We've already taken ourselves out of evolution," says Rutgers' Susan Cachel. "(Humans are) all effectively tropical animals, and through our use of technology, like winter clothes, we've shielded ourselves from the effects of cold weather."

So we've beaten natural selection by the elements. We'll see what we can achieve with two hearts.

Quiz

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- Which of the following MOST influenced the development of the one heart/two lungs system in animals?
 - (A) the need for a new organ system that would allow animals to use carbon dioxide in the body
 - (B) the need for a new organ system that would allow animals to use oxygen in the body
 - (C) the need for a new organ system for animals that were transitioning to living on land
 - (D) the need for a new organ system for animals that were transitioning to living in the sea

How do the lungs affect the heart in most animals?

- (A) The lungs breathe in carbon dioxide and help carry it through the blood to the heart, which then distributes the blood to the rest of the body.
- (B) The lungs breathe in oxygen and help carry it through the blood to the heart, which then distributes the blood to the rest of the body.
- (C) The lungs breathe in carbon dioxide and help carry it through the blood to the heart, which then gives carbon dioxide back to the lungs.
- (D) The lungs breathe in oxygen and help carry it through the blood to the heart, which then gives oxygen back to the lungs.
- 3 Read the following paragraph from the section "Life With Two Hearts."

Not at first, says physiologist Bruce Martin, a colleague of Dr. Neff's at Indiana University. Your body is a system, and it's built so that the system is always functioning at its full capacity. When the system is attacked -- for example, through starvation -- all parts of the system suffer at the same rate. Conversely, when one part breaks down, the whole system suffers. If your lungs become irreparably damaged -- say, through emphysema -- the rest of the system will slow down to accommodate the broken part.

Which word from the paragraph helps the reader to understand that other organs must adjust when one organ fails?

- (A) capacity
- (B) conversely
- (C) irreparably
- (D) accommodate

Read the following selection from the introduction [paragraphs 1-8].

Phylogeny is the study of how the first ribonucleic acid (RNA) strands in Earth's primordial soup developed into humans and other animals. As these animals evolved into such divergent species as birds, insects and humans, the organ systems in those animals remained similar to one another.

Why did the author use the word "divergent"?

- (A) to convey a sense of how different all of the animals have become through evolution
- (B) to convey a sense of how similar all of the animals have become through evolution
- (C) to convey a sense of how long ago animals began the process of evolution
- (D) to convey a sense of how recently animals began the process of evolution

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What animal has the weirdest heart?

By Atlas Obscura, adapted by Newsela staff on 02.23.20 Word Count **1,051**

Level 1040L



Image 1. A glass frog, with its organs - including its small red heart - clearly visible. Photo: Geoff Gallice/Flickr

The human heart is a wonder — it keeps us alive, and it is literally electric. Does the human heart have the power to regenerate itself, though? Does it pump exclusively clear blood? Can it freeze and then come back to life? Some animal species' hearts can do these things and more.

We searched the animal kingdom for cardiac marvels, from the depths of the ocean to the top of the Himalayas. Here are some of the strangest we found.

Earthworm

Depending on how you define your terms, earthworms either have five hearts or no heart at all. They lack the chambered, muscular organ that normally comes to mind when you think of a heart. However, they do have five special blood vessels that contract to pump blood. If you look really closely at a specimen, you can see the vessels squeezing and releasing.

Cockroach

A human heart has four chambers, each with a specific job, so if any of them fail, it's bad news. A cockroach heart, on the other hand, has 12 to 13 chambers, all powered by a separate set of

508

muscles. This means that if any one chamber fails, the cockroach is barely affected.

Marmalade Hoverfly

Marmalade hoverflies like to linger in the air over flowers, harvesting as much pollen as possible in one trip. To do this, they have evolved what is essentially a one-track heart. It spends almost all of its time and energy pumping blood forward into the head and thorax, where the wing muscles and mouthparts are.

Zebrafish

The zebrafish looks like your average pet store minnow, but inside of it beats an incredible heart. In 2002, scientists did an experiment. They found that if you cut out part of the zebrafish's lower ventricle, the fish will regenerate, or regrow, all of that lost tissue within a couple of months. This happens because of specialized muscle cells that promote their own growth and the production of new veins.

Ocellated Icefish

Ocellated icefish live about a mile (kilometer) down in the Southern Ocean, which is next to Antarctica. Their blood lacks hemoglobin, the red protein that normally binds to oxygen. Instead, due to the low temperatures, oxygen is dissolved directly into their plasma. Because of this, they have clear blood.



Blue-Throated Hummingbird

You have probably heard that hummingbirds flap their wings 15 times a second. The wings move so fast that the human eye just sees a blur. Enabling that wing speed is an even faster heart, which in the blue-throated hummingbird has been measured beating up to 21 times a second. That powerful heart helps the hummingbird to quickly bring oxygen to its muscles.

Emperor Penguin

Emperor penguins are famous for the softness of their hearts. Penguin couples spend most of each year tending to each other, their eggs and their chicks. Less well-known, but equally important, is the slowness of their hearts. While diving, emperor penguins can dial back their heart rate to about 15 beats per minute. This shuts off blood supply to all but the most important organs.

Wood Frog

Plenty of animals, from bears to groundhogs, slow their hearts when hibernating. As far as we know, though, only wood frogs can stop the beat completely. During the winter, these frogs essentially become frogsicles. Thanks to special substances in their cells, they can halt the metabolic activity, the chemical reactions that that provide the body with energy. Stopping this activity allows most of their body water to solidify. Their hearts take it in stride, stopping when the world freezes and starting again when it thaws out.

Glass Frog

All frogs have three-chambered hearts, with two atria that receive blood from the body, and one ventricle that sends blood back out again. Glass frogs are unique in that you can actually see this happening. Their see-through abdominal skin provides a great view of the heart at work, as well as the blood vessels snaking through its other organs.

Python

If a human heart is filled with fat, there is cause for concern. If a python heart is filled with fat, in comparison, things are going great for that python. After one of its famously giant meals, a python's heart increases in size by about 40 percent. It swells up with the fatty acids it absorbs from the meal. This helps to speed up digestion, though it still takes days.

Blue Whale

The heart of the blue whale is often said to be as big as a car, and that a human could crawl through its aorta. The aorta is the large artery that carries blood away from the heart. In truth, the blue whale's heart and aorta are not that big, though they are pretty big. Scientists say the blue whale heart is closer in size to a small golf cart or a big bumper car. Meanwhile, the aorta could barely fit a human head, according to scientist Jacqueline Miller. She shared this information with British TV in 2015, after dissecting a blue whale heart.



Giraffe

You know those carnival games where you hit a lever and, if you are good, the target shoots 6 feet up into the air? A giraffe's heart has to do something similar every day, fighting the pressure of gravity to get blood up to the head. The animal manages this by having extra-thick, extra strong cardiac walls. The blood vessels get thicker as the giraffe's neck gets longer so that they don't collapse under the increasing weight.

Cheetah

A cheetah's resting heart rate is around 120 beats per minute (BPM), about the same as a jogging human's. The human heart rate tops out around 220 BPM, and it takes a little while to get there. The cheetah's heart, however, can skyrocket to 250 BPM in just a few seconds. This ramp-up is so intense that it limits the cheetah's sprinting time to about 20 seconds. If she ran any longer than that, her organs would become so hot they would be permanently damaged.

Quiz

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- According to the article, why do MOST of these animals develop specialized hearts?
 - (A) to allow them to digest their food quickly and efficiently
 - (B) to allow them to speed up or slow down the rate of their heart
 - (C) to allow them to survive cold environments without hemoglobin
 - (D) to allow them to support extremely large and heavy bodies
- 2 Why did scientists cut out part of the zebrafish's lower ventricle?
 - (A) They wanted to see if the fish could regenerate the lost tissue.
 - (B) They wanted to see if the fish could survive without that part.
 - (C) They wanted to try to transplant it to another zebrafish.
 - (D) They wanted to try to give it clear blood like the ocellated icefish.
- 3 Read the sentence from the introduction [paragraphs 1 and 2].

We searched the animal kingdom for cardiac marvels, from the depths of the ocean to the top of the Himalayas.

Why does the author choose to use the word "marvels"?

- (A) to emphasize the success of the scientists studying animal hearts
- (B) to emphasize the determination and effort it took to locate examples
- (C) to convey a sense of amazement regarding these unusual animals
- (D) to convey a sense of horror regarding the unusual nature of the species
- Read the selection from the section "Wood Frog."

As far as we know, though, only wood frogs can stop the beat completely. During the winter, these frogs essentially become frogsicles. Thanks to special substances in their cells, they can halt the metabolic activity, the chemical reactions that that provide the body with energy. Stopping this activity allows most of their body water to solidify.

Which word from the selection shows a humorous tone?

- (A) essentially
- (B) frogsicles
- (C) metabolic
- (D) solidify

Chocolate Lab's nose knows when a diabetic emergency could be lurking

By Lynh Bui, Washington Post, adapted by Newsela staff on 11.06.17 Word Count **786** Level **MAX**



Kate Rondelli and her son Mylon, 4, visit the Bunker Hill Fire Station in Brentwood, Maryland, with Slash, a chocolate Lab who has been trained to detect diabetic emergencies. Photo by Washington Post photo by Lynh Bui

Slash the chocolate Labrador retriever jumped into Kate Rondelli's bed in the middle of the night Tuesday, licking her face to wake her up.

There was trouble.

The dog led her to her son's room, where Rondelli tested her 4-year-old's blood sugar levels: Over 400 milligrams per deciliter. That is more than twice the maximum range desirable for the little boy with Type 1 diabetes.

Rondelli quickly gave her son, Mylon, insulin to stabilize his levels, averting a possible medical emergency.

"His nose is always working," Rondelli said.

Diabetes Detection Dog

Slash is a diabetes detection dog. He was trained to alert Rondelli when her son's blood sugar falls or spikes to potentially dangerous levels. The dog and his new family visited the Bunker Hill Fire Station in Prince George's County, Maryland on Wednesday. They were there to get acquainted with first responders as part of Slash's training.

Service dogs can be protective of their owners. Rondelli and Slash's trainers wanted to make sure that if firefighters have to be called to the house for a medical emergency, Slash would be familiar with people in uniform. Then he would stand down to let medics treat Mylon.

The dog visited the firehouse in Brentwood twice. This way, "when we show up for a call, not only Mylon but Slash is familiar with us being there and us being in close contact with Mylon," said James Key. He is the acting battalion chief for the Prince George's County Fire Department. "The first time Slash will meet us is not when we come with lights and sirens."

Erin Gray works for the organization that trained Slash. Gray said diabetes dogs, like bombsniffing or drug-sniffing dogs, are trained to detect smells as a way to alert people to trouble.

Acetone And Sweet Scents

In Slash's case, he was taught to detect acetone scents coming from Mylon's body as a signal of low blood sugar. He can also detect sweet, syrupy smells, which are an indication of high blood sugar.

"He gets rewarded when Mylon is out of range," said Gray, a trainer with Service Dogs by Warren Retrievers. The group is based in Virginia.

Dogs like Slash go through an extensive training and obedience program for nine to 18 months before they are delivered to families, Gray said. After that, each dog is customized to the needs of the person they serve.

Mylon was diagnosed with Type I diabetes two years ago. Rondelli noticed then that her son was constantly thirsty and quickly wetting diapers.

She took him to the doctor where they discovered his blood-sugar levels were through the roof. Mylon immediately was sent to a children's hospital. He spent four days in intensive care.

People with Type I diabetes do not have a pancreas functioning normally to produce insulin that regulates the body's blood sugar. Levels that are too high can damage nerves and blood vessels. Levels that are too low can trigger seizures, fainting or a coma.

Slash has been with the family only since Monday, but he has already sensed Mylon's swings in blood sugar several times, Rondelli said.

On the first night, Slash woke up Rondelli when her son's blood levels dropped below 80 three times, allowing her to give Mylon glucose.

Rondelli said that although her son has a monitor to test his levels, she said the device is designed for adults and can be inaccurate and slow. Slash offers a more immediate response, she said.

"He's going to have a more real-time sense," Rondelli said.

In the days they've been together, Rondelli said Slash has mostly been spot on — pawing at Rondelli when he detects Mylon needs his blood sugar tested. But the dog is still new to training.

Not The Only Line Of Defense

At the firehouse Wednesday, Slash pawed at Rondelli. She took her son to a chair and checked his blood levels with Slash at his feet. But the results showed Mylon's levels were normal.

It turns out Slash had detected off-kilter blood sugar for a firefighter who also is diabetic.

In that case, Slash didn't get a treat. This is a way of training him to alert the family only if it is Mylon experiencing problems.

It's unclear what chemical dogs are detecting when they sense someone's blood sugar has gone too high or low. And research appears to be mixed when it comes to the effectiveness of diabetic-alert dogs.

But Rondelli is convinced Slash is going to be a great help to her family.

"There's amazing technology out there," she said, "but dogs just have an amazing sense."



Quiz

3

- 1 Which paragraph in the section "Not The Only Line Of Defense" supports the inference that some people do NOT support the use of diabetic detection dogs?
- 2 Which selection from the article shows how Rondelli solved her problem?
 - (A) Slash the chocolate lab jumped into Kate Rondelli's bed in the middle of the night Tuesday, licking her face to wake her up.
 - (B) Rondelli quickly gave her son, Mylon, insulin to stabilize his levels, averting a possible medical emergency.
 - (C) He was trained to alert Rondelli when her son's blood sugar falls or spikes to potentially dangerous levels.
 - (D) She took him to the doctor where they discovered his blood-sugar levels were through the roof.
 - What is MOST likely the reason why the author included the story about taking Slash to the fire department?
 - (A) to explain why service dogs need to get used to people
 - (B) to show how good Slash is at detecting changes in blood sugar
 - (C) to show how important Slash is to the Rondelli family
 - (D) to explain how service dogs detect blood sugar changes
- 4 Which answer choice accurately characterizes Rondelli's reaction to to Slash's help?
 - (A) indifferent
 - (B) uncertain
 - (C) nervous
 - (D) grateful

Everyday Mysteries: What is our strongest muscle?

By Library of Congress on 01.18.17 Word Count **710** Level **MAX**



Young fans flex their muscles during the second quarter of a football game between the Denver Broncos and Carolina Panthers. Helen H. Richardson/The Denver Post via Getty Images

Question: What is the strongest muscle in the human body?

Answer: There is no one answer for this question since there are different ways to measure strength. There is absolute strength (maximum force), dynamic strength (repeated motions), elastic strength (exert force quickly) and strength endurance (withstand fatigue).

There are three types of muscles in the human body: cardiac, smooth and skeletal.

Cardiac muscle makes up the wall of the heart and is responsible for the forceful contraction of the heart. Smooth muscles make up the walls of the intestine, the uterus, blood vessels and internal muscles of the eye. Skeletal muscles are attached to the bones and in some areas the skin (muscles in our face). Contraction of the skeletal muscles helps limbs and other body parts move.

Most sources state that there are over 650 named skeletal muscles in the human body, although some figures go up to as many as 840. The dissension comes from those that count the muscles

within a complex muscle. For example, the biceps brachii is a complex muscle that has two heads and two different origins. However, they insert on the radial tuberosity. Do you count this as one muscle or two?

Although most individuals have the same general set of muscles, there is some variability from one person to another. Generally, smooth muscles are not included with this total since most of these muscles are at the cellular level and number in the billions. In terms of a cardiac muscle, we only have one of those: the heart.

Muscles are given Latin names according to location, relative size, shape, action, origin/insertion and/or number of origins. For example, the flexor hallicis longus muscle is the long muscle that bends the big toe. A *flexor* is a muscle that flexes a joint, *hallicis* means great toe and *longus* means long. The following are muscles that have been deemed the strongest based on various definitions of strength, listed in alphabetical order.

External Muscles Of The Eye

The muscles of the eye are constantly moving to readjust the positions of the eye. When the head is in motion, the external muscles are constantly adjusting the position of the eye to maintain a steady fixation point. However, the external muscles of the eye are subject to fatigue. In an hour of reading a book, the eyes make nearly 10,000 coordinated movements.

Gluteus Maximus

The gluteus maximus, the largest muscle in the human body, is large and powerful because it has the job of keeping the trunk of the body in an erect posture. It is the chief anti-gravity muscle that aids in walking up stairs.

Heart

The hardest working muscle is the heart. It pumps out 2 ounces (71 grams) of blood at every heartbeat and at least 2,500 gallons (9,450 liters) of blood every day. The heart has the ability to beat over 3 billion times in a person's life.

Masseter

The strongest muscle based on its weight is the masseter, which is the primary muscle for helping you chew. With all muscles of the jaw working together, it can close the teeth with a force as great as 55 pounds (25 kilograms) on the incisors or 200 pounds (90.7 kilograms) on the molars.

Muscles Of The Uterus

The uterus sits in the lower pelvic region. Its muscles are deemed strong because they contract to push a baby through the birth canal. The pituitary gland secretes the hormone oxytocin, which stimulates the contractions.

Soleus

The muscle that can pull with the greatest force is the soleus, which is found below the gastrocnemius, or calf muscle. The soleus is very important for walking, running and dancing. It is

considered a very powerful muscle along with calf muscles because it pulls against the force of gravity to keep the body upright.

Tongue

The tongue is a tough worker. It is made up of groups of muscles and, like the heart, it is always working. It helps in the mixing process of foods and binds and contorts itself to form letters. At the back of the base of the tongue are the lingual tonsils, which filter out germs. Even when a person sleeps, the tongue is constantly pushing saliva down the throat.

Quiz

1

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- Which of the following sentences from the article MOST highlights why the tongue is considered to be so strong?
 - (A) The tongue is a tough worker.
 - (B) It is made up of groups of muscles and, like the heart, it is always working.
 - (C) It helps in the mixing process of foods and binds and contorts itself to form letters.
 - (D) At the back of the base of the tongue are the lingual tonsils, which filter out germs.
- 2 Read the selection from the article.

Most sources state that there are over 650 named skeletal muscles in the human body, although some figures go up to as many as 840. The dissension comes from those that count the muscles within a complex muscle.

Which of the following ideas can be inferred from the selection above?

- (A) It is unknown how many complex muscles have been counted.
- (B) Some people have more muscles in their bodies than others do.
- (C) Experts differ in how they count the skeletal muscles.
- (D) Experts continue to discover new skeletal muscles in the body.

3 Is the second paragraph of the article an effective way to engage readers on the topic of the article? Why or why not?

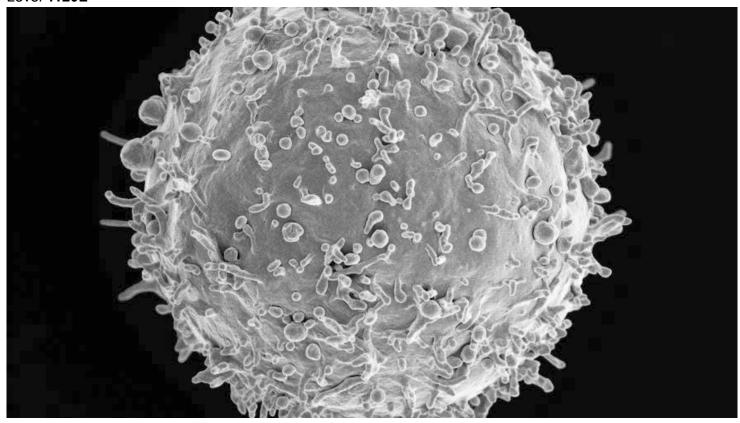
- (A) Yes, it generates interest in the primary method for measuring muscle strength.
- (B) Yes, it suggests that there are multiple muscles that can be considered the strongest.
- (C) No, it fails to provide a scientific answer to the question posed in the first paragraph.
- (D) No, it indicates that there is no way to determine the strongest muscle in the body.

Which of the following options BEST describes the structure of the article?

- (A) The article compares and contrasts the three types of muscles.
- (B) The article defends the argument that there is a singular strongest muscle.
- (C) The article narrates experts' search for the body's strongest muscle.
- (D) The article details why different muscles have been identified as the strongest.

The cells of the human body

By ThoughtCo.com, adapted by Newsela staff on 10.23.17 Word Count **1,013** Level **1120L**



Colorized scanning of a lymphocyte, whose responsibility is to produce antibodies. Photo by: NIAID/Flickr.

Cells in the human body number in the trillions and come in all shapes and sizes. These tiny structures are the basic unit of living organisms. Cells make up tissues, and tissues make up organs. Organs form organ systems, and organ systems work together to keep an organism alive.

There are hundreds of different types of cells in the body and the structure of a cell is perfectly suited for the role it performs. Cells of the digestive system, for instance, have a different function from cells of the skeletal system.

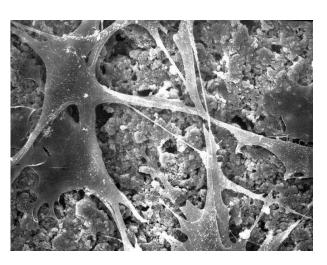
No matter the differences, cells of the body depend on one another, either directly or indirectly, to keep the body functioning as one unit. The following are examples of different types of cells in the human body.

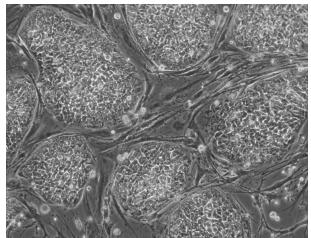
Stem Cells

Stem cells are unique cells of the body in that they are not specialized for any particular role. However, they have the ability to develop into specialized cells for specific organs or tissues when the need arises. Stem cells are able to divide and replicate many times in order to renew and repair tissue. Scientists are researching ways to take advantage of the renewal properties of stem cells. They use these cells to repair damaged tissue, for organ transplantation and for the treatment of disease.

Bone Cells

Bones are a type of





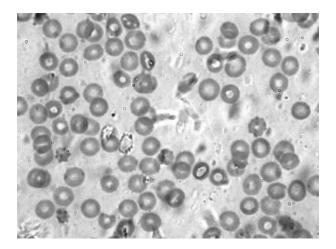
connective tissue and a major part of the skeletal system. They are formed by bone cells, and are a combination of collagen and calcium phosphate minerals.

There are three primary types of bone cells in the body. Osteoclasts are large cells that decompose bone so it can be absorbed into the body. Osteoblasts regulate bone mineralization and produce the substance osteoid, which mineralizes, or hardens, in order to form bone. Osteoblasts mature to form osteocytes, which aid in the formation of bone and help maintain calcium balance.

Blood Cells

From transporting oxygen throughout the body to fighting infection, cells of the blood are vital to life. The three major types of cells in the blood are red blood cells, white blood cells and platelets.

Red blood cells determine blood type and are also responsible for transporting oxygen to other cells. White blood cells are immune system cells that destroy pathogens, or disease-causing organisms, and provide protection. When blood vessels break, platelets, which are produced by bone marrow, help to clot the blood and prevent too much blood loss.



Muscle Cells

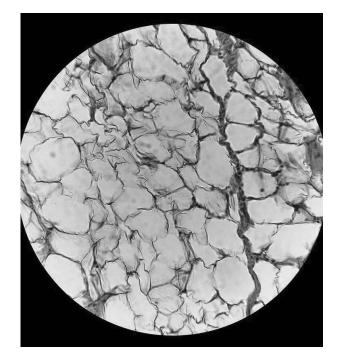
Muscle cells form muscle tissue, which is important for moving the body. Skeletal muscle tissue, like a tendon, attaches to bones and allows us to move as we please.

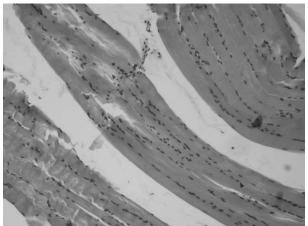
Cardiac muscle cells form the muscles in the heart, which help the heart contract as it pumps blood. These muscles are involuntary, which means that they move without us telling them to do so.

Smooth muscle is also involuntary. It is a type of muscle that forms the walls of many organs, including kidneys, intestines, blood vessels and lung airways.

Fat Cells

Fat cells, or

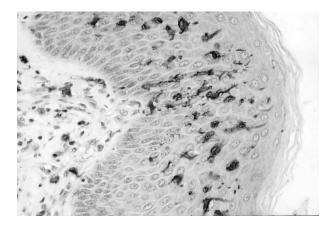




adipocytes, are the major cell parts inside adipose tissue. Fat cells contain droplets of stored fat that can be used for energy. When fat is being stored, fat cells swell and become round in shape. When fat is being used, these cells shrink in size. Adipocytes also produce hormones that influence blood pressure regulation, fat storage and use, blood clotting and cell signaling.

Skin Cells

The skin is composed of a series of layers. The outermost layer is called epidermis, and is supported by a layer of connective tissue called dermis. The outermost layer of the skin is composed of flat epithelial cells that are closely packed together. The skin protects the internal structures of the body from damage and prevents dehydration. It also acts as a barrier against germs, stores fat and produces vitamins and hormones.

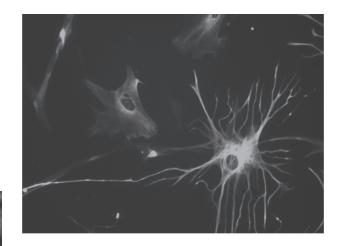


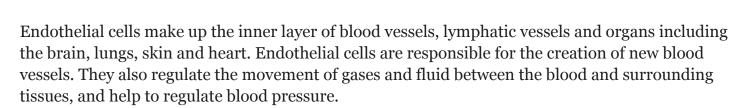
Nerve Cells

Nerve cells, or neurons, are the basic units of the nervous system. Nerves send signals between the brain, the spinal cord and the various body organs through nerve impulses.

A neuron consists of two major parts, a cell body and nerve processes. The central cell body contains the neuron's nucleus, associated cytoplasm and organelles. Nerve processes, called axons and dendrites, extend from the cell body and are able to create and send signals elsewhere.

Endothelial Cells



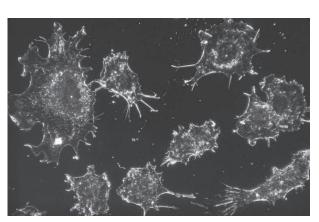


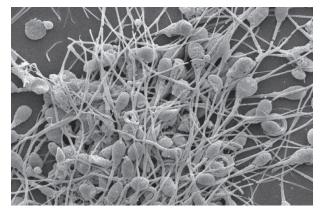
Sex Cells

Sex cells, or gametes, are reproductive cells, which combine during fertilization in order to create new life. Male sex cells, or sperm, can move by using a long tail called a flagellum to propel themselves forward. Female sex cells, or ova, do not move and are relatively large in comparison to the male gamete.

Cancer Cells

Cancer is caused when normal cells develop abnormal





properties, such as not being able to go through apoptosis. Without apoptosis, which is the cell's self-destruct mechanism, these cells can divide uncontrollably and spread to other locations.

Cancer cell development can be caused by mutations. These mutations may form because of exposure to chemicals, radiation or viral infection.

Quiz

2

- 1 Which shows the correct order, from simplest to most complex?
 - (A) tissues, cells, organ systems, organs
 - (B) cells, organs, tissues, organ systems
 - (C) tissues, organs, organ systems, cells
 - (D) cells, tissues, organs, organ systems
 - According to the article, different types of cells work together to ensure that the human body works properly.

Which paragraph BEST supports the idea outlined above?

- (A) Stem cells are unique cells of the body in that they are not specialized for any particular role. However, they have the ability to develop into specialized cells for specific organs or tissues when the need arises.
- (B) There are three primary types of bone cells in the body. Osteoclasts are large cells that decompose bone so it can be absorbed into the body. Osteoblasts regulate bone mineralization and produce the substance osteoid, which mineralizes, or hardens, in order to form bone. Osteoblasts mature to form osteocytes, which aid in the formation of bone and help maintain calcium balance.
- (C) Muscle cells form muscle tissue, which is important for moving the body. Skeletal muscle tissue, like a tendon, attaches to bones and allows us to move as we please.
- (D) A neuron consists of two major parts, a cell body and nerve processes. The central cell body contains the neuron's nucleus, associated cytoplasm and organelles. Nerve processes, called axons and dendrites, extend from the cell body and are able to create and send signals elsewhere.
- 3 The axons of some neurons can be up to a meter long. Why might nerve cells need to be so long?
 - (A) to help them pump blood through the body
 - (B) so they can carry messages throughout the body
 - (C) so they can protect the whole body from illness
 - (D) to help the cells reproduce more quickly
- 4 Read these sentences from the article.
 - 1. No matter the differences, cells of the body depend on one another, either directly or indirectly, to keep the body functioning as one unit.
 - 2. Stem cells are able to divide and replicate many times in order to renew and repair tissue.
 - 3. Osteoclasts are large cells that decompose bone so it can be absorbed into the body.
 - 4. White blood cells are immune system cells that destroy pathogens, or disease-causing organisms, and provide protection.

Which two sentences taken together provide the BEST evidence to support the idea that cells protect the body?

- (A) 1 and 3
- (B) 1 and 4
- (C) 2 and 3
- (D) 2 and 4

- Imagine you fall and scrape your knee. Which two types of cells would you MOST rely on to protect your body?
 - (A) muscle cells and platelets
 - (B) bone cells and muscle cells
 - (C) skin cells and platelets
 - (D) skin cells and red blood cells
- 6 Read the sentence from the section "Stem Cells."

Stem cells are unique cells of the body in that they are not specialized for any particular role.

Which of the following words from the article provides context clues to the meaning of the word "specialized"?

- (A) particular and specific
- (B) develop and repair
- (C) ability and replicate
- (D) unique and renew

7 What is true about apoptosis?

- 1. It causes cells to die.
- 2. It causes cells to divide and spread.
- 3. It is common in cancer cells.
- (A) 1 only
- (B) 2 only
- (C) 1 and 3
- (D) 2 and 3
- 8

5

Read the sentence from the section "Cancer Cells."

Cancer is caused when normal cells develop abnormal properties, such as not being able to go through apoptosis.

The author uses the word "abnormal" to mean:

- (A) ordinary
- (B) standard
- (C) traditional
- (D) exceptional

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Legend of Loch Ness monster will be tested with DNA samples

By Nick Perry, Associated Press, adapted by Newsela staff on 06.04.18 Word Count **642**

Level MAX



Image 1. A friendly recreation of the legendary Loch Ness monster at a sports game in Glasgow, Scotland. Scientists are going to test the waters of Loch Ness to find out what really is living there. Photo by Andrew Milligan/PA Images via Getty Images

The stories seem as tall as the lake is deep. For hundreds of years, visitors to Scotland's Loch Ness have described seeing a monster. Some believe it lurks in the depths of the loch, or lake.

But now the legend of "Nessie" may have no place left to hide. A New Zealand scientist is leading an international team to the lake next month. They will take samples of the murky waters and conduct DNA tests to determine what species live there.

Do You Believe In Nessie?

University of Otago professor Neil Gemmell says he's no believer in Nessie, but he wants to take people on an adventure and communicate some science along the way. Besides, he says, his kids think it's one of the coolest things he's ever done.

One of the more far-fetched theories is that Nessie is a long-necked plesiosaur. Plesiosaurs were long-necked marine animals that lived during the time of dinosaurs. The theory is that the reptile

somehow survived the period when all dinosaurs became extinct. Another theory is that the monster is actually a sturgeon or giant catfish. Many believe the sightings are hoaxes or can be explained by floating logs or strong winds.

Gemmell said that when creatures move about in the water, they leave behind tiny fragments of DNA. It comes from their skin, feathers, scales and urine.

He said his team will take 300 samples of water from different points around the lake and at different



depths. They will filter the organic material and extract the DNA, he said, sequencing it by using technology originally created for the human genome project.

He said the DNA results will then be compared against a database of known species. He said they should have answers by the end of the year.

A Survey Of The Biodiversity Of Loch Ness

"I'm going into this thinking it's unlikely there is a monster, but I want to test that hypothesis," Gemmell said. "What we'll get is a really nice survey of the biodiversity of the Loch Ness."

He said the real discoveries may come in determining things like the prevalence of invasive species.

Gemmell, 51, said he first visited Loch Ness in his late 20s while on vacation. Like thousands of tourists before him, he gazed out over the lake trying to catch sight of a monster. He said he first came up with the idea of testing DNA from the lake a couple of years ago. The idea resonated with many, including his children, aged 7 and 10.

Graeme Matheson, chief of the Scottish Society of New Zealand, said he, too, has visited Loch Ness. He has gazed out over the water there. He wishes Gemmell all the best.

"I hope he and his cohorts find something, although I think they'll be battling," Matheson said. "Still, it's a good way to get a trip to Scotland."

DNA Deniers Prepare To Fight

Gemmell said that even if they don't find any monster DNA, it won't deter some Nessie believers. He said they've already been offering him theories, like how Nessie might be on vacation after swimming to the sea via hidden underwater caves. Another is that the creature might be extraterrestrial and not leave behind any DNA.

"In our lives we want there still to be mysteries, some of which we will ultimately solve," Gemmell said. "That's part of the spirit of discovery. And sometimes, what you find may not be what you were expecting."

Quiz

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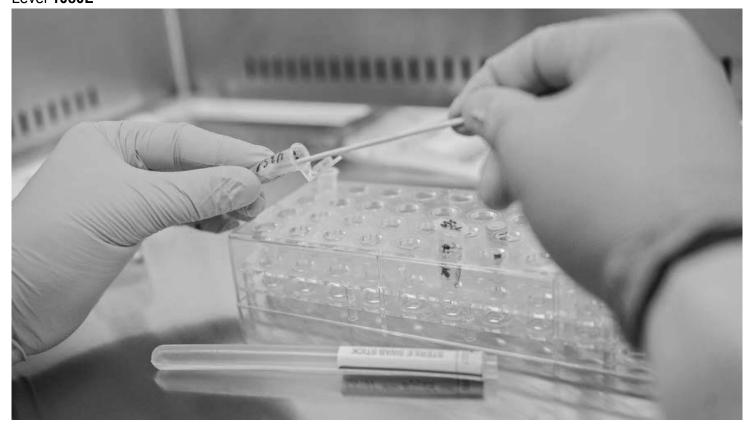
Read the section "A Survey Of The Biodiversity Of Loch Ness."

Which paragraph from the section suggests the scientist in charge of DNA testing the lake may not believe there is truly a monster in the lake?

- (A) "I'm going into this thinking it's unlikely there is a monster, but I want to test that hypothesis," Gemmell said. "What we'll get is a really nice survey of the biodiversity of the Loch Ness."
- (B) Gemmell, 51, said he first visited Loch Ness in his late 20s while on vacation. Like thousands of tourists before him, he gazed out over the lake trying to catch sight of a monster. He said he first came up with the idea of testing DNA from the lake a couple of years ago. The idea resonated with many, including his children, aged 7 and 10.
- (C) Graeme Matheson, chief of the Scottish Society of New Zealand, said he, too, has visited Loch Ness.
 He has gazed out over the water there. He wishes Gemmell all the best.
- (D) "I hope he and his cohorts find something, although I think they'll be battling," Matheson said. "Still, it's a good way to get a trip to Scotland."
- Which sentence in the section "DNA Deniers Prepare To Fight" supports the conclusion that people have begun creating theories as to why scientists may not find DNA in the waters of Loch Ness?
 - (A) Gemmell said that even if they don't find any monster DNA, it won't deter some Nessie believers.
 - (B) He said they've already been offering him theories, like how Nessie might be on vacation after swimming to the sea via hidden underwater caves.
 - (C) "In our lives we want there still to be mysteries, some of which we will ultimately solve," Gemmell said.
 - (D) And sometimes, what you find may not be what you were expecting."
- Which section of the article is BEST illustrated by image 3?
 - (A) Introduction [paragraphs 1-2]
 - (B) "Do You Believe In Nessie?"
 - (C) "A Survey Of The Biodiversity Of Loch Ness"
 - (D) "DNA Deniers Prepare To Fight"
- How do image 2 and the text in the section "Do You Believe In Nessie?" help to develop a coherent understanding of the Loch Ness monster?
 - (A) They give more information about Scotland and the people who live there.
 - (B) They explain how people are hoping to find proof of the Loch Ness monster.
 - (C) They inform the reader about how people in Scotland view the monster.
 - (D) They provide context about the lake where the monster supposedly lives.

A distant relative's DNA could be used to identify you

By Smithsonian.com, adapted by Newsela staff on 11.07.18 Word Count **793** Level **1080L**



More than half of Americans of Northern European descent could be matched to a third cousin or closer through anonymous DNA samples, like the one shown here. Photo by: Mohamed Abdiwahab/AFP/Getty Images

About 15 million Americans have submitted samples of their DNA to at-home testing services. They use the tests in hopes of learning more about their genetic makeup.

A new study suggests that these vast stores of genetic information will make it possible for most people of Northern European descent in the United States to find a third cousin or closer match. Even people who have never undergone DNA testing can find family members.

Genetic Data Collection Is On The Rise

Consumer DNA testing services like 23andMe have risen in popularity lately. They offer an easy way to undergo genetic screening, without having to go through a doctor. Customers simply take a swab of their saliva and mail it into the company.

Many testing services also let their customers download files of their genetic information. The files can then be uploaded to sites like GEDmatch. These sites let users search their databases for

relatives who might match their genetics.

Sequences of DNA, called genes, tell our bodies how to grow and operate. DNA contains the instructions for how each part of the body works and is passed from parent to child.

DNA Helped Crack A Case In California

High-tech genealogical research isn't only of interest to people looking to track down their longlost aunt. Recently, investigators have relied on genetic databases to crack cold cases.

Last spring, police in California used a genealogy service to catch the so-called "Golden State Killer." He had committed a series of rapes and murders in the 1970s and 1980s. Police submitted DNA collected from crime scenes to a public genealogy database and found a match to a distant relative. Eventually, they were able to follow the lead to 72-year-old former police officer Joseph James DeAngelo. He was charged with the crimes from decades earlier.

This case and others like it made Yaniv Erlich think about possibilities. He is chief science officer at the genetic ancestry website MyHeritage. Before joining MyHeritage he was a computer science professor at Columbia University specializing in genetic privacy. He wondered how frequently people can be identified through the DNA of their distant relatives.

Genealogy Sites Can Connect Distant Relatives

As part of a new study published in Science magazine, Erlich and a team of researchers analyzed 1.28 million unidentified genomes. They had been submitted to MyHeritage and GEDmatch. A genome is a complete set of DNA, including all of one's genes. Most of the genomes belonged to people of Northern European descent because this demographic is most likely to use genealogy sites.

The researchers projected that for Americans of Northern European descent, 60 percent of longrange searches will come up with a match with someone who was a third cousin or closer. For 15 percent, the searches will find a second cousin or closer.

By making connections between relatives, a good detective could construct a family tree and then do more targeted research that might lead to someone who had never submitted his or her DNA for testing. That was the case with the Golden State Killer.

"Think of your family like layers of an onion," Erlich told Scientific American magazine. Each layer going away from the center of the onion represents increasingly distant relatives. "When you go to very distant relatives, chances of a link are much higher."

A Threat To Our Privacy?

The researchers expect more and more people to submit their genetic data to genealogical databases. They estimate that within two or three years, 90 percent of people with European ancestry will be traceable in this way. The New York Times reported the estimate.

Why are these results troubling? One concern is that it will be a threat to privacy. Some people worry about their personal information being made public.

In addition, public genealogy databases could be used by "people seeking personal information about someone" for criminal purposes, writes Maggie Fox of NBC News. However, CeCe Moore

told the New York Times that this is easier said than done. Moore is a genealogist at Parabon, a company that looks at suspect's DNA for law enforcement agencies and tries to figure out a "phenotype," or how a person might look and act based on their genes and environment. Building a family tree out of genetic information is no simple matter, Moore says. It requires expert skills.

Some scientists say there are benefits to learning about one's ancestry, even at a risk to personal privacy. Robert Green is a medical geneticist at Harvard University and Brigham and Women's Hospital in Massachusetts. He spoke in an interview with STAT, a health news website. Green said that "we should keep in mind the personal and societal value that we believe that we are accruing as we make these large collections."

Quiz

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The sentence below from the section "Genetic Data Collection Is On The Rise" helps to prove that DNA testing services make it convenient for people to learn about their genetics.

They offer an easy way to undergo genetic screening, without having to go through a doctor.

Which sentence from the section provides further support for the claim?

- (A) Consumer DNA testing services like 23andMe have risen in popularity lately.
- (B) Customers simply take a swab of their saliva and mail it into the company.
- (C) Sequences of DNA, called genes, tell our bodies how to grow and operate.
- (D) DNA contains the instructions for how each part of the body works and is passed from parent to child.
- 2 Read the following paragraph from the section "Genealogy Sites Can Connect Distant Relatives."

The researchers projected that for Americans of Northern European descent, 60 percent of longrange searches will come up with a match with someone who was a third- cousin or closer. For 15 percent, the searches will find a second-cousin or closer.

What conclusion is BEST supported by the paragraph above?

- (A) For Americans of Northern European descent, it is less likely that they will find a third-cousin or closer than a second-cousin or closer.
- (B) For Americans of Northern European descent, it is more likely that they will find a third-cousin or closer than a second-cousin or closer.
- (C) For Americans of Northern European descent, it is just as likely that they will find a third-cousin or closer as it is to find a second- cousin or closer.
- (D) For Americans of Northern European descent, it is not likely that they will find either a third- cousin or closer or a second-cousin or closer.
- 3 According to the article, why did CeCe Moore dismiss fears that public genealogy databases could be used for criminal activities?
 - (A) She thinks it is incredibly difficult for those who are not genealogists to use genetic information to cause others harm.
 - (B) She thinks people are right to be concerned but that they should be more worried about their privacy.
 - (C) She thinks such fears are silly because it is relatively easy for people to protect their information and make a family tree.
 - (D) She thinks that putting your information on a public genealogy database is more risky than people believe.
 - How did the "Golden State Killer" case affect Yaniv Erlich's study?
 - (A) It made him revise his study to show that genetic databases are mostly used in cold cases.
 - (B) It made him change his study from looking at genetic databases to examining how police solve crimes.
 - (C) It was the main reason why Erlich decided to leave his position as a professor and lead the study.
 - (D) It was one of the cases that sparked Erlich's interest in exploring the potential of genetic databases.

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Scientists around the world are working to map animal genomes

By Associated Press, adapted by Newsela staff on 10.02.18 Word Count **611** Level **1040L**



Scientists Jen Vashon (left) and Tanya Lama are pictured with a Canada lynx that was used to source genetic material for the Canada lynx reference genome at Cummings School of Veterinary Medicine in Worcester County, Massachusetts, in February 2018. Photo: Bill Byrne/MassWildlife/Massachusetts Division of Fisheries & Wildlife via AP

A group of scientists is mapping the genes of tens of thousands of animal species. They just revealed the first results of the project. The project could help to save animals from extinction in the future, they said.

The scientists are working with a group called Genome 10,000 on the Vertebrate Genomes Project. A genome is the entire set of genetic material that is present in a living thing. A genome is made up of DNA. The DNA contains the instructions for how each part of the body works and is passed on from parents to children.

The project seeks to map the genomes of all 66,000 species of mammals, birds, reptiles, amphibians and fish on Earth. Genome 10,000 has members at more than 50 institutions around the world. It started the Vertebrate Genomes Project last year.

Cataloging Species For The Future

Genome 10,000 released the first 15 gene maps on September 13. The animals range from Canada's lynx to the kakapo, a flightless parrot native to New Zealand.

Harris Lewin is a professor of evolution at University of California, Davis, who is working on the project. He studies how animals have changed over many, many years. The release of the first maps is a statement to the world that what the scientists want to accomplish is indeed possible, he said.

The work will help to guide future conservation of endangered species, scientists working on the project said. The first 14 species to be mapped also include the duck-billed platypus, two bat species and the zebra finch. The zebra finch was the one species for which both the male and female genomes were mapped, bringing the total to 15.

Sadye Paez is a leader on the project. Sequencing the genome of tens of thousands of animals could easily take 10 years, she said. Even so, giving scientists access to this kind of information could help to save rare species because it would give conservationists and biologists a new set of tools, she said.

Paez described the project as an effort to create a "library of life."

Scientists Will Be Able To Better Plan For The Animals

Tanya Lama is an expert on environmental conservation at the University of Massachusetts at Amherst. She coordinated the effort to discover the lynx genome. The wildcat is the subject of debate about how endangered it really is in the United States, and a better understanding of genetics can better protect its future, Lama said.

"It's going to help us plan for the future," she said. It can help to create tools for monitoring population health, and help scientists develop a conservation plan, she said.

The project has three "genome sequencing hubs." They include Rockefeller University in New York, the Sanger Institute outside Cambridge, England, and the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden, Germany, organizers said.

A Genetic Health Chart

Mollie Matteson is a senior scientist with the Center for Biological Diversity in Arizona who is not involved in the project. The work is interesting because it could have an impact on future conservation efforts of endangered species, she said. More information about animals' genetics could lead to a better understanding of how animals resist disease or adapt to changes in the environment, she said.

Matteson says the research could teach us more about the genetic variation of individual animals within a species. This knowledge could prove to be very helpful for conservation.

The project has similarities with the Earth BioGenome Project, which seeks to catalog the genomes for 1.5 million species. Lewin works on that project as well. The Vertebrate Genomes Project will contribute to that effort.

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Read the following claim.

Genome 10,000 will provide new insight that will help protect animals in the wild.

Which sentence from the article provides the BEST support for the statement above?

- (A) The project seeks to map the genomes of all 66,000 species of mammals, birds, reptiles, amphibians and fish on Earth.
- (B) The release of the first maps is a statement to the world that what the scientists want to accomplish is indeed possible, he said.
- (C) It can help to create tools for monitoring population health, and help scientists develop a conservation plan, she said.
- (D) Matteson says the research could teach us more about the genetic variation of individual animals within a species.
- Read the paragraph from the article's introduction [paragraphs 1-3].

The scientists are working with a group called Genome 10,000 on the Vertebrate Genomes Project. A genome is the entire set of genetic material that is present in a living thing. A genome is made up of DNA. The DNA contains the instructions for how each part of the body works and is passed on from parents to children.

What conclusion is BEST supported by the paragraph above?

- (A) The Vertebrate Genome Project is a major undertaking that will require many years to finish.
- (B) Mapping the genomes of 66,000 species will help scientists better protect endangered species.
- (C) Vertebrates are all species that have a backbone and include mammals, reptiles, birds and fish.
- (D) A genome contains a large amount of genetic information about a given species.
- What is the author's purpose for writing this article?
 - (A) to announce the findings of a long-running scientific study
 - (B) to convince the reader that a new project should be supported and funded
 - (C) to inform the reader of scientists' ambitious animal research and what they hope to achieve
 - (D) to argue that a popular initiative is not the most effective way to protect endangered species

How does the author develop his or her own perspective in the article?

- (A) by using logical reasoning to explain why mapping genomes can help protect animals
- (B) by using humor to highlight how long any meaningful discoveries from the project will take
- (C) by using strong, argumentative language to explain the importance of conservation efforts
- (D) by using quotes from scientific experts with contrasting views of the project

🔲 newsela

Explainer: What are blood groups and why do they matter?

By Erica Wood and Lucy Fox, The Conversation, adapted by Newsela staff on 10.11.17 Word Count **805** Level **1090L**



A woman makes a blood donation during a blood drive. Photo from Wikimedia.

People used to think all blood was the same. Now, we know that there are different types of blood, called blood groups.

A blood transfusion, which is the act of transferring one person's blood to another, can be dangerous, even deadly, when people don't share the same blood group. Knowing the blood type of donors and those receiving blood recipients is important.

Our bodies have trillions of red blood cells, and each is covered in various proteins and sugars that we inherit from our parents. These proteins and sugars determine our blood group. We can all be classified into group A, B, AB or O, based on which sugars coat our red blood cells.

We're also classified as positive or negative. That classification is based on whether our blood cells carry a protein called the Rhesus D (RhD) antigen. These two blood group systems (ABO and Rh) give us the eight main blood types: O-, O+, B-, B+, A-, A+, AB-, AB+.

There are also more than 300 different antigens – proteins and sugars that cause the body's immune system to respond – expressed on red cells. There are also 36 recognized blood group systems. And they're just the ones we know about.

Most people know they are, for example, A+ or O-. But few people will know (and never need to know) what their expression of other red cell antigens are.

How Were Blood Groups Discovered?

Transfusion has been practiced from time to time since the 1660s, but blood groups weren't discovered until 1900. Before 1900, it was assumed that all blood was of the same type.

This led to serious problems. There were dangerous transfusions of animal blood into humans, and there were also some transfusions between humans that led to people dying. Because transfusions were seen as dangerous, they were banned in the U.K. and France for more than 100 years.

But in 1900, physician Karl Landsteiner conducted experiments that changed how people thought about transfusions. He showed that some people's red cells "reacted" with blood samples from other people, while others did not. This led to him describing the ABO system. The ABO system is the most important blood group system and the basis of safe modern transfusion.

Landsteiner won the 1930 Nobel Prize for Medicine for this work. Landsteiner's later experiments with the blood of Rhesus monkeys helped him discover what is now known as the RhD antigen.

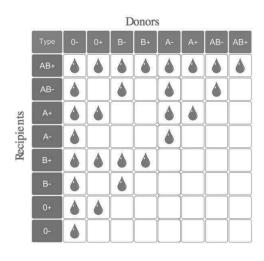
Compatibility

If we need to transfuse blood from one person to another, we want to give donor blood that is compatible with the recipient's blood. That reduces the chance of a transfusion reaction.

So if a person is group A, this means she can receive a red cell transfusion from either a group A or a group O donor. She should not receive group B or AB red cells, as she has naturally occurring antibodies (proteins formed as part of the immune response) that will likely cause a transfusion reaction.

Group O negative people are called "universal donors," because their red cells are unlikely to cause a reaction in recipients.

Those with AB positive blood are called "universal receivers," because they are usually able to receive blood from any other group without having a reaction.





Blood group B has B antigens with anti-A antibodies in the plasma.

Blood group A has A antigens

on the red blood cells with anti-B antibodies in the plasma.



B antigens, but no antibodies.

Blood group AB has both A and



Blood group O has no antigens, but has both anti-A and anti-B antibodies in the plasma, as well as some special "anti-A,B" antibodies.

Emergency departments and some ambulances carry a stock of O negative blood, because in an emergency this is the safest blood to give an ill person of an unknown blood type.

What Are Blood Groups For?

It is likely all of the molecules that cover the surface of cells serve some purpose. These purposes are often completely unrelated to transfusion.

One of the 36 blood group systems is the Colton blood group. This is interesting because the molecules recognized by the immune system as Colton blood group antigens are actually located on an aquaporin (AQP1) molecule. The molecule is one of a family of molecules responsible for water passage into and out of cells, and it is abundant in the red cell membrane. Professor Peter Agre and colleagues described this in 1992. He received a Nobel Prize for this work.

Fascinatingly, the normal function of ABO and Rh, the two most important blood group systems, is still essentially unknown. It is thought that perhaps particular ABO blood types give people an advantage when it comes to surviving in different settings.

Different medical conditions occur more frequently for people of certain ABO blood types. For example, stomach ulcers are more common in those with group O blood. Stomach cancer is more common in those with group A blood. We don't yet know exactly why this occurs.

Erica Wood is an associate professor; Head, Transfusion Research Unit at Monash University.

Lucy Fox is a clinical research fellow in Haematology at Monash University.



A mutation story about sickle cell

By WGBH (PBS) on 10.04.19 Word Count **531** Level **MAX**

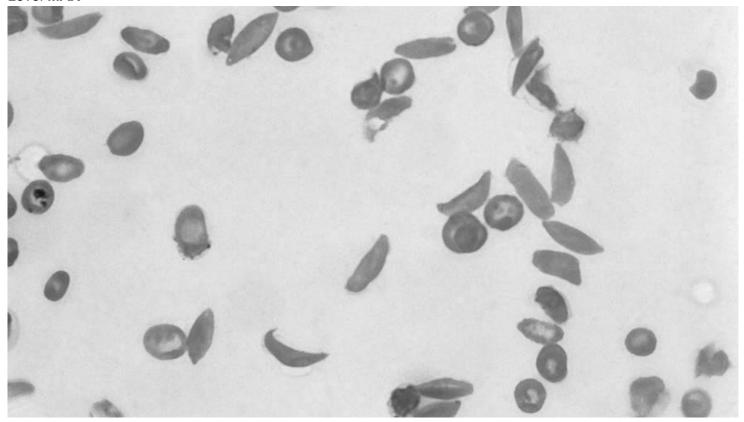


Image 1. A light micrograph showing sickle cells in sickle cell anemia, a blood disorder caused by a mutation in the haemoglobin gene. Photo by: Biophoto Associates/Science Source

A gene known as HbS was the center of a medical and evolutionary detective story that began in the middle-1940s in Africa. Doctors noticed that patients who had sickle cell anemia, a serious hereditary blood disease, were more likely to survive malaria, a disease that kills some 1.2 million people every year. What was puzzling was why sickle cell anemia was so prevalent in some African populations.

How could a "bad" gene, the mutation that causes the sometimes lethal sickle cell disease, also be beneficial? On the other hand, if it didn't provide some survival advantage, why had the sickle gene persisted in such a high frequency in the populations that had it?

The sickle cell mutation is like a typographical error in the DNA code of the gene that tells the body how to make a form of hemoglobin (Hb), the oxygen-carrying molecule in our blood. Every person has two copies of the hemoglobin gene. Usually, both genes make a normal hemoglobin protein. When someone inherits two mutant copies of the hemoglobin gene, the abnormal form of the hemoglobin protein causes the red blood cells to lose oxygen and warp into a sickle shape during periods of high activity. These sickled cells become stuck in small blood vessels, causing a "crisis" of pain, fever, swelling and tissue damage that can lead to death. This is sickle cell anemia.

But it takes two copies of the mutant gene, one from each parent, to give someone the full-blown disease. Many people have just one copy, the other being normal. Those who carry the sickle cell trait do not suffer nearly as severely from the disease.

Researchers found that the sickle cell gene is especially prevalent in areas of Africa hard-hit by malaria. In some regions, as much as 40 percent of the population carries at least one HbS gene.

It turns out that, in these areas, HbS carriers have been naturally selected, because the trait confers some resistance to malaria. Their red blood cells, containing some abnormal hemoglobin, tend to sickle when they are infected by the malaria parasite. Those infected cells flow through the spleen, which culls them out because of their sickle shape — and the parasite is eliminated along with them.

Scientists believe the sickle cell gene appeared and disappeared in the population several times, but became permanently established after a particularly vicious form of malaria jumped from animals to humans in Asia, the Middle East and Africa.

In areas where the sickle cell gene is common, the immunity conferred has become a selective advantage. Unfortunately, it is also a disadvantage because the chances of being born with sickle cell anemia are relatively high.

For parents who each carry the sickle cell trait, the chance that their child will also have the trait, and be immune to malaria, is 50 percent. There is a 25 percent chance that the child will have neither sickle cell anemia nor the trait which enables immunity to malaria. Finally, the chances that their child will have two copies of the gene, and therefore sickle cell anemia, is also 25 percent. This situation is a stark example of genetic compromise, or an evolutionary "trade-off."

Quiz

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- Which of the following ideas did the author develop the LEAST in this article about sickle cell mutation?
 - (A) how and when scientists discovered the link between sickle cell mutation and malaria resistance
 - (B) how and where the sickle cells wipe out the parasite that causes malaria
 - (C) the odds of having immuninty to malaria based on whether a person's parents carry the sickle cell trait
 - (D) the differences associated with one HbS gene versus having two

How does the author describe a person with two HbS genes over the course of the article?

- (A) fortunate for having won the genetic lottery and escaping both malaria and sickle cell anemia
- (B) unfortunate because such a person will definitely develop sickle cell anemia and will have a 25 percent chance of developing malaria
- (C) fortunate for escaping malaria but doomed to have sickle cell anemia
- (D) unfortunate because the person will be doomed to develop both malaria and sickle cell anemia

How effective is the last paragraph at concluding the article for readers? Explain your reasoning.

- (A) Ineffective; because it leaves too many unanswered questions regarding why malaria jumped from animals to humans and why the sickle cell gene sometimes disappeared from populations.
- (B) Effective; because it provides a glimmer of hope that a child who is born to parents who carry the trait will have a healthy life.
- (C) Ineffective; because it underscores the message that despite gaining knowledge about sickle cell mutation, scientists have not yet come up with a way to prevent sickle cell anemia in at-risk children.
- (D) Effective; because it demonstrates the competing and high stakes regarding both malaria and sickle cell anemia are for a child who is born to parents who carry the trait.
- How effective is the first paragraph in engaging the reader in this article about the connection between sickle cell anemia and malaria?
 - (A) Effective; because it hints that doctors have found the secrets to avoiding catching malaria, and readers must continue if they want to know what the answer is.
 - (B) Effective; because it draws readers in to a medical mystery involving two extremely deadly diseases, and answers are only revealed by continuing to read.
 - (C) Ineffective; because the article appeals to few readers because both malaria and sickle cell anemia are limited to a tiny portion of the world's population.
 - (D) Ineffective; because of its overly scientific tone signals that it will be hard for average readers to follow and understand.

This article is available at 5 reading levels at https://newsela.com.

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Colorblind teen and two men see world anew with special eyeglasses

By Matt Campbell, Kansas City Star on 02.16.17 Word Count **652**

Level MAX



In Mission, Kansas, one teen and two men with color vision deficiency, or color blindness, had the opportunity to see their world more vibrantly as they try on special EnChroma glasses. The lenses allow the wearer to experience more color saturation, distinguish certain colors better and see better detail and depth. Photo by: Jill Toyoshiba/Kansas City Star/TNS

MISSION, Kan. — For 16-year-old Noah Vittengl, who is just beginning to drive, being able to tell a red light from a green light is rather important.

"It's been difficult trying to figure out what light is what and what color is what," the Blue Springs high school student said Wednesday.

A few minutes later, Noah was witnessing the world with colors a lot closer to what most people see, with the help of special eyeglass lenses that correct deficiencies that make some people colorblind.

"It's awesome," he said with a big grin. "Everything just seems more vibrant and clear. Before, the colors were kind of like a blur and not necessarily big and bright. Now it's like, whoa!"

Noah and two other colorblind men got a more accurate picture of the everyday world when they were each given a free, promotional pair of the special eyeglasses at the Brill Eye Center in Mission. Brill has been offering the technology, known as EnChroma, for about six months and is the only practice in four states to do so.

"This is an innovation that is really making a difference in people's lives," said Raymond J. Brill of the eye center. "Whether it's for safety, like with stoplights, or for aesthetics, like looking at flowers and artwork, or just for everyday life, like looking at food and being able to tell whether the steak is rare or not."

The technology used by EnChroma, a company based in Berkeley, Calif., was developed in 2010 with funding from the National Institutes of Health. Eyeglasses with EnChroma cost about \$269 to \$349. They can also be made with prescription lenses. The lenses are effective for about four out of five people with red-green color vision deficiency. They are not a cure for colorblindness.

Being colorblind is a hereditary condition that affects the cones in the eye that perceive color. It is far more common among men, affecting about 1 in 12. About 1 in 200 women is affected, but those women will pass the trait to their sons. It is estimated there are about 90,000 colorblind people in the Kansas City area.

To them, the produce section of a supermarket, the arrangements in a flower shop and the magic of a rainbow are dull and drab. They're used to it because they were born with it. It's normal until they make the discovery, usually in childhood, that there is more to the world than what they perceive.

Ryan January, a 37-year-old IT professional from Olathe, was in the third grade and was helping his mother decorate cupcakes for a class treat. His job was to sort candy bits by color.

"She kept getting more and more frustrated throughout the evening," January recalled. Soon afterward, they went to the optometrist.

Austin Mitchell-Goering, a 22-year-old junior at the University of Kansas, originally from Baltimore, was in middle school art class and drawing with crayons.

"I'd always get the blue and purple confused, so I would always have to ask the person next to me," he said. "I scratched a little mark into the purple one so I wouldn't use that for the sky anymore."

Mitchell-Goering plays on the KU lacrosse team. Sometimes the boundary lines are red on a green surface. That can be a problem for someone who is colorblind.

On Wednesday afternoon, Mitchell-Goering and January also got to see the world as most people do.

"I can see differences in the grass," Mitchell-Goering said. "There's, like, live grass and dead grass. Now I can differentiate everything."

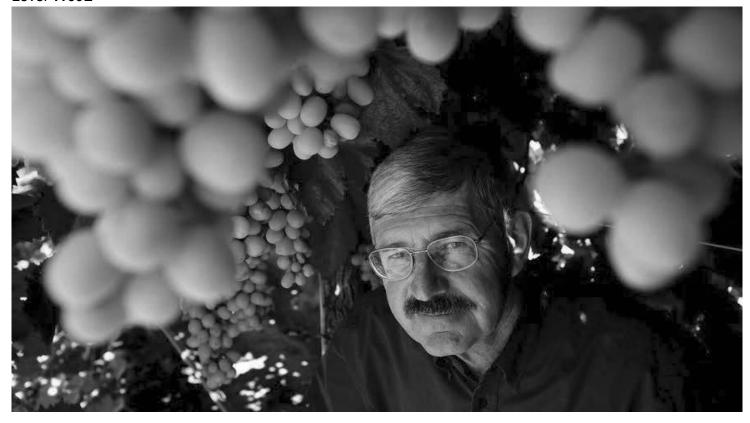
January looked around and described a slow, subtle effect, like someone turning up the color saturation knob. The painted yellow lines in the street, which looked faded before, now popped off the ground.

"The sky is a much more vibrant blue," he said. "The (blue) building in the background here just keeps getting brighter and brighter. It's strange eels great."

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Breeding a grape that tastes just like cotton candy to capture consumers

By Los Angeles Times, adapted by Newsela staff on 08.15.13 Word Count **969** Level **1160L**



Geneticist David Cain with the Cotton Candy grape at International Fruit Genetics. Cain spearheads the Delano, California, facility, seeking varieties that pack enough sweetness to capture consumer tastes. "We're competing against candy bars and cookies," he said. Anne Cusack/Los Angeles Times/MCT

LOS ANGELES — It's not easy peddling fresh fruit to a nation of junk-food addicts. But in rural Kern County, Calif., David Cain is working to win the stomachs and wallets of grocery shoppers.

Cain is a fruit breeder. His latest invention is called the Cotton Candy grape. Bite into one of these green globes and the taste triggers the unmistakable sensation of eating a puffy, pink ball of spun sugar.

By marrying select traits across thousands of nameless trial grapes, Cain and other breeders have developed patented varieties that pack enough sugar they may as well be Skittles on the vine. That's no accident.

"We're competing against candy bars and cookies," said Cain, 62, a former scientist at the U.S. Department of Agriculture (USDA) who now heads research at privately owned International Fruit Genetics in Bakersfield, Calif.

Designer Fruit Craze

In an intensely competitive marketplace, breeding and branding have become almost as valuable to farmers as sun and soil. Producers are constantly tinkering, hoping to come up with the next Cuties Clementine orange or Honeycrisp apple — distinct products that stand out in the crowded fruit aisle.

"People are looking for more flavor," said Mark Carroll, senior director for produce and floral at Gelson's Markets, which will carry the Cotton Candy grape. "Once they get hooked, they want more no matter what."

Cain's company, in the heart of California's \$1.1 billion table grape industry, specializes in bold flavors and exotic shapes. Purple-hued Funny Fingers are long and thin like chili peppers. A variety named Sweet Sapphire come as round and fat as D batteries. Like the Cotton Candy, the special varieties are patented, then licensed to growers.

Ordinary grapes like the red Flame Seedless can cost as little as 88 cents per pound. The Cotton Candy could fetch around \$6 a pound, though prices would come down if enough growers cultivate the grape.

The U.S. designer-fruit craze kicked into high gear in the late 1980s when a Californian plumapricot hybrid called the pluot hit the market. The crispy stone fruit, which took 20 years to develop, proved such a hit with consumers that it inspired more farmers to invest in breeding programs to boost sales.

Apriums And Cherums

California is now churning out other sweet inventions, including apriums (a pluot but with more apricot in it), peacharines (peach and nectarine) and cherums (cherry and plum).

Cross-breeding techniques employed by fruit breeders are centuries old. In the case of grapes, pollen from male grape flowers is extracted and then carefully brushed onto the female clusters of the target plant. Then comes a lot of waiting. Then replanting. Then repeating the process — for years, even decades.

"It's a bit like fishing. You never know when you're going to get the big one," said Cain, a softspoken man who would look every bit the lab coat-clad scientist if it weren't for the soil under his nails.

Although some of these grapes have been bred for higher sugar content, nutritionists don't seem all that bothered.

"You would have to eat about 100 grapes to consume the same amount of calories in a candy bar," said David Heber, director of the UCLA Center for Human Nutrition.

A Taste That Transports

Cain got his start in the 1970s as a researcher with the USDA, developing new varieties of table grapes and seedless raisins in Fresno, Calif. Then, most fruit breeding was done by the government or universities that could afford the time-consuming and expensive work.

Cain went to the private sector in 1987 just as U.S. grape consumption was exploding, thanks to new seedless varieties developed in California.

He helped start International Fruit Genetics in 2001. A few months later at a trade event, he tasted the grape that has obsessed him ever since.

Researchers from the University of Arkansas were showing off a purple Concord grape that didn't look like much. The flesh was mushy and speckled with tiny seeds. The skin slipped off easily after biting, a no-no in the grape business. But its cotton candy flavor transported Cain to a carnival or county fair.

What if he could take the unique flavor of that Eastern U.S. native and meld it with Californian qualities such as superior crunch, thin skin and generous size?

International Fruit Genetics signed a licensing agreement with the University of Arkansas. By 2003, Cain was cross-pollinating their grapes with a dozen California varieties on his test field.

First Large Harvest

On a recent weekday, Cain showed why he spends half his time outdoors. Rows and rows of vines needed to be inspected in search of the next big thing. Carrying a tool belt and a refractometer to measure the sugar content of each grape, Cain methodically tasted his berries, deciding what to keep and what to toss. With 300 kinds of grapes to taste on each row, swallowing the fruit is out of the question.

"I've learned to do a lot of spitting," Cain said.

It was this same painstaking process that led Cain to find the ideal mate for his spun-sugarflavored Concord, a green beauty called Princess. That variety was developed by the USDA and is known for its crisp texture and juiciness.

After five more years of test planting, the Cotton Candy was patented in 2010. A Bakersfield grower is set to harvest the first large crop in August. Cain doesn't like to fuss over such milestones, but the Cotton Candy has him excited. He thinks its signature flavor has a chance to hook consumers like nothing before.

"It's going to be introduced slowly," Cain said. "Whether it will be a niche grape or start a revolution is hard to say. What we're hoping is it will do for grapes what all these new varieties have done for fruit like apples."

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Adaptation

By National Geographic Society on 03.21.19 Word Count **880**



Image 1. A gray whale calf sits on top of its mother's back. They are seen here in the San Ignacio Lagoon, in Baja California South, Mexico. Gray whale mothers migrate thousands of miles every year from the Arctic to give birth in warm waters. Photo by: Francois Gohier/UIG via Getty Images

An adaptation is a mutation, or genetic change, that helps an organism, such as a plant or animal, survive in its environment. Due to the helpful nature of the mutation, it is passed down from one generation to the next. As more and more organisms inherit the mutation, the mutation becomes a typical part of the species. The mutation has become an adaptation.

Structural And Behavioral Adaptations

An adaptation can be structural, meaning it is a physical part of the organism. An adaptation can also be behavioral, affecting the way an organism acts.

An example of a structural adaptation is the way some plants have adapted to life in the desert. Deserts are dry, hot places. Plants called succulents have adapted to this climate by storing water in their thick stems and leaves.

Animal migration is an example of a behavioral adaptation. Gray whales migrate thousands of miles every year as they swim from the cold Arctic Ocean to the warm waters off the coast of

Mexico. Grey whale calves are born in the warm water, and then travel in groups called pods to the nutrient-rich waters of the Arctic.

Some adaptations are called exaptations. An exaptation is an adaptation developed for one purpose, but used for another. Feathers were probably adaptations for keeping the animal warm that were later used for flight, making feathers an exaptation for flying.

Some adaptations, on the other hand, become useless. These adaptations are vestigial: remaining but functionless. Whales and dolphins have vestigial leg bones, the remains of an adaptation (legs) that their ancestors used to walk.

Habitat

Adaptations usually develop in response to a change in the organisms' habitat.

A famous example of an animal adapting to a change in its environment is the English peppered moth. Prior to the 19th century, the most common type of this moth was cream-colored with darker spots. Few peppered moths displayed a mutation of being grey or black.

As the Industrial Revolution changed the environment, the appearance of the peppered moth changed. The darker-colored moths, which were rare, began to thrive in the urban atmosphere. Their sooty color blended in with the trees stained by industrial pollution. Birds couldn't see the dark moths, so they ate the cream-colored moths instead. The cream-colored moths began to make a comeback after the United Kingdom passed laws that limited air pollution.

Speciation

Sometimes, an organism develops an adaptation or set of adaptations that create an entirely new species. This process is known as speciation.

The physical isolation or specialization of a species can lead to speciation.

The wide variety of marsupials in Oceania is an example of how organisms adapt to an isolated habitat. Marsupials, mammals that carry



their young in pouches, arrived in Oceania before the land split with Asia. Placental mammals, animals that carry their young in the mother's womb, came to dominate every other continent, but not Oceania.

Koalas, for instance, adapted to feed on eucalyptus trees, which are native to Australia. The extinct Tasmanian tiger was a carnivorous marsupial and adapted to the niche filled by big cats like tigers on other continents. Marsupials in Oceania are an example of adaptive radiation, a type of speciation in which species develop to fill a variety of empty ecological niches.

The cichlid fish found in many of Africa's lakes exhibit another type of speciation, sympatric speciation. Sympatric speciation is the opposite of physical isolation. It happens when species share the same habitat. Adaptations have allowed hundreds of varieties of cichlids to live in Lake Malawi. Each species of cichlid has a unique, specialized diet: One type of cichlid may eat only insects, another may eat only algae, another may feed only on other fish.

Coadaptation

Organisms sometimes adapt to and with other organisms. This is called coadaptation. Certain flowers have adapted their pollen to appeal to the hummingbirds' tastes. Hummingbirds have adapted long, thin beaks to extract the pollen from certain flowers. In this relationship, the hummingbird gets food, while the plant's pollen is distributed. The coadaptation is beneficial to both organisms.

Mimicry is another type of coadaptation. With mimicry, one organism has adapted to resemble another. The harmless king snake (sometimes called a milk snake) has adapted a color pattern that resembles the deadly coral snake. This mimicry keeps predators away from the king snake.

The mimic octopus has behavioral as well as structural adaptations. This species of octopus can mimic the look and movements of animals such as sea snakes, flatfish, jellyfish and shrimp.

Coadaptation can also limit an organism's ability to adapt to new changes in their habitat. This can lead to co-extinction. In southern England, the large blue butterfly adapted to eat red ants. When human development reduced the red ants' habitat, the local extinction of the red ant led to the local extinction of the large blue butterfly.

Vestigial Adaptations

Vestigial organs are adaptations that have become useless. In humans, vestigial organs include the appendix, thought to be left over from when the human diet was primarily vegetation; the coccyx, a vestigial tail; and gill slits that are found in human embryos, though embryos never breathe through them.

URL: https://www.nationalgeographic.org/encyclopedia/adaptation-survival/

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Which choices could be considered adaptations?

a frog having strong jumping legs
 a giraffe stretching its neck to eat

- 3. a bear hibernating in winter
- 4. a bird having long feathers for flight
- (A) 1, 2 and 3
- (B) 2, 3 and 4
- (C) 1, 3 and 4
- (D) 1, 2 and 4

Which paragraph in the section "Speciation" BEST supports the idea that animals can adapt in ways that allow multiple species to survive together in a common area?

- (A) Sometimes, an organism develops an adaptation or set of adaptations that create an entirely new species. This process is known as speciation.
- (B) The wide variety of marsupials in Oceania is an example of how organisms adapt to an isolated habitat. Marsupials, mammals that carry their young in pouches, arrived in Oceania before the land split with Asia. Placental mammals, animals that carry their young in the mother's womb, came to dominate every other continent, but not Oceania.
- (C) Koalas, for instance, adapted to feed on eucalyptus trees, which are native to Australia. The extinct Tasmanian tiger was a carnivorous marsupial and adapted to the niche filled by big cats like tigers on other continents. Marsupials in Oceania are an example of adaptive radiation, a type of speciation in which species develop to fill a variety of empty ecological niches.
- (D) The cichlid fish found in many of Africa's lakes exhibit another type of speciation, sympatric speciation. Sympatric speciation is the opposite of physical isolation. It happens when species share the same habitat. Adaptations have allowed hundreds of varieties of cichlids to live in Lake Malawi. Each species of cichlid has a unique, specialized diet: One type of cichlid may eat only insects, another may eat only algae, another may feed only on other fish.
- 3 How can plant spines and bird migrations be categorized as adaptations?
 - (A) Plant spines a structural adaptation, while the bird migration is a behavioral adaptation.
 - (B) Bird migration is a structural adaptation, while the plant spines is a behavioral adaptation.
 - (C) They are both structural adaptations.
 - (D) They are both behavioral adaptations.
 - Which piece of evidence BEST explains WHY the darker English peppered moths were more likely to survive during the Industrial Revolution?
 - (A) Prior to the 19th century, the most common type of this moth was cream-colored with darker spots. Few peppered moths displayed a mutation of being grey or black.
 - (B) As the Industrial Revolution changed the environment, the appearance of the peppered moth changed. The darker-colored moths, which were rare, began to thrive in the urban atmosphere.
 - (C) Their sooty color blended in with the trees stained by industrial pollution. Birds couldn't see the dark moths, so they ate the cream-colored moths instead.
 - (D) The cream-colored moths began to make a comeback after the United Kingdom passed laws that limited air pollution.

This article is available at 5 reading levels at https://newsela.com.

Which situation is MOST likely to cause sympatric speciation?

- (A) Galapagos tortoises developing differently on 2 different islands
- (B) changes in 2 deer populations after an earthquake separates them
- (C) a forest bird population dividing into 2 as they eat different seeds
- (D) Oceania splitting up to separate Koalas and Tasmanian tigers

Read the selection below.

Some adaptations, on the other hand, become useless. These adaptations are vestigial: remaining but functionless. Whales and dolphins have vestigial leg bones, the remains of an adaptation (legs) that their ancestors used to walk.

Why did the author include this selection?

- (A) to show that certain animal species don't need any structural adaptations in order to survive
- (B) to introduce the idea that animals can have structural adaptations that they wind up not needing
- (C) to highlight the importance of environmental changes on adaptions and exaptations
- (D) to provide support for the idea that ocean animals are more likely to have useless adaptations

Some fish that live in pitch-dark caves have things that look like eyes but do not see.

Are their eyes best described as an exaptation or a vestigial adaptation?

- (A) an exaptation because the eyes no longer have a useful function
- (B) an exaptation because the eyes changed once fish moved into caves
- (C) a vestigial adaptation because the eyes no longer have a useful function
- (D) a vestigial adaptation because the eyes changed once fish moved into caves

What is the MOST LIKELY reason the author included the information about the blue butterfly and the red ants?

- (A) to illustrate that coadaptation does not ensure survival
- (B) to explain why coadaptation causes animals to change the food that they eat
- (C) to describe the negative impact that humans have had on endangered species
- (D) to suggest that southern England experiences a lot of co-extinction

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Keystone species

By National Geographic Society, adapted by Newsela staff on 11.21.17 Word Count **1,803** Level **1100L**

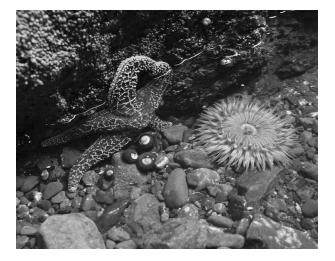


The jaguar has a varied diet in Central and South America. It acts as a keystone predator by helping to balance the animals in the jungle ecosystem by consuming 87 different species of prey. Photo from the public domain.

A keystone species is an organism that helps define an entire ecosystem.

If the keystone species were to disappear from the ecosystem, no other species would be able to fill its environmental role. The ecosystem would be forced to radically change, allowing new and possibly invasive species to take over the habitat.

Any organism, from plants to fungi, may be a keystone species. They are not always the largest or most abundant species in an ecosystem. However, almost all examples of keystone species are animals that have a huge influence on food webs. The way these animals influence food webs varies from habitat to habitat.



Carnivores, Herbivores And Mutualists

Predators

A keystone species is often, but not always, a predator. Just a few predators can control the distribution and population of large numbers of prey species.

The entire concept of keystone species started with a study of predators. American zoology professor Robert T. Paine was researching Tatoosh Island in Washington state. He found that removing a single species, the Pisaster ochraceus sea star, from a tidal plain there had a huge effect on the ecosystem. These creatures, commonly known as purple sea stars, are a major predator of mussels and barnacles on Tatoosh Island. With the sea stars gone, mussels took over the area and crowded out other species, including benthic algae that supported communities of sea snails, limpets and bivalves. Lacking a keystone species, the tidal plain's biodiversity, or variety of creatures, was cut in half within a year.

In the Greater Yellowstone Ecosystem (GYE), gray wolves are a keystone species. The GYE stretches across the U.S. states of Montana, Wyoming and Idaho. It includes active geysers, mountains, forests, meadows and freshwater habitats.

The elk, bison, rabbit and bird species in the Greater Yellowstone Ecosystem are at least partly controlled by the presence of wolves. The feeding behavior of these prey species, as well as where they choose to make their nests and burrows, are largely a reaction to



wolf activity. Scavenger species, such as vultures, are also controlled by the wolf activity.

When the U.S. government designated land for Yellowstone National Park in the late 19th century, hundreds of wolves roamed the GYE. They preyed primarily on abundant herds of elk and bison. The government feared that wolves would too heavily hunt these animals, as well as local livestock, like cows. So it worked to remove wolves from the GYE. The last wolf pups in Yellowstone were killed in 1924.

This started a top-down trophic cascade in the Greater Yellowstone Ecosystem. This is when an ecosystem changes due to the addition or removal of a predator. A top-down trophic cascade describes changes that result from the removal of an ecosystem's top predator.

Lacking a top predator, elk populations in Yellowstone exploded. Elk herds competed for food resources, and plants such as grasses, sedges and reeds did not have time or space to grow back. This hurt populations of other species, such as fish, beaver and songbirds. These animals rely on plants and their roots, flowers, wood and seeds for survival.

It wasn't just animals who were affected. Stream banks eroded as wetland plants failed to anchor valuable soil and sediments. Lake and river temperatures increased as trees and shrubs failed to provide shaded areas.

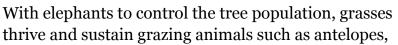
Starting in the 1990s, the U.S. government began reintroducing wolves to the Greater Yellowstone Ecosystem. The results have been noteworthy. Elk populations have shrunk, willow heights have

increased and beaver and songbird populations have recovered.

Herbivores

Herbivores can also be keystone species. By eating plants, they help control the physical and biological aspects of an ecosystem.

In African savannas such as the Serengeti plains in Tanzania, elephants are a keystone species. Elephants eat shrubs and small trees that grow on the savanna. Even if the acacia tree grows to a height of a yard or more, elephants are able to knock it over and uproot it. This feeding behavior keeps the savanna a grassland, rather than a forest.



wildebeests and zebras. Smaller animals such as mice and shrews are able to burrow in the warm, dry soil of a savanna. Predators such as lions and hyenas depend on the savanna for finding prey.

Keystone Mutualists

Keystone mutualists are two or more species that work like a team. A change in one species would impact the other, and change the entire ecosystem. These are often pollinators, such as bees.

In the woody grasslands of Patagonia, a region of South America, a species of hummingbird and native plants work together. Local trees, shrubs and flowering plants have evolved to only be pollinated by a hummingbird called the green-backed firecrown. Green-backed firecrowns pollinate 20 percent of local plant species. In turn, these plants provide the sugary nectar that makes up most of the hummingbird's diet.

Pockets of the existing Patagonian habitat would collapse without green-backed firecrowns. No other pollinator has adapted to pollinate these plants.

Other Organisms Crucial To Ecosystems

In addition to keystone species, there are other categories of organisms crucial to their ecosystems' survival.

Umbrella Species

Umbrella species are often confused with keystone

species. Both terms describe a single organism on which many other species depend. The main difference between the two is that an umbrella species travels widely so it has an effect on a larger area.





Umbrella species have large habitat needs, and the requirements of that habitat impact many other species living there. Most umbrella species are migratory — that is, they move from place to place.

For conservation — it's often important to identify umbrella species in specific areas. If an area is about to be protected, its measurements may be determined by how far a key umbrella species travels.

The Siberian tiger, an endangered species, is an umbrella species with a range of more than 620 miles in Russia's far east, with territory stretching into China and North Korea. Populations of deer, boar and moose are under the snowy "umbrella" of the Siberian tiger range.

Foundation Species

Foundation species play a major role in creating or maintaining a habitat.

Corals are a key example of a foundation species across many islands in the South Pacific Ocean. These tiny animals grow as a colony of thousands and even millions of individual polyps. The rocky outer layers of these polyps create enormous structures around islands: coral reefs.

Coral reefs are one of the most biologically diverse ecosystems on the planet. Microscopic plankton, as well as crustaceans, mollusks, sponges, fish and marine reptiles are all part of healthy coral reef ecosystems.

Coral reef ecosystems also contribute to the human geography of a region. Pummeled by waves and ocean currents, coral exoskeletons can experience erosion. These worn-away fragments of coral, along with bony fragments of organisms such as mollusk and crustaceans, create a soft sand known as coral sand.



Coral sand beaches are among the most popular tourist destinations in the world.

Ecosystem Engineers

Like foundation species, ecosystem engineers contribute to the physical geography of their habitat. Ecosystem engineers modify, create and maintain habitats.

Some engineers modify their environment by modifying their own biology. These are called autogenic engineers. Corals and trees are autogenic engineers. As they grow, they are a living part of the environment, providing food and shelter to other organisms. The hard outer shells left behind as corals die continue to define and modify the ecosystem.

Allogenic engineers physically change their environment from one state to another. Beavers are a classic example. They help maintain woodland ecosystems by thinning out older trees and allowing young saplings to grow. Converting these trees into timber for dams radically alters woodland meadows and streams, changing them into wetland habitats.

Invasive species are often ecosystem engineers. Lacking natural predators or other factors to constrain them, these introduced species change the existing environment in ways that hold back

the growth of the native ecosystem.

Kudzu, the so-called "vine that ate the South," is an invasive species of plant that modified the environment of the southeastern United States. Kudzu regularly fights native species for space and nutrients. As it crowds out native species, kudzu limits the pollinators, insects and bird species that inhabit an area.

Indicator Species

An indicator species describes an organism that is very sensitive to environmental changes in its ecosystem. Indicator species are almost immediately

affected by changes to the ecosystem and can give early warning that a habitat is suffering.

Changes associated with outside influences such as water pollution, air pollution or climate change first appear in indicator species.

In Chesapeake Bay, in the northeastern U.S., oysters are an indicator species. Oysters filter water as they strain it for food particles. Oysters filter nutrients, sediments and pollutants that enter the bay. Oyster beds help protect fisheries and coastal habitats. The health of oyster populations in the Chesapeake, therefore, is used to help understand the health of the entire ecosystem.

Flagship Species

A flagship species acts as a symbol for an environmental habitat, movement, campaign or issue. They can be mascots for entire ecosystems.

Identifying a flagship species relies heavily on the social, cultural and economic value of a species. They are often large animals with popular appeal due to how they look, or when they appear in popular culture, like movies, TV or books.

Flagship species can sometimes be symbols of general ideas about conservation. Polar bears are the unchallenged flagship species associated with climate change.

The giant panda is perhaps the most familiar flagship species. Pandas are the global symbol of endangered species.





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The marine food chain

By National Geographic Society on 03.13.19 Word Count **524** Level **MAX**



Image 1. A tiger shark (Galeocerdo cuvier) eating tuna in Fuvahmulah, Maldives, in 2018. Photo: Andrey Nekrasov/Barcroft Media via Getty Images

Some 300,000 marine species are known to science – about 15 percent of all the species identified on the planet. But the sea is so vast that a million or more as yet unknown species may live in its waters. Most of these aquatic species are tied together through the food web. NATIONAL GEOGRAPHIC

Level One: Photoautotrophs

The foundation of the sea's food chain is largely invisible. Countless billions of one-celled organisms, called phytoplankton, saturate sunlit upper-ocean waters worldwide. These tiny plants and bacteria capture the sun's energy and, through photosynthesis, convert nutrients and carbon dioxide into organic compounds. On the coast, seaweed and seagrasses do the same thing.

Together, these humble plants play a large role: They are the primary producers of the organic carbon that all animals in the ocean food web need to survive. They also produce more than half of

the oxygen that we breathe on Earth.

Level Two: Herbivores

The next level of the marine food chain is made up of animals that feast on the sea's abundant plant life. On the ocean's surface waters, microscopic animals—zooplankton, which includes jellyfish and the larval stages of some fish, barnacles, and mollusks—drift across the sea, grazing opportunistically. Larger herbivores include surgeonfish, parrotfish, green turtles and manatees.

Despite their differences in size, herbivores share a voracious appetite for ocean vegetation. Many of them also share the same fate – which is to become food for the carnivorous animals of the food chain's top two levels.

Level Three: Carnivores

The zooplankton of level two sustains a large and diverse group of small carnivores, such as sardines, herring and menhaden. This level of the food chain also includes larger animals, such as octopuses (which

feed on crabs and lobsters) and many fish (which feed on small invertebrates that live near shore). Though these animals are very successful hunters, they often fall prey to a simple fact of ocean life: big fish eat smaller fish.

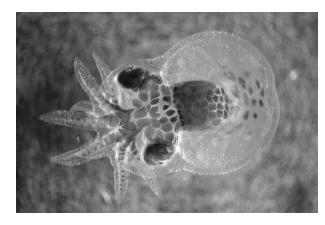
Level Four: Top Predators

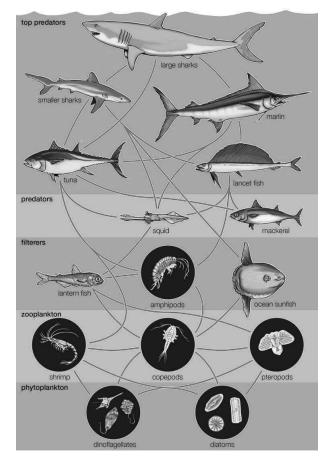
The large predators that sit atop the marine food chain are a diverse group that includes finned (sharks, tuna, dolphins), feathered (pelicans, penguins), and flippered (seals, walruses) animals. These apex predators tend to be large, fast and very good at catching prey. They are also long-lived and usually reproduce slowly.

But the marine food chain's top predators are common prey for the most deadly hunters of all – humans. When top predator species are depleted, their numbers are often slow to rebound, and their loss can send shock waves through the entire food web.

Alternative Food Chains

The primary marine food web, which is based on plant productivity, includes many of the sea's species – but not all of them. There are other deep-ocean ecosystems that are entirely independent of the sunlight energy that kick-starts the main marine





ecosystem. At their roots, these unique ecosystems are fueled by chemical energy, which enters the ocean from sources like seafloor hydrothermal vents.

Quiz

- 1 A factory is pumping toxic chemical into a portion of the ocean. These chemicals have been found to reduce the ability of plants to undergo photosynthesis. What effects might this have on the ocean's food web?
 - (A) The number of zooplankton present in the ocean will more than likely increase as the food demand for carnivores will increase.
 - (B) The number of top predators will increase because their natural food source will increase.
 - (C) There will most likely be a decrease in herbivores until a new food source can be found.
 - (D) There will most likely not be a change in the food web because there are many other food options available to ocean animals.
- 2 Which of the following claims does the author support the LEAST?
 - (A) Each level of the food chain includes specific species.
 - (B) Food chains are essential to maintaining a healthy ecosystem.
 - (C) Entire ecosystems are fueled by chemical energy.
 - (D) Marine species are connected through complex food webs.
- 3 What is true about the populate of top predators?
 - 1. It can take years to recover when the population declines rapidly.
 - 2. It has been harmed because of human activities.
 - 3. It often falls prey to other animals in the ocean.
 - 4. It plays an important role in keeping the ocean's food web in balance.
 - (A) 1 and 2
 - (B) 3 and 4
 - (C) 1, 2, and 4
 - (D) 2, 3, and 4
- 4 Read the following selections from the article.

Countless billions of one-celled organisms, called phytoplankton, saturate sunlit upper-ocean waters worldwide.

These apex predators tend to be large, fast and very good at catching prey. They are also longlived and usually reproduce slowly.

Which of the following conclusions can be drawn from these selections?

- (A) Apex predators and phytoplankton are both highly skilled species.
- (B) The size of a species' population is linked to its level of advancement.
- (C) Disruptions to the food chain are most disastrous at its lowest level.
- (D) Species can evolve to become more advanced over time.

- The ocean contains a vast array or organisms. Some of these organisms live at depths of water absent from sunlight. Since there is no sunlight penetrating the waters at these depths, photoautotrophs are not able to survive. With this information, how are deep ocean ecosystems able to function?
 - (A) Many of the deep ocean animals come to the surface to consume organisms.
 - (B) Deep ocean animals are fueled by chemical energy rather than products of photosynthesis.
 - (C) These deep ocean animals rely on organisms that have died and sank to the bottom of the ocean.
 - (D) These deep-ocean organisms are able to produce their own energy even in the absence of sunlight.
- What purpose is served by including examples of specific animals in the article?
 - (A) The examples help the reader to comprehend how difficult it is for marine species to get energy.
 - (B) The examples help the reader to visualize what would happen if the food chain was disrupted.
 - (C) The examples help the reader to understand the predators and prey that interact within the food chain.
 - (D) The examples help the reader to appreciate the diversity and uniqueness of marine species.
- 7 Billions of one-celled organisms live in the upper part of ocean waters. Here they capture energy from sunlight and use it for an important purpose. Although these organisms are virtually invisible, they play a vital role. How can an organism so small in size have such an important role in the ocean?
 - (A) Although these organisms are mostly invisible, they play a very important role in removing waste from the ocean.
 - (B) Many of the plant species depend on this organisms for nutrients. They are also a very important food source for plants.
 - (C) These organisms are the main food source for many of the carnivores.
 - (D) Phytoplankton use the sun's energy and turn nutrients into organic compounds that all animals in the ocean need to survive.

How effective is the last section, "Alternative Food Chains," at concluding the article for readers?

- (A) Effective; it sums up the important details discussed in the article.
- (B) Ineffective; it introduces a subtopic without explaining it completely.
- (C) Effective; it restates the article's main claim to prove a point.
- (D) Ineffective; it analyzes conflicting research and data.

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What does a bear do in the Alaska woods? Disperse seeds

By Dan Joling, Associated Press, adapted by Newsela staff on 02.26.18 Word Count **547**

Level MAX



A black bear walks through dense bushes of blueberries in Juneau, Alaska. A study of bears and berries has determined that the big animals are the main dispersers of fruit seeds in southeast Alaska. Photo from: Taal Levi and Laurie Harrer via AP

Does a bear leave scat in the woods? The answer is obvious but the effects on an ecosystem may not be.

Researchers from Oregon State University did a study. It concludes that brown and black bears -and not birds, as commonly thought -- are primary distributors of small fruit seeds in southeast Alaska. The bears spread the seeds through their excrement.

"Bears are essentially like farmers," said Taal Levi, an Oregon State assistant professor. "By planting seeds everywhere, they promote a vegetation community that feeds them."

Seed dispersal is a key component in the understanding of any ecosystem, Levi said. The study is the first instance of a temperate plant being primarily dispersed by mammals through their gut. The finding suggests repercussions for plant life when bears are removed. Brown bears, or grizzlies, flourish in size and numbers in the Tongass National Forest, America's largest. They gorge on spawning salmon in the forest's rivers, lakes and streams. As they wait for fish to enter streams, the bears eat berries.

Levi and graduate student Laurie Harrer, the study's primary author, set up motion-triggered video cameras. The cameras allowed them to detect which animals were eating berries. The researchers collected bear DNA from saliva left on plants after berries



disappeared. They recorded birds picking off a few berries at a time. Bears were recorded gulping berries by the hundreds.

When brown bears shift to eating fish, black bears move into berry patches.

Both bears, through their scat, disperse fruit seeds by the thousands. This profoundly affects what grows in the forest, according to the researchers.

Rodents that find bear scat further disperse seeds. They bury the seeds in caches a few millimeters deep, Levi said. If rodents lose track of caches, there's a chance for new plant growth.

It's an intricate system starting with salmon attracting bears, Levi said.

Laura Gough is an ecologist at Towson University. She has conducted research for more than 20 years on how plants interact with other organisms in Alaska's tundra. Gough said a lot of ecology research focuses on uncovering those relationships and how whole systems change if they're disrupted.

"When you think about that, if the species is an important food source, then if that plant should diminish in abundance, there could be a whole suite of changes to that ecosystem," she said.



When she read the study, she said, she thought of the

dodo bird stories she tells to students in biology classes. The extinct birds spread seeds of certain plants.

"When dodos went extinct, those plants basically went extinct as well," she said. "So, this link between animals that eat plant seeds and disperse them — that can maintain both populations."

The Oregon State study concludes that if bears are removed, the seeds they move would simply fall to the ground. A decline in bear density, even if only brown bears, likely leads to a reduction in seed dispersal. And that would have consequences for plants.



World Geography



Ninth Grade Summer At-Home Learning

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The five themes of geography help coordinate the study of our planet

By Matt Rosenberg, ThoughtCo.com on 11.12.19 Word Count 822 Level MAX



Image 1. The bridge over the Zambezi River at Victoria Falls separates the countries of Zimbabwe and Zambia. Photo by Diego Delso, delso.photo, License CC-BY-SA via Wikimedia Commons.

The five themes of geography are location, place, human-environment interaction, movement, and region. They were created in 1984 by the National Council for Geographic Education and the Association of American Geographers to facilitate and organize the teaching of geography in the K-12 classroom. While they have been supplanted by the National Geography Standards, they provide an effective organization of the teaching of geography.

Location

Most geographic studies begin with learning the location of places. Location can be relative or absolute.

Relative Location: Relative location refers to locating a place relative to other landmarks. For example, you could give the relative location of St. Louis, Missouri as being in eastern Missouri, along the Mississippi River southwest of Springfield, Illinois.

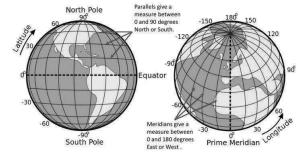
As one drives along most major highways, there are mileage signs indicating the distance to the next town or city. This information expresses your current location relative to the upcoming place. So, if a highway sign states that St. Louis is 96 miles away from Springfield, you know your relative location from St. Louis.

Relative location is also a term that is used to indicate a place's location within a larger context. For example, one could state that Missouri is located in the Midwest of the United States and is bordered by Illinois, Kentucky, Tennessee, Arkansas, Oklahoma, Kansas, Nebraska and Iowa. That is the relative location of Missouri based on its location within the United States.

Alternatively, you could state that Missouri is south of Iowa and north of Arkansas. This is yet another example of relative location.

Absolute Location: On the other hand, absolute location references a place on the Earth's surface based on specific geographic coordinates, such as latitude and longitude. Based on the previous example of St. Louis, the absolute location of St. Louis is 38°43' North 90°14' West.

One can also give an address as an absolute location. For example, the absolute location of St. Louis City Hall is 1200 Market Street, St. Louis, Missouri 63103. By providing the full address you can pinpoint the location of St. Louis City Hall on a map.



While you can give the geographic coordinates of a city or a building, it is difficult to provide the absolute location of an area such as a state or country because

such places can't be pinpointed. With some difficulty, you could provide the absolute locations of the boundaries of the state or country but most of the time it's easier to just display a map or describe the relative location of a place like a state or country.

Place

Place describes the physical and human characteristics of a location.

Physical characteristics: Includes a description of such things as the mountains, rivers, beaches, topography, climate, and animal and plant life of a place. If a place is described as hot, sandy, fertile or forested, these terms all paint a picture of the physical characteristics of the location. A topographical map is one tool used to illustrate the physical characteristics of a location.

Human characteristics: Includes the human-designed cultural features of a place. These features include land use, architectural styles, forms of livelihood, religious practices, political systems, common foods, local folklore, means of transportation, and methods of communication. For example, a location could be described as a technologically advanced French-speaking democracy with a Catholic majority.

Human-Environment Interaction

This theme considers how humans adapt to and modify the environment. Humans shape the landscape through their interaction with the land; this has both positive and negative effects on the environment. As an example of the human-environment interaction, think about how people

living in cold climates have often mined coal or drilled for natural gas in order to heat their homes. Another example would be the massive landfill projects in Boston conducted in the 18th and 19th centuries to expand habitable areas and improve transportation.

Movement

Humans move, a lot! In addition, ideas, fads, goods, resources and communication all travel distances. This theme studies movement and migration across the planet. The emigration of Syrians during war, the flow of water in the Gulf Stream, and the expansion of cell phone reception around the planet are all examples of movement.

Regions

Regions divide the world into manageable units for geographic study. Regions have some sort of characteristic that unifies the area. Regions can be formal, functional or vernacular.

Formal regions are those that are designated by official boundaries, such as cities, states, counties and countries. For the most part, they are clearly indicated and publicly known. Functional regions are defined by their connections. For example, the circulation area



for a major city area is the functional region of that paper. Vernacular regions are perceived regions, such as "The South," "The Midwest" or the "Middle East"; they have no formal boundaries but are understood in our mental maps of the world.

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Read the following sentence from the section "Human-Environment Interaction."

Humans shape the landscape through their interaction with the land; this has both positive and negative effects on the environment.

Which sentence from the article BEST supports this idea?

- (A) As one drives along most major highways, there are mileage signs indicating the distance to the next town or city.
- (B) As an example of the human-environment interaction, think about how people living in cold climates have often mined coal or drilled for natural gas in order to heat their homes.
- (C) The emigration of Syrians during war, the flow of water in the Gulf Stream, and the expansion of cellphone reception around the planet are all examples of movement.
- (D) Vernacular regions are perceived regions, such as "The South," "The Midwest" or the "Middle East"; they have no formal boundaries but are understood in our mental maps of the world.
- Read the following paragraph from the section "Regions."

Formal regions are those that are designated by official boundaries, such as cities, states, counties and countries. For the most part, they are clearly indicated and publicly known. Functional regions are defined by their connections. For example, the circulation area for a major city area is the functional region of that paper. Vernacular regions are perceived regions, such as "The South," "The Midwest" or the "Middle East"; they have no formal boundaries but are understood in our mental maps of the world.

Which of the following conclusions can be drawn from the paragraph above?

- (A) Functional regions are influenced by official boundaries.
- (B) Formal regions are not always well-known.
- (C) Vernacular regions can be based on biases.
- (D) "The South" is considered by many to be part of a functional region.

What purpose is served by including examples in the article of movement?

- (A) They highlight the variety of movement that is studied in this theme.
- (B) They explain how human migration patterns have changed over time.
- (C) They describe the tools that geographers use to study movement.
- (D) They illustrate the importance of studying movement.

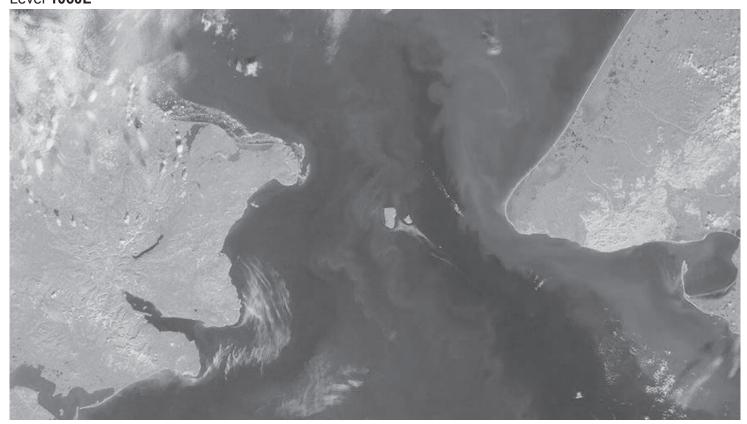
How is this article organized overall? What is the MOST LIKELY reason the author chose this organizational structure?

- (A) by problem and solution; to argue that the National Geography Standards should not have replaced the five themes of geography
- (B) by order of importance; to explain why location is the most important theme of geography to study
- (C) by topic; to help readers understand the key elements of each of the five themes of geography
- (D) by compare and contrast; to compare the five themes of geography with the new National Geography Standards

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History of the Land Bridge Theory

By U.S. National Park Service, adapted by Newsela staff on 09.07.17 Word Count **941** Level **1060L**



A satellite image of the Bering Strait. Cape Dezhnev, Russia, is on the left, the two Diomede Islands are in the middle and Cape Prince of Wales, Alaska, is on the right. Image by: NASA

People have lived in North America for at least 16,500 years. By the early 1800s, scientists began discussing the possibility of a land bridge that had connected Asia and North America thousands of years ago. The theory of a land bridge has fueled the imagination of explorers and scientists for centuries.

Early expeditions

In 1590, the Spanish missionary Fray Jose de Acosta was the first to suggest that a land bridge connected Asia to North America. Acosta believed that hunters from Asia had used it to cross into North America.

During the 18th century, Peter the Great, the Russian czar from 1682-1725, chartered an exploration of the eastern borders of the Russian Empire. He hired the



Danish explorer Vitus Bering to lead an expedition in the Bering Strait region. Bering's two

voyages confirmed that there was land and even people across the water; people who had been trading and traveling across the Bering Strait for thousands of years.

The second explorer to confirm the existence of present-day Alaska was the Englishman Captain James Cook. On his 1778 expedition, he produced detailed maps of the Alaskan coast. The outside world learned about the Bering Strait region from the results of his exploration. Soon, theories of human migration between Asia and North America began to gain strength.

Scientists confirm first Americans came from another place

The confirmation of a strait between Asia and North America fueled an interest in the possibility of a wide plain that might have connected the two continents. Beginning in the early 1800s, American scientists and naturalists started investigating archaeological sites on the coasts of the United States. Their findings suggested that the first people to live in North America had come to the continent from another place. But where? It wasn't until the mid-1920s that scientists would finally restart the search for evidence of how people came to North America.

Hopkins' groundbreaking discoveries

David M. Hopkins studied geology at the University of New Hampshire before accepting a position with the U.S. Geological Society in 1942. He worked with many scientists and researchers to make groundbreaking discoveries about the Bering Land Bridge.

The type of plants that grew on the land bridge had been questioned by scientists for years. Hopkins worked with three other scientists to confirm the age of plants frozen in a layer of ash from a volcanic eruption 18,000 years ago. Their findings confirmed that a greater variety of plants grew on the land bridge than originally believed.

To strengthen the concept of the Bering Land Bridge Theory, Hopkins reached out to scientists and researchers studying the Chukotka Peninsula. He brought their work to the attention of researchers and scientists studying the Seward Peninsula. His passion for the Bering Land Bridge did not just help create the Bering Land Bridge National Preserve. It has also built great interest in the Bering Land Bridge theory.

No one knows exactly when and how they came to Americas

In today's world, how people came to the Americas is still debated. As of 2008, findings suggest that a single population of modern humans migrated from southern Siberia as early as 30,000 years ago, and crossed over to the Americas 16,500 years ago. While this may represent the earliest migration, it was not the only one. Once the first humans made it over, it appears that several migrations took place over the next several millennia. The small amount of evidence available often conflicts. Some theories of the first Americans are still uncertain.

For years, it was thought the first Americans arrived about 13,500 years ago. But over the last 20 years, other theories have been proposed.

If the first Americans didn't travel to the continent over the Bering Land Bridge, where did they come from? When and how did they get here? In 1997, an archaeological site in Monte Verde, Chile, was discovered. This site dated back to 14,500 years ago. It also indicated that these humans settled much farther south than expected.

This finding brought up an interesting question. If humans settled in the Americas so much earlier than previously thought, is it possible that they reached the continent through a different route? One theory claims it is possible that the first Americans didn't cross the Bering Land Bridge at all. They didn't even travel by foot, but rather by boat across the Atlantic Ocean.

There are many challenges in studying the first Americans

Research and dating methods continue to improve. Other conclusions can be determined from the evidence we now have. Sites all around the country suggest that the earliest Americans dispersed throughout the continent at least 14,500 years ago.

In 2017, San Diego Natural History Museum paleontologist Tom Deméré claimed to have found evidence that humans reached California 130,000 years ago. A mastodon bone determined to be 130,000 years old had been crushed with a tool that Deméré believes only could have belonged to an early human. To date, however, additional evidence has not been found proving this claim.

Weaknesses in dating methods, artifacts, and genetics provide endless hurdles to overcome. But the study of the first Americans offers great opportunities to pioneer new discoveries in a field that still has not been completely studied. The theory of the first Americans crossing over the Bering Land Bridge remains possible. Thus, we continue to celebrate our distant past in the ways we protect and use our enduring resources.

- 1 Whi
 - Which two of the following sentences from the article include CENTRAL ideas of it?
 - 1. By the early 1800s, scientists began discussing the possibility of a land bridge that had connected Asia and North America thousands of years ago.
 - 2. During the 18th century, Peter the Great, the Russian czar from 1682-1725, chartered an exploration of the eastern borders of the Russian Empire.
 - 3. The type of plants that grew on the land bridge had been questioned by scientists for years.
 - 4. In today's world, how people came to the Americas is still debated.
 - (A) 1 and 3
 - (B) 1 and 4
 - (C) 2 and 3
 - (D) 2 and 4
- 2

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Read the section "Scientists confirm first Americans came from another place."

How is the CENTRAL idea developed in this section?

- (A) by illustrating the importance of archaeological sites farther south than expected
- (B) by describing the evidence that has been given to support the Bering Land Bridge theory
- (C) by emphasizing the idea that the first Americans have been studied for many years
- (D) by outlining the investigations and questions that led to the Bering Land Bridge theory

Why is the arrival of the first people in the Americas still debated?

- (A) because research and dating methods suggest the timeline of the Bering Land Bridge might not be correct
- (B) because evidence has been discovered that the first Americans actually traveled to the continent by boat
- (C) because Hopkins was unable to confirm the age of plants in a layer of volcanic ash from the Bering Strait
- (D) because many archaeologists believe that a land bridge from Siberia would have been impossible

What is the MOST LIKELY reason the author included the description of Tom Deméré's theory?

- (A) to elaborate on the types of studies that have cast doubt on the validity of the Bering Land Bridge theory in recent years
- (B) to emphasize that weaknesses in archaeological studies make the first arrival of people in the Americas uncertain
- (C) to introduce an argument in the archaeological community that surrounds the arrival of the first Americans
- (D) to illustrate the difficulty of finding evidence to support claims that the earliest Americans used tools to kill mastodons

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Reading Maps and Globes

By Encyclopaedia Britannica, adapted by Newsela staff on 08.30.17 Word Count **1,746** Level **1090L**



A globe is a three-dimensional representation of the Earth. Even a globe, however, cannot perfectly represent all the complexities of the people and places on our planet. Photo: Pixabay

Perhaps you have watched someone draw directions to their house on a napkin. Or maybe you like to watch as a map moves and changes on a smartphone as you ride in a car. Whether they are on paper or are digital, maps are an important part of everyday life.

A map is a pictorial representation of a large area. It could be of Earth's surface, the night sky, or the ocean. Whatever it is, maps give us an idea of our place in the world.

They once thought the world was flat

Usually a map is in shown in two dimensions. In other words, it is drawn on a flat surface. Because world maps are drawn on a flat surface, they cannot show Earth's curved surface without significant distortions of how things really are.

Globes help to solve that problem. A globe shows the planet as a sphere. It is usually mounted on an axle that allows for rotation. A globe can show a planet with less distortion because of its

rounded shape. However, Earth—like most other planets—is not a perfect sphere, but bulges a bit at the equator.

Maps and globes are tools for planning trips, learning about faraway places, and studying movements of people, goods and information. Maps can be misleading, however; their crisp lines, bright colors and labels might not always represent the truth. In reality, all maps and globes have some distortions and simplifications associated with the intended use of the map.

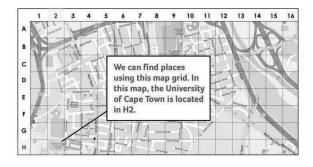
Reading a map or globe

Map styles and symbols vary across cultures, but most published maps share details in common. Maps should show a date of publication so people know it is still accurate.

Maps should also include place names, a scale (to compare sizes), and a guide to symbols (called a key or legend). There should be an arrow pointing north or a compass rose (showing the four cardinal directions: north, south, east, west).

Intuitive searches and basic grids

One strategy for reading a map is to look first for familiar shapes or outlines, oceans and inlets, the arcs of mountains, or the blue swoops of rivers. It might be helpful to find a familiar city, road or other landmark. After getting a general overview of the map, more complex symbols and information can be explored.



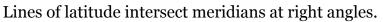
Many paper maps have a grid. Basic map grids place letters across the top (A, B, C, etc.) and numbers on the side (1, 2, 3, etc.). Let's say you are looking at a

map of your city and looking for a famous statue. The map may list that statue in the area "B4." You can trace down from the B and across from the 4 to find the statue.

Latitude and longitude

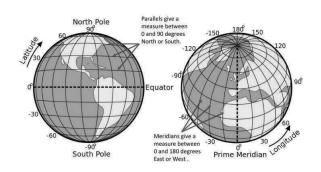
World maps show the latitude and longitude coordinates of Earth.

Lines of longitude, or meridians, are drawn from the North Pole to the South Pole. They show distances east or west from the prime meridian, which is at O degrees longitude and runs through the city of Greenwich, England.



These are also called parallels because they parallel the equator (0 degrees latitude), from which they measure north or south.

There are 360 degrees in a circle. Longitude measures to 180 degrees east or west (180 + 180 = 360) until arriving at a point in the mid-Pacific Ocean, on or near the International Date Line. That is the imaginary line running between the North Pole and the South Pole. It is also the point that distinguishes each calendar day from the next.



Latitude runs to the North Pole (90 degrees north) and the South Pole (90 degrees south). That adds up to 360 degrees if we see a globe in cross section (90 + 90 on one side, 90 + 90 on the other).

Scale

A scale is a mathematical relationship between actual sizes and the sizes shown on a map. If 1 centimeter on the map equals 10 actual kilometers, the ratio can be written 1:1,000,000. That is because, there are 1 million centimeters in 10 kilometers. A map's scale can also be shown as a line marked with distances.



The scale shows how much real-life distance is represented on the map.

There is no perfect map scale. It is a compromise between two conflicting aims—the desire to show

details, while also covering as much area as possible. Large-scale maps cover smaller areas, just as cameras with large zoom lenses provide close-ups. Small-scale maps show wider areas with less detail.

Map and globe orientation

People often assume that the top of a map should point north. However, map orientation is a choice, not a natural law. It is subject to political, economic, religious, and artistic desires. Muslim mapmakers, such as 12th-century geographer ash-Sharif al-Idrisi, often placed south at the top of their maps. Many medieval European maps were oriented toward the east, out of the belief that the Holy Land and the biblical Garden of Eden were the most important areas in the world.

Nothing is inherently wrong with a map topped by the South Pole, yet it seems odd to many people.

Video games and GPS (global positioning systems) in phones or in cars allow the user to change the way the map is oriented.

Map symbols

Some map symbols are easily understood, but others require a legend – a key that explains the symbols. That is because symbols change depending on where you are. Native Americans, for example, once used cross-shapes to indicate stars. Spanish conquistadors used crosses to represent churches and towns.

On a typical map, black lines usually symbolize roads. Tick-marked lines are railroads, circles or stars are



cities, and shading or dark lines are contours (lines that indicate how high up you are from sea level). Green and brown may shade real-world features (green forests, brown deserts).

Advantages of globes

Although globes are clunky and more expensive than maps, they show how the Earth is tilted (about 23.5 degrees) and how this relates to day lengths and the seasons. For example, when in a

dark room, a person can shine a flashlight (representing the sun) on one side of a globe. This demonstrates how sunlight reaches half the tilted Earth while leaving the rest in shadow, according to the season. Globes also show shapes, sizes and lines with fewer distortions.

Types of terrestrial maps

The most popular maps are road maps, political maps (showing countries, states or counties), and physical maps (of mountains, rivers, etc.).

Thematic maps are also popular, focusing on one or two themes, such as how much money people make on average in an area. General reference maps include a mixture of information, as do many road, political and physical maps.

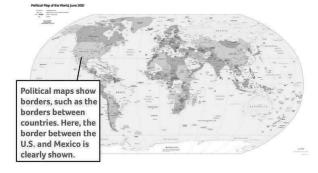
Transportation maps

Road maps blend political and physical information. GPS and Web-based aids such as Google Maps include these as basic maps. When these are too old, however, mistakes can occur. Green fields may appear where malls have been built, and streets might continue where they show up as dead ends.

As a GPS is moved, its satellite coordinates are beamed onto the base map. The screen shows a shifting, turning icon, which gives the illusion that the map is being created as you move.

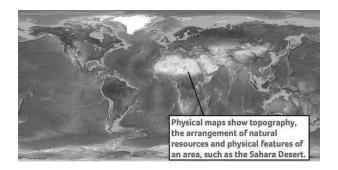
Political maps

Countries, provinces or states, cities and counties are the focus of political maps. Their bright colors and crisp borderlines encourage geographic literacy but are deceptively simple. They tell only partial truths about nations and borders. These maps do not show, for example, that many borders are not even lined by walls or fences. Moreover, they eventually change as countries disappear (such as the Soviet Union), are renamed (such as when Burma became Myanmar), or reunify (as East and West Germany did in 1990).



Physical maps

Rivers, lakes, mountains, hills, deserts and other natural features are on physical maps. Topographic maps show the relief, or shape of mountains, with dark shading or short lines showing how steep they are. Some show elevations with contours, lines of progressively greater height, such as 50, 60 and 70 feet. Contours drawn close together indicate steeper slopes (called grades, or gradients).



Older maps depict highlands with sketches of snowcapped peaks rather than with detailed sketches of mountains and plateaus. Some maps and globes are made with raised bumps along mountain ranges.

Thematic maps

If a map focuses on the symbolic display of data such as a country's population, it is called a thematic map. These maps might focus on language, religion, income, population, or any other kind of measurable data. Some show processes such as toxic waste spills, earthquakes, or the geologic history of continental drift.

The most common types use shading, line patterns, or dots to indicate different measures. Flow maps often use arrows to indicate change or movement.

Thematic maps can be misleading because they hide certain statistics. A presidential election map, for instance, might shade a state red if 50.1 percent of its voters elect a Republican lawmaker. It might then be

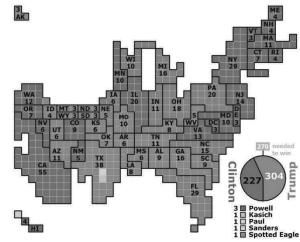


called a "red state." However, this ignores nearly half the population that did not vote to elect a lawmaker from that political party.

Cartograms

Another way of showing information about different locations is the cartogram. These involve more artwork than normal maps. They freely distort shapes, directions and areas beyond normal ranges to illustrate or explain statistics. A cartogram "weights" the sizes of states, provinces or countries to reflect information: a large number swells an area, while a small number shrinks it.

For example, a comparison of weapons exports by country would show a bloated United States because it ships out more weapons than any other country. A population cartogram would bloat the outlines of



India and China, the two countries in the world with the most people.

1

2

4

The sentence from the section "They once thought the world was flat" helps prove the claim that globes are more accurate representations of Earth than maps.

A globe shows the planet as a sphere.

Which sentence from the article provides further support for this claim?

- (A) Maps can be misleading, however; their crisp lines, bright colors and labels might not always represent the truth.
- (B) For example, when in a dark room, a person can shine a flashlight (representing the sun) on one side of a globe.
- (C) Globes also show shapes, sizes and lines with fewer distortions.
- (D) Some maps and globes are made with raised bumps along mountain ranges.
- Which section of the article highlights the idea that mapmakers make specific choices when determining which viewpoint a map should be drawn from?
 - (A) "Intuitive searches and basic grids"
 - (B) "Latitude and longitude"
 - (C) "Scale"
 - (D) "Map and globe orientation"
- 3 Read the sentences from the section "They once thought the world was flat."

Usually a map is in shown in two dimensions. In other words, it is drawn on a flat surface. Because world maps are drawn on a flat surface, they cannot show Earth's curved surface without significant distortions of how things really are.

Which option is the BEST definition of the word "distortions" as used in the third sentence?

- (A) misrepresentations
- (B) elaborations
- (C) changes
- (D) additions
- Read the selection from "Political Maps."

Countries, provinces or states, cities and counties are the focus of political maps. Their bright colors and crisp borderlines encourage geographic literacy but are deceptively simple.

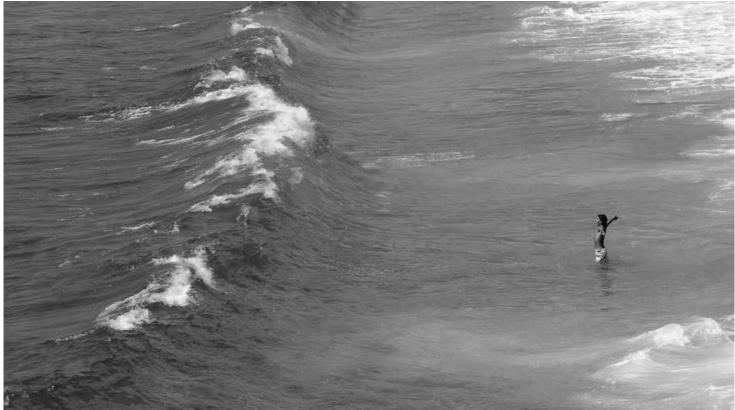
Which word from the selection shows a critical tone?

- (A) focus
- (B) crisp
- (C) deceptively
- (D) simple

Bodies Of Water: Oceans

By Encyclopaedia Britannica, adapted by Newsela staff on 10.02.17 Word Count **747**

Level MAX



A child plays in the waves of the Atlantic Ocean in Porto Corvo on the coast of Portugal. Photo from: Wikimedia Commons

An ocean is a massive body of salt water. Oceans cover nearly 71 percent of Earth's surface and contain almost 98 percent of all the water on Earth.

There is one world ocean, but it is divided into five main areas: the Pacific, the Atlantic, the Indian, the Arctic and the Southern, or Antarctic. Together, they can be seen as one world ocean because they have no real borders, and water flows freely among them. Smaller parts of these oceans are called seas, gulfs and bays.

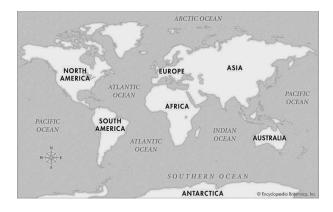
Ocean Water

Ocean water is salty. The saltiness comes from a chemical substance called sodium chloride, which is dissolved in the water. (The salt that people eat is sodium chloride in the form of crystals.)

Winds and other forces cause ocean water to be constantly in motion. Large amounts of ocean water move around Earth in patterns called currents. Ocean currents may be warm or cold. Warm currents tend to bring warm weather and rain to nearby land, while cold currents tend to cause a

dry climate. The Gulf Stream is a warm current that runs north along the eastern coast of the United States.

Winds also cause ocean water to move in waves. Steady, powerful winds cause big waves and gentle breezes create ripples. Large swells in ocean water usually come from stormy weather.



Tides, the rise and fall of ocean levels, are another way that ocean water moves. Tides happen throughout the

day. On a beach, for example, the ocean covers more sand at high tide than at low tide. The pull of a force called gravity among the Earth, the moon and the sun causes tides.

Ocean Floor

The ocean floor has many levels. The shallowest part of the oceans, called the continental shelf, lies along the edges of the continents. The edges of the continental shelf slope down toward the deep parts of the oceans, called the basins. At the bottom of the basins are large, flat plains.

In some places, deep cracks called trenches cut into the ocean floor. In other places, underwater mountain chains, called oceanic ridges, rise up from the floor. Earthquakes sometimes occur along the trenches and ridges, and parts of the ridges even contain active volcanoes.

Ocean Life

Living things inhabit all levels of Earth's oceans. Ocean plants grow fairly close to the water's surface because they need sunlight to stay alive. Sunlight penetrates the water to only about 656 feet. The most numerous ocean plants, called phytoplankton, are tiny, one-celled plants that drift with the ocean currents. Various kinds of sea grass and other plants also grow in the world's oceans, and seaweeds, which are plantlike forms of algae, are plentiful as well.



Like ocean plants, most ocean animals live in shallower water. This is because there are more plants and animals to eat near the water's surface. But animals also can be found in deep water, including within the oceans' deepest, darkest trenches.

The largest ocean animal is the blue whale. No larger animal has ever lived on Earth. The tiniest animals are a form of plankton called zooplankton. Hundreds of thousands of other types of animal also live in the ocean, including clams, crabs, squid, dolphins and many different kinds of fish. Corals and sea anemones look like plants, but they are animals, too.

Importance Of The Oceans

The world's oceans are important to life on Earth. Oceans are a great source of food for people around the world and also provide minerals, oil and natural gas. Phytoplankton and algae create much of the world's oxygen. Oceans also help to keep climates stable by storing heat from the sun.

Today, many dangers threaten the health of the oceans. People pollute oceans by dumping poisonous waste and garbage into them. Ocean pollution reduces oxygen in the water and harms ocean life. Overfishing and oil spills harm ocean life as well.

People called oceanographers study the oceans to try to keep them healthy. Some examine the quality of the water and the way the water moves. Others look at the structures of the seafloors and basins. Another group of oceanographers is interested in the plants and animals that live in oceans.

Quiz

1

- Which sentence from the article BEST supports the idea that oceans are important for life on Earth to thrive?
 - (A) Oceans are a great source of food for people around the world and also provide minerals, oil and natural gas.
 - (B) Ocean pollution reduces oxygen in the water and harms ocean life.
 - (C) People called oceanographers study the oceans to try to keep them healthy.
 - (D) Another group of oceanographers is interested in the plants and animals that live in oceans.
- 2 Read the section "Ocean Water."

Select the paragraph from the section that suggests that the people who live close to the ocean can feel the effect it has on the temperature in the area.

- 3 Which sentence would be BEST to include in a summary of the article?
 - (A) The ocean is divided into smaller parts called seas, gulfs and bays.
 - (B) The ocean gets its saltiness from a substance called sodium chloride.
 - (C) The ocean is known to have earthquakes and active volcanoes.
 - (D) The ocean is home to many diverse forms of plant and animal life.
- 4 Read the following detail from the article.

Oceans cover nearly 71 percent of Earth's surface and contain almost 98 percent of all the water on Earth.

How does this detail develop the CENTRAL idea of the article?

- (A) It shows readers why oceans are necessary for life on Earth.
- (B) It explains why the ocean has many different plants and animals.
- (C) It shows that a large portion of the Earth is covered by oceans.
- (D) It suggests that it is very important to keep oceans healthy.

Landforms: Mountains

By Encyclopaedia Britannica, adapted by Newsela staff on 10.10.17 Word Count **461** Level **MAX**



The peak and southern face of Mount Everest, the tallest mountain on the planet. Photo: Wikimedia Commons.

A mountain is a landform that rises high above its surroundings. Taller than a hill, it usually has steep slopes and a rounded or sharp peak. Mountains are rarely found alone. Groups of mountains are called ranges. Lines of ranges form mountain belts.

Mountains have played a major role in human history, forming geopolitical boundaries between countries and natural barriers to migration and transportation. They also have formed refuge areas for distinctive mountain cultures and economies, such as those that have flourished in the Himalayan nations of Tibet and Nepal. Potential water power and mineral deposits are commonly found in mountains but are frequently expensive to develop.

How Mountains Were Formed

Some mountains were formed by the activity of volcanoes. Scientists believe that most volcanic mountains are made up of rock that melted deep within Earth. The rock rose through Earth's surface, or crust. It then flowed onto the surface in the form of lava. The lava, along with volcanic dust, built up to form mountains. Volcanic mountains are typically steep and cone-shaped. Mount

Fuji in Japan, Mount Kilimanjaro in Africa and Mount Rainier in the United States are examples of volcanic mountains.

Other





mountains were formed by movements within Earth's surface, or crust. The theory called plate tectonics explains this type of mountain building. Earth's surface is divided into huge pieces called plates, which move very slowly. The continents sit on top of the plates and move with them. At times the plates collide, forcing the rock upward. The Himalayas of Asia are an example of this type of mountain chain. They were formed when a plate carrying India collided with the Asian plate.

Mountain Climate

Because of their great elevation, mountains affect climate and vegetation in different ways. Mountain areas typically have heavier rainfall than the surrounding lowlands. The windward sides of mountains tend to be more cloudy and rainy, and have smaller temperature ranges. Leeward sides of mountains are drier, sunnier and more variable in temperature.

Living In Mountain Lands

Mountain ranges are natural barriers to travel. Roads are difficult to build across them. Railroads need expensive tunnels to cross even low mountains. Therefore, mountain ranges tend to divide the people on either side of them. They often form borders between countries.

Life is hard in mountain lands. The high places of the world are cold and have little soil, making farming difficult. However, many mountain areas are vacation resorts. Skiing and climbing are popular mountain sports.

Quiz

1

4

- Which detail from the article would be MOST important to include in a summary of the article?
 - (A) Mountains have played a major role in human history, forming geopolitical boundaries between countries and natural barriers to migration and transportation.
 - (B) They also have formed refuge areas for distinctive mountain cultures and economies, such as those that have flourished in the Himalayan nations of Tibet and Nepal.
 - (C) Mount Fuji in Japan, Mount Kilimanjaro in Africa and Mount Rainier in the United States are examples of volcanic mountains.
 - (D) The theory called plate tectonics explains this type of mountain building. Earth's surface is divided into huge pieces called plates, which move very slowly.
- 2 Which sentence from the article BEST supports the article's CENTRAL idea?
 - (A) Some mountains were formed by the activity of volcanoes.
 - (B) Volcanic mountains are typically steep and cone-shaped.
 - (C) Earth's surface is divided into huge pieces called plates, which move very slowly.
 - (D) Railroads need expensive tunnels to cross even low mountains.

3 Read the section "Mountain Climate." What does this section explain that other sections do not?

- (A) how mountains impact the world around them
- (B) how mountains can be hard to travel around
- (C) how mountains can affect weather patterns
- (D) how mountains have very high elevations

Read the section "Living In Mountain Lands." How does this section contribute to the article's MAIN idea?

- (A) by stating how expensive it is to travel around mountains
- (B) by stating why farmers have trouble farming on mountains
- (C) by stating that mountains are formed in ranges
- (D) by stating how mountains continue to affect people today

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Landforms: Islands

By Encyclopaedia Britannica, adapted by Newsela staff on 10.13.17 Word Count **502** Level **MAX**



A small island in Lower Saranac Lake in the Adirondacks, New York. Photo: Wikimedia Commons.

An island is an area of land that is surrounded by water. Islands can be found in all bodies of water, from streams and rivers to lakes, seas, and oceans. The two main types of islands are oceanic islands and continental islands.

Oceanic Islands

Oceanic islands are the tops of underwater volcanoes. An oceanic island forms when a volcano erupts deep under the ocean and pushes the ocean floor upward into a mountain. The island is the top of that mountain. The Hawaiian Islands are examples of oceanic islands.

Atolls are another category of island in the ocean. An atoll is a ring of land around a shallow body of water called a lagoon. Atolls form when corals build a colony, or reef, around the top of a volcanic island. Eventually the reef reaches the surface of the water and becomes land. The volcanic island may sink, leaving a lagoon in its place. Atolls make up the country of the Marshall Islands.

Continental Islands

Continental islands are close to the continents, and are parts of the same land that makes up the continents. One way that continental islands form is by the flooding of valleys close to the coast. The valleys fill with seawater, and the tops of nearby hills then become islands. Long Island, which lies off the coast of New York State, is a continental island.

The islands in rivers and lakes are also continental islands. The city of Paris, France, began as a settlement on an island in the Seine River. Of river islands, probably the most famous is Manhattan,



which is part of New York City. It is bounded on the west by the Hudson River, on the east by the East River, on the northeast by the Harlem River and Spuyten Duyvil Creek, and on the south by Upper New York Bay. Manhattan has a total area of 22 square miles. The largest river island, Ilha de Marajo in the Amazon River in Brazil, is much, much bigger. It is 183 miles long and 124 miles wide, with an area of 18,900 square miles.

Archipelagoes

An archipelago is a group of islands. The islands in archipelagoes may be oceanic or continental. Japan and the Aleutian Islands in Alaska are archipelagoes. Indonesia is the largest archipelago in the world.

Island Life

Plant and animal life on islands within or very near a continent is normally representative of plants and animals that flourish on the continent. More isolated



oceanic islands, however, are usually colonized by only a few animal forms. They are often covered with luxuriant vegetation, the seed of which first arrived when carried by wind, water currents or birds. But the variety of plants is not usually great.

Quiz

1

Read the section "Continental Islands."

Select the sentence that suggests that continental islands are formed by natural disasters.

- (A) The valleys fill with seawater, and the tops of nearby hills then become islands.
- (B) Long Island, which lies off the coast of New York State, is a continental island.
- (C) The city of Paris, France, began as a settlement on an island in the Seine River.
- (D) The largest river island, Ilha de Marajo in the Amazon River in Brazil, is much, much bigger.

2 Which piece of evidence BEST explains the cause of atoll islands?

- (A) Atolls are another category of island in the ocean.
- (B) An atoll is a ring of land around a shallow body of water called a lagoon.
- (C) Eventually the reef reaches the surface of the water and becomes land.
- (D) The volcanic island may sink, leaving a lagoon in its place.
- 3 Read the section "Island Life."

What does this section explain that other sections do NOT?

- (A) how the wildlife of continental and oceanic islands compare
- (B) how continental islands are similar to their closest continent
- (C) how oceanic islands are similar to continental islands
- (D) how oceanic islands are different from continental islands
- 4 Read the selection from the section "Continental Islands."

Of river islands, probably the most famous is Manhattan, which is part of New York City.

How does this sentence contribute to the rest of the article?

- (A) It gives a widely recognizable example of a continental island.
- (B) It explains how the island of Manhattan was formed.
- (C) It defines what a river island is and how it is formed.
- (D) It compares Manhattan with other famous river islands.

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Landforms: Plateaus

By Encyclopaedia Britannica, adapted by Newsela staff on 10.11.17 Word Count **517** Level **MAX**



Kukenan Tepui is a beautiful plateau in Gran Sabana National Park, Venezuela. Photo by: Paolo Costa Baldi, Wikimedia Commons, License CC-BY-SA 3.0.

Raised, flat-surfaced areas bounded on one or more sides by cliffs or steep slopes are known as plateaus. They are found on every continent, along continental shelves and in most oceans. Continental plateaus, along with their enclosed basins, account for about 45 percent of Earth's land surface.

The largest plateaus include the continent of Africa, the western plateau of Australia and the Arabian Peninsula. In North America, plateaus occur along the western mountain system, in Alaska and west of the Appalachian Highlands. South America has plateaus in five regions: Guiana Highlands, Brazilian Highlands, Paraná Basin, the Patagonia region and the Andes. In Europe, plateaus are found in Spain, north of the Alps; in Scandinavia; and in western Russia. There are spectacular plateaus in central Turkey, Iran and Central Asia. They can also be found in the extensive region covered by the Tibetan Plateau.

How Plateaus Are Formed

Plateaus develop in many ways. They occur in a variety of geologic settings, too. Lava plateaus are built by the accumulation of basalt released by volcanic activity. Typical examples of these formations can be seen in Ethiopia, Somalia, the western United States, the Paraná Basin, Iceland and the Deccan Plateau of India.

Intermontane plateaus are high areas of diverse topography. They are enclosed within mountain systems. These plateaus can be found in most of the world's major mountain chains. The Tibetan Plateau in the Himalayas is the largest of these landforms. It covers 530,000 square miles. Intermontane plateaus are distributed worldwide. They include much of Central Asia, part of China's Sichuan Province, Mongolia, Anatolia, Armenia and Iran.

In the United States and Mexico, intermontane plateaus are called basin and range topography. They consist of closely spaced, parallel mountain ranges separated by elongated basins. These landforms are found chiefly between the Sierra Nevada and the Rockies in the United States and alongside the Sierra Madre Occidental mountains in Mexico.

Types Of Plateaus

Ice plateaus cover most of Greenland and Antarctica. In many places the sheets are more than 4,900 feet thick with bases that descend well below sea level. The ice is a relic of the Pleistocene ice age when continental glaciers covered much of the Arctic, sub-Arctic and some temperate regions.

Most oceanic plateaus occur along midocean rises, such as the Albatross Plateau of the eastern equatorial Pacific. Other oceanic plateaus occur along continental slopes, as exemplified by the Blake



Plateau off the southeastern coast of the United States. These plateaus rise at least 660 feet above the surrounding seafloor. Flat-lying marine sediments lie on top of them.

Continental plateaus are subject to erosion and dissection by wind, streams and glaciers. In some cases dissection has been so thorough that little remains of the original plateau surface. In dry regions, such as the southwestern United States, plateaus may be eroded into mesas and buttes. Plateaus, being elevated, often create local climates, which range from temperate to desertlike conditions.



Quiz

4

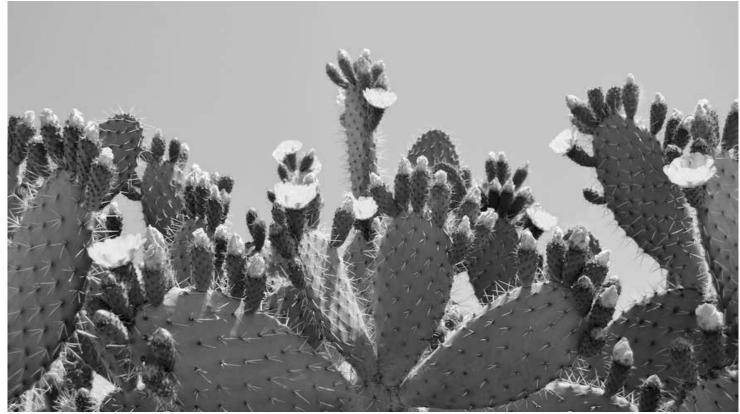
- 1 Read the section "Types Of Plateaus." Select the paragraph that suggests that climate and environment can alter the shape of plateaus.
- 2 Select the sentence from the section "How Plateaus Are Formed" that shows the vast size of plateaus.
 - (A) They consist of closely spaced, parallel mountain ranges separated by elongated basins.
 - (B) These plateaus can be found in most of the world's major mountain chains.
 - (C) It covers 530,000 square miles. Intermontane plateaus are distributed worldwide.
 - (D) Lava plateaus are built by the accumulation of basalt released by volcanic activity.
- 3 Which detail would be MOST important to include in a summary of the article?
 - (A) They are found on every continent, along continental shelves and in most oceans.
 - (B) Lava plateaus are built by the accumulation of basalt released by volcanic activity.
 - (C) The Tibetan Plateau in the Himalayas is the largest of these landforms.
 - (D) In some cases dissection has been so thorough that little remains of the original plateau surface.
 - Which of the following is the BEST summary of the section "How Plateaus Are Formed"?
 - In North America, intermontane plateaus are called basin and range topography. They are found between the Sierra Nevada and the Rockies. These plateaus are found in the Sierra Madre Occidental Mountains in Mexico.
 - (B) Plateaus develop in many ways. Intermontane plateaus are found among mountain systems. The Tibetan Plateau in the Himalayas is the largest intermontane in the world! These forms of plateaus are also found throughout North America.
 - (C) In Greenland and Antarctica, the ice sheets date back more than 4,900 years. The sheets are very thick and descend below sea level. Most oceanic plateaus occur along midocean rises.
 - (D) Lava plateaus are built by the accumulation of basalt released by volcanic activity. Typical examples of these formations can be seen in Ethiopia, Somalia, the western United States, the Paraná Basin, Iceland and the Deccan Plateau of India.

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Deserts, explained

By Christina Nunez, National Geographic Society, adapted by Newsela staff on 08.05.19 Word Count **868**

Level MAX



Deserts may seem lifeless, but in fact many species, like this cactus, have evolved special ways to survive in the harsh environments. Photo by: Blanchi Costela/Getty Images

Far from being barren wastelands, deserts are biologically rich habitats with a vast array of animals and plants that have adapted to the harsh conditions there. Some deserts are among the planet's last remaining areas of total wilderness. Yet more than 1 billion people, one-sixth of the Earth's population, actually live in desert regions.

What Is A Desert?

Deserts cover more than one-fifth of the Earth's land area. They are found on every continent. A place that receives less than 10 inches of rain per year is considered a desert. Deserts are part of a wider class of regions called drylands. These areas exist under a "moisture deficit." This means they can frequently lose more moisture through evaporation than they receive from annual precipitation.

Despite the common conceptions of deserts as hot, there are cold deserts as well. The largest hot desert in the world is northern Africa's Sahara. It reaches temperatures of up to 122 degrees Fahrenheit (50 degrees Celsius) during the day. But some deserts are always cold. This includes

the Gobi Desert in Asia and the polar deserts of the Antarctic and Arctic. These two deserts are the world's largest. Others are mountainous. Only about 20 percent of deserts are covered by sand.

The driest deserts, such as Chile's Atacama Desert, have parts that receive less than .08 inches of precipitation a year. Such environments are so harsh that scientists have even studied them for clues about life on Mars. On the other hand, every few years, an unusually rainy period can produce "super blooms." Even the Atacama becomes blanketed in wildflowers.

Desert Animals And Plants

Desert animals have evolved ways to help them keep cool and use less water. Camels can go for weeks without water. Their nostrils and eyelashes can form a barrier against sand. Many desert animals, such as the fennec fox, are nocturnal. They come out to hunt only when the sun has descended. Some animals, like the desert tortoise in the southwestern United States, spend much of their time underground. Most desert birds are nomadic. This means they crisscross the skies in search of food. And among insects, the Namibian desert beetle can harvest fog from the air for water. Because of their very special adaptations, desert animals are extremely vulnerable to changes in their habitat.

Desert plants may have to go without fresh water for years at a time. Some plants have adapted to the arid climate by growing long roots. These roots tap water from deep underground. Other plants, such as cacti, have special means of storing and conserving water.

Deserts, Land Use And Climate Change



Some of the world's semi-arid regions are turning into desert at an alarming rate. This process, known as desertification, is not caused by drought. Instead, it

usually arises from deforestation and the demands of human populations that settle on the semiarid lands. One example is the pounding of the soil by the hooves of livestock in ranching. It can degrade the soil and encourage erosion by wind and water. In northern China, growing urbanization has left much of the land unprotected against wind erosion and the buildup of sediment from the surrounding desert. This has created a desertification problem. It prompted the government to build a "great green wall" as a hedge against encroaching desert.

In existing deserts, some species are in peril because of climate change. Global warming threatens to change the ecology of deserts: Higher temperatures may produce more wildfires that alter desert landscapes. They do this by eliminating slow-growing trees and shrubs and replacing them with fast-growing grasses.

Many desert plants can live for hundreds of years. But in California, the iconic Joshua tree — the oldest found was 1,000 years old — may not survive a hotter climate, scientists warn. If they don't survive, that could affect species such as the yucca moth. This moth lays its eggs inside the Joshua tree flower.

Desert bird species could also be in danger from climate change. This is because heat waves can lead to lethal dehydration.

The effort to reduce planet-warming greenhouse gas emissions by expanding solar energy has also created some tensions for desert habitats. In the Mojave, the 2013 arrival of the Ivanpah solar thermal plant created concerns about how the facility would affect threatened desert tortoises. Conservationists are working to ensure solar energy projects like these can coexist with wildlife.

Other land use changes also threaten to degrade desert habitats. The downsizing of the Grand



Staircase-Escalante National Monument poses a threat to some of the 660 bee species that live in the area. The prospect of a border wall between the U.S. and Mexico could disconnect a third of 346 native wildlife species from 50 percent or more of their range that lies south of the border. This includes the desert bighorn sheep.

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Read the following inference.

Desert species have evolved in such specific ways that it would be difficult for them to survive in a different environment.

Which sentence from the article provides the BEST support for the statement above?

- (A) Desert animals have evolved ways to help them keep cool and use less water.
- (B) Some animals, like the desert tortoise in the southwestern United States, spend much of their time underground.
- (C) Because of their very special adaptations, desert animals are extremely vulnerable to changes in their habitat.
- (D) Other plants, such as cacti, have special means of storing and conserving water.

Read the section "Deserts, Land Use And Climate Change."

Which sentence from the section suggests that there might be solutions for some concerns caused by human activity in deserts?

- (A) They do this by eliminating slow-growing trees and shrubs and replacing them with fast-growing grasses.
- (B) The effort to reduce planet-warming greenhouse gas emissions by expanding solar energy has also created some tensions for desert habitats.
- (C) Conservationists are working to ensure solar energy projects like these can coexist with wildlife.
- (D) The downsizing of the Grand Staircase-Escalante National Monument poses a threat to some of the 660 bee species that live in the area.
- Which answer choice accurately summarizes the article without judgment?
 - (A) Deserts can be wonderful places for both animals and humans to live if they have the right adaptations.
 This is why many governments are working to build homes in deserts, and why they carelessly hurt desert trees.
 - (B) Deserts can frequently lose their moisture because of evaporation in the hottest areas of the world. This is why most desert animals choose to live in the cool underground, and why desert plants are often small and funny-looking.
 - (C) Deserts are interesting areas that have some of the most beautiful plants and animals on Earth. The variety of life in very hot and very cold deserts has allowed scientists to study them, helping to show what life would be like on Mars.
 - (D) Deserts are dry areas of the world that have a variety of plants and animals specially adapted for life there. Human activities are having serious effects on semi-arid lands and deserts, threatening the species that live there.

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But some deserts are always cold. This includes the Gobi Desert in Asia and the polar deserts of the Antarctic and Arctic. These two deserts are the world's largest. Others are mountainous. Only about 20 percent of deserts are covered by sand.

How does this detail develop the article's CENTRAL idea?

- (A) It emphasizes the large size of deserts and the amount of sand it takes to cover them.
- (B) It elaborates on the ways that deserts are different from many people's ideas about them.
- (C) It introduces the need to protect the species of the Antarctic and Arctic deserts.
- (D) It illustrates that polar deserts are often much larger than the typical hot desert.

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Weather and Climate: What is climate?

By Encyclopaedia Britannica on 04.26.17 Word Count **614** Level **MAX**



Adelie penguins sit on an iceberg in Antarctica, which has a polar climate. Photo by: Jason Auch via Flickr.

The weather found in a certain place over a long period of time is known as the climate. For example, a description of weather might be "It rained yesterday in Phoenix," while "Phoenix gets only 10 inches of rain per year" would be a statement about climate. Descriptions of climate include such weather elements as temperature, precipitation, humidity, wind, cloudiness and snow cover.

An area's climate determines what kinds of plants can grow and what kinds of animals can survive there. People use information about climates to decide which crops to plant, to prepare for natural disasters and even to choose the best season for traveling to vacation spots.

Studying Climates

The study of climates is called climatology. Scientists have many tools to help in this study. They construct weather stations on Earth to measure rainfall, temperature and wind speed. They send weather balloons with specialized instruments up into the atmosphere. Weather satellites in space also transmit information to scientists on the ground.

Factors That Affect Climate

Many factors affect climate. These factors include the sun, oceans, winds, land types, clouds and human activities.

Sunlight affects climate by hitting Earth unevenly. Places near the equator receive lots of strong sunlight throughout the year. This gives them a hot climate



year-round. Places far from the equator get less strong sunlight, and so they are cooler.

Oceans also affect climate. Land near an ocean usually has a milder climate than an inland area. The ocean warms the land in winter and cools it in summer. This happens because water cools and heats more slowly than land.

Winds affect climate by carrying warm or cool air to areas. Winds also bring different amounts of moisture.

The type of land in an area affects the climate, too. For example, mountain ranges can block cold air. Also, places that are at higher elevations are usually cooler than nearby places at lower elevations.

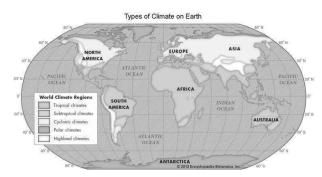
Clouds affect climate by blocking some of the heat received from the sun during the day. During the night, clouds keep heat from escaping into space.

Finally, human activities may affect climate. When people burn fuels such as oil and coal to run cars and heat homes, the fuels release certain gases into the air. These gases trap heat on Earth. Some scientists think that Earth is slowly getting warmer, and that this may be because of the extra gases in the air. This concept is known as global warming.

Types Of Climates

No two places on Earth have identical climates. Nevertheless, many climates are similar to one another. Some of these general types of climates are tropical, subtropical, cyclonic, polar and highland.

Tropical climates are warm all year and have no winter. They lie near the equator. Some tropical climates have a lot of rain. Others are dry.



Subtropical climates are found north and south of the tropical climates. They have a greater range of temperatures than tropical climates. They also may be humid or dry.

Cyclonic climates are found mostly north of the equator. In these climates, cold air from the north combines with warm tropical air from the south. This mixing often causes rain and snow. Cyclonic climates usually have warmer summers and colder winters.

Polar climates are very cold. Snow and ice often cover the land. Some polar areas always have a layer of frost, called permafrost, below the soil.

Highland climates have a great range of temperature between day and night. They tend to be humid and cooler than the lower lands nearby.

Quiz

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- What is the BEST description of the difference between climate and weather?
 - (A) Climate happens every day, while weather describes longer periods.
 - (B) Climate has little to do with weather because climate is so broad.
 - (C) Climate is just the sum of weather, such as rain, sleet, or snow.
 - (D) Climate is a description of weather trends over long periods.
- 2 Which piece of evidence BEST explains the reason for global warming?
 - (A) Sunlight affects climate by hitting Earth unevenly. Places near the equator receive lots of strong sunlight throughout the year.
 - (B) The ocean warms the land in winter and cools it in the summer. This happens because water cools and heats more slowly than land.
 - (C) Clouds affect climate by blocking some of the heat received from the sun during the day.
 - (D) Some scientists think that Earth is slowly getting warmer, and that this may be caused by the extra gases in the air.
- 3 Which of these areas is MOST LIKELY to have a warm climate?
 - (A) The area is far from the equator and high in the mountains.
 - (B) The area is close to the equator, in the lowlands.
 - (C) The area is close to the equator and high in the mountains.
 - (D) The area is far from the equator, in the lowlands.
- 4 Choose the paragraph from the introduction [paragraphs 1-2] that describes the importance of understanding climate.
- 5 Which of the following statements are TRUE about regional climates in relation to the equator?
 - (A) Climates in the subtropics are always dry.
 - (B) Climates south of the equator are all tropical.
 - (C) All climates near the equator are warm.
 - (D) All tropical climates are really rainy and humid.
 - Which selection would be MOST important to include in a summary of the article?
 - (A) For example, a description of weather might be "It rained yesterday in Phoenix," while "Phoenix gets only 10 inches of rain per year" would be a statement about climate.
 - (B) Many factors affect climate. These factors include the sun, oceans, winds, land types, clouds and human activities.
 - (C) Tropical climates are warm all year and have no winter. They lie near the equator. Some tropical climates have a lot of rain.
 - (D) The type of land in an area affects the climate, too. For example, mountain ranges can block cold air.
 - How are humans are causing a rise in Earth's temperature?
 - (A) by living together and generating lots of heat
 - (B) by building plant greenhouses that trap warming gases
 - (C) by reducing their use of oil and coal for activities
 - (D) by burning fossil fuels for various activities

1.Climate includes weather elements such as temperature, precipitation, humidity, wind, cloudiness and snow cover.

- 1. Climatologists study the different climates on Earth to understand and prepare for natural disasters.
- 2. Oceans, winds and sunlight affect climates the most, and can cause dangerous weather patterns.
- 3. Although areas on the earth have similar climates, no two areas have exactly the same climates.
- (A) 1 and 2
- (B) 3 and 4
- (C) 1 and 3
- (D) 2 and 4

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Weather and Climate: What is weather?

By Encyclopaedia Britannica, adapted by Newsela staff on 04.27.17 Word Count **360** Level **MAX**



A thunderstorm lights up the sky over Portugal. Photo from: Wikimedia Commons.

Weather is the daily state of the atmosphere, or air, in any given place. Climate is the average of weather conditions in an area over a long period. The weather is important to people. It affects their comfort, their food supply and even their safety.

Elements Of Weather

Many different elements combine to create weather. Temperature, how warm or cold it is outside, is one of the fundamental elements of weather.

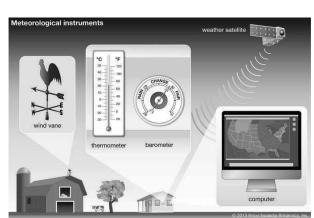
Wind, or the movement of air across Earth's surface, is a second element of weather. Winds may be gentle or powerful.

A third element of weather is humidity, or the amount of moisture in the air. Warm air can retain more moisture than cold air can.

Precipitation, the fourth element of weather, may come in many forms, including rain, hail, sleet and snow. The form precipitation takes varies based on other weather conditions, such as temperature. A fifth element of weather is atmospheric pressure, the weight of air above a given area. Changes in pressure help people to predict approaching storms. A storm is a disturbance in the atmosphere - for example, a thunderstorm or a hurricane.

Meteorology

The scientific study of weather is called





meteorology, and people who study and predict weather are called meteorologists.

Meteorologists use many instruments to gather information about weather. The thermometer and the barometer are some of the oldest and most common weather instruments. The thermometer measures temperature, and the barometer measures atmospheric pressure. Atmospheric pressure, also called barometric pressure, is is the weight of the air as felt at any given spot on Earth. Another common instrument is the wind vane, which shows the direction in which winds are blowing.

Today satellites in space collect weather information worldwide. Computers help meteorologists to analyze weather patterns and make weather forecasts.

Quiz

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- Would a cold, rainy day or a warm, rainy day be less humid?
 - (A) A warm, rainy day would be less humid because cold air holds more moisture.
 - (B) A cold, rainy day would be less humid because cold air holds less moisture.
 - (C) A cold, rainy day would be more humid because cold air holds more moisture.
 - (D) Both days would be equally humid because humidity is the amount of moisture in the air and rain is moisture.

2 Which of the following sentences best explains WHY meteorologists study weather?

- (A) The scientific study of weather is called meteorology.
- (B) Meteorologists use many instruments to gather information about weather.
- (C) Another common instrument is the wind vane, which shows the direction in which winds are blowing.
- (D) Computers help meteorologists to track weather patterns and to make weather forecasts, or predictions.
- How do weather and climate differ from each other?
 - (A) Climate is the average condition of the atmosphere in a single day. Weather is the daily global state of the air.
 - (B) Weather is the average condition of the atmosphere in a single day. Climate is the daily global state of the air.
 - (C) Climate is the average conditions of the atmosphere in an area over a long period of time. Weather is the daily state of the air in any given place.
 - (D) Weather is the average conditions of the atmosphere in an area over a long period of time. Climate is the daily state of the air in any given place.
- 4 Read the section "Meteorology." Based on information in this section, which of these statements is TRUE?
 - (A) Meteorologists know exactly what the weather will be like in the future.
 - (B) Meteorologists collect many different types of information about the weather.
 - (C) Now that there are weather satellites, meteorologists no longer have to use thermometers or barometers.
 - (D) Air pressure is the most important element of weather for a meteorologist to track.
- 5 How do satellites help meteorologists study weather?
 - (A) Satellites measure air temperature and pressure.
 - (B) Satellites measure wind speed and direction.
 - (C) Satellites measure precipitation and temperature.
 - (D) Satellites measure weather data from all around the world.

Which detail would be most important to include in a summary of the article?

- (A) Climate is the average of weather conditions in an area over a long period.
- (B) Warm air can hold more moisture than cold air can.
- (C) Meteorologists use many instruments to gather information about weather.
- (D) The form precipitation takes depends on other weather conditions, such as temperature.

What is precipitation?

- (A) It is the weight of air above a given area.
- (B) It is the movement of the air above Earth's surface.
- (C) It is the amount of moisture in the air of a given area.
- (D) It is the different forms of water falling to Earth's surface
- Which detail from the article BEST reflects a central idea?
 - (A) Many different elements combine to create weather.
 - (B) Winds may be gentle or powerful.
 - (C) The form precipitation takes depends on other weather conditions, such as temperature.
 - (D) Another common instrument is the wind vane, which shows the direction in which winds are blowing.

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Asia: Human geography

By National Geographic, adapted by Newela staff on 11.08.17 Word Count **1,477** Level **960L**

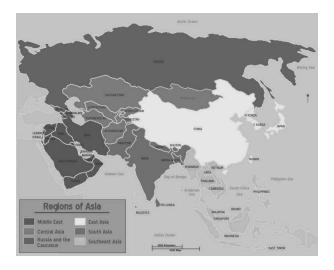


More than 18 million people live in Mumbai, India. It is one of the largest cities in Asia. Photo by: Anshuman Poyrekar/Hindustan Times via Getty Images

Asia is the largest continent in the world. It is home to about 60 percent of all people on Earth.

The term "Asia" was originally used by ancient Greeks to describe the civilizations to their east. These included the oldest civilizations in human history. Today, Asia includes 47 countries with rich and complex cultures.

The human geography of Asia can be broken down into two categories: cultural and political. As Asia takes on a greater role on the world stage, its human geography will become even more important in shaping the world's future.



Historic Cultures

Asia was the birthplace of the first human civilizations. They sprung up in an area called the Fertile Crescent, a region that is now called the Middle East. The Middle East is a region of the world in between Europe and Asia but technically is located on the continent of Asia. One exception is the country of Egypt, which is located in North Africa. The Tigris and Euphrates rivers flow through the Middle East.

Thousands of years ago, people started settling along the lush banks of these rivers, harvesting the wild wheat and barley that grew there. They soon became the world's first farmers. Before that, all humans had been hunter-gatherers, living on the move in search of food. With farming, people learned to survive by taking control of the natural environment.

As more tribes started farming and working together, new tools were invented, such as the wheel. Irrigation systems were also created, allowing people to move water from place to place and have bigger and better farms. Meanwhile, farmers tamed animals such as cows, sheep and pigs and raised them on their land.

This agricultural revolution made cities and civilizations possible. Farming let humans produce more food than they needed to survive, freeing up time for things like writing, religion, taxation, trade, and engineering.

Along with farming, religion also played an important role in the cultural geography of Asia. The largest religion to come from the continent is Buddhism.

Buddhism has its roots in Nepal and India and dates back more than 2,500 years. As Buddhism became more popular, trade routes helped it spread to other Asian territories. Today, Buddhism is a majority religion in many countries of eastern Asia.

The modern human geography of Asia is changing quickly. Cultures are adapting as new technologies reshape the world. In many Asian countries, the number of middle-class people is growing. Film, fashion, and music industries throughout Asia are on the rise.

Historic Issues

Asia has also been shaped by its complex political geography - the ways that power has been balanced among governments and the people. During the course of its history, it has been home to major political conflicts.

One of the oldest and most difficult disputes has to do with the Levant, an area in the modern-day Middle East. The Levant is sometimes called "The Holy Land," as it is important to followers of Jewish, Christian, and Muslim religions.

Because of its importance to so many groups, people have been fighting over the Levant for thousands of years. The most recent conflict is between Israel and its neighbors. Israel, the only Jewish-majority nation in the world, was established in 1948 in the Levant. Before that, the area was a colony controlled by the British called Palestine. Many Palestinians felt their land was being stolen and joined with neighboring countries to attack Israel as soon as it was created. This set off the Arab-Israeli War in 1948. Since then, several more wars have been fought over the land.

Today, there are two Palestinian Territories, the West Bank and Gaza, which both border Israel. There are still deep divisions between the Israeli and Palestinian people. An important part of Asia's political geography was defined by colonization. Much of Southeast Asia was taken over as colonies. These areas were controlled by governments in other parts of the world. Several foreign powers ruled over the region for more than 1,000 years.

European countries, the United States, and Japan controlled parts of Southeast Asia from the 1500s to the mid-1940s. They benefited from their colonies in a number of ways. Colonies expanded the countries' territory, increased trade, gave them access to cheap raw materials, and spread their culture.

The Dutch and British established companies that held as much power in Southeast Asia as governments. The Dutch East India Company, for example, was based in Indonesia. It had the power to print its own money and engage in war. These companies became very rich but gave little back to the local people who provided the necessary labor.

Colonialism was held in place with force. The French, for example, used their military to control the local populations in their colonies, resulting in the deaths of hundreds of thousands of people.

The countries of Southeast Asia are now independent. The effects of colonization are still felt in their economies, politics, and cultures, though. For instance, the Vietnamese language is written using the Roman alphabet because it was ruled by the French for so long.

In the mid-1900s, Asia was deeply affected by World War II. Of the Asian countries in the war, Japan experienced the worst destruction and the greatest loss of life. After the war, however, Japan's economy experienced a period of record growth. The Ministry of International Trade and Industry came up with new ideas to improve business and production. The government built transportation, communications, and technology systems. Today, Japan is one of the most developed countries in the world.

Current Issues

The economies of India and China have grown dramatically in the last 20 years. This growth has had both good and bad effects.

Since 2000, China has had the world's fastest-growing economy, according to the International Monetary Fund. This is largely because of the country's enormous manufacturing industry. It is predicted to become the world's largest economy in the coming decades.

As a result, wages have increased in China, which has given workers a better quality of life. The rapid growth in China has also caused a number of problems, though. While cities have expanded, many people in



the countryside have been left out. Millions have had to move to the city to find jobs. Manufacturing has also led to extreme pollution, causing health problems.

India's growth has been very different from China's. It is largely driven by the country's fastgrowing service industry. India has become a major producer of information technology services. These include things like over-the-phone customer service, or "tech support" for people with questions about their computers or other technology.

Wages in India have doubled in the past decade, bringing more than 430 million Indians out of poverty and creating a huge middle-class population. While the country has become wealthier overall, there are extreme gaps between the rich and the poor. Millions of Indians live on less than \$1.25 a day. As in China, people in the countryside in India have suffered the most.

Future Issues

Asia's political and economic power is likely to keep growing. This will probably have several serious effects on the environment.

Deforestation is one of those effects. In Southeast Asia, forests are being cut down too quickly. Between 1990 and 2010, they shrank in size by roughly 81.5 million acres, an area larger than the entire country of Vietnam.

Governments and others organizations are trying to step in. Myanmar (formerly known as Burma) has developed a network of more than 600 community forest management agreements that bring local people and the government together. Organizations



such as the Forest Stewardship Council and the Malaysian Timber Certification Scheme help companies do business in ways that minimize harm on important ecosystems like rainforests.

Perhaps the most serious threat to the environment at the moment is global warming. Global warming is caused by the buildup of greenhouse gases. As we build more cars and burn more fuel, we are trapping more and more heat in the atmosphere.

Nowhere are the dangers of global warming more real than in the Maldives, a country made up of hundreds of islands in the Indian Ocean. The effects of rising sea levels, a result of warmer temperatures, can already be felt there. A 2004 tsunami flooded the entire country, killing 82 people. People have had to find new homes. The effects of global warming on the Maldives will only get worse. 1

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Read the section "Historic Cultures."

Which detail from the section BEST explains the cause of changes to Asia's historic cultural geography?

- (A) Thousands of years ago, people started settling along the lush banks of these rivers, harvesting the wild wheat and barley that grew there.
- (B) As more tribes started farming and working together, new tools were invented, such as the wheel.
- (C) Farming let humans produce more food than they needed to survive, freeing up time for things like writing, religion, taxation, trade, and engineering.
- (D) As Buddhism became more popular, trade routes helped it spread to other Asian territories.
- 2 Read the inference below.

Asia's growing businesses and economy have helped those living in cities at the expense of people living in other areas.

Which sentence from the section "Current Issues" provides the BEST support for the statement above?

- (A) The economies of India and China have grown dramatically in the last 20 years.
- (B) Millions have had to move to the city to find jobs.
- (C) While the country has become wealthier overall, there are extreme gaps between the rich and the poor.
- (D) As in China, people in the countryside in India have suffered the most.
- Read the section "Historic Issues."

What does this section explain that other sections DO NOT?

- (A) how foreign powers shaped Asia's politics
- (B) how people in Asia manage their environment
- (C) the causes of economic growth in Asia's history
- (D) the effects of rapid growth on Asia's environment
- Read the selection from the section "Future Issues."

Myanmar (formerly known as Burma) has developed a network of more than 600 community forest management agreements that bring local people and the government together. Organizations such as the Forest Stewardship Council and the Malaysian Timber Certification Scheme help companies do business in ways that minimize harm on important ecosystems like rainforests.

How does this selection contribute to the article overall?

- (A) It indicates that the economy is likely to suffer as more effort is made to help Asia's environment.
- (B) It describes the effects that conservation efforts are already having on Asia's rainforests.
- (C) It contrasts the conservation efforts of local people in Asia with those of their governments.
- (D) It emphasizes how Asia is trying to find solutions that benefit both its economy and environment.

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Africa's rich human geography

By National Geographic Society, adapted by Newsela staff on 09.15.17 Word Count **1,226** Level **980L**



Samburu County, Kenya. Photo by: Edward Harris/Africa Progress Panel/Flickr.

Africa is the world's second-largest continent. It is bounded by the Mediterranean Sea, the Red Sea, the Indian Ocean and the Atlantic Ocean.

Today, Africa is home to more countries than any other continent. It is also home to many different peoples, each with their own culture and language.

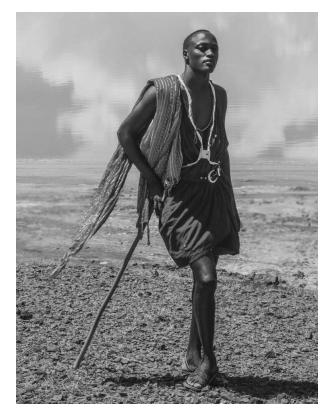
Major Cultural Groups

Today, there are hundreds of native languages and cultures in Africa. Most of these groups mix traditional customs and beliefs with modern social practices and conveniences. Three groups that demonstrate this are the Maasai, Tuareg and Bambuti.

Maasai peoples are the original settlers of southern Kenya and northern Tanzania. The Maasai are nomadic pastoralists. Nomadic pastoralists are people who are always on the move to find fresh grasslands or pastures for their livestock. The Maasai travel throughout East Africa and survive off the meat, blood and milk of their cattle. The Maasai are famous for their striking red robes and rich traditional culture. Young Maasai men between the ages of 15 and 30 are known as moran, or "warriors." Yet, even though some remain nomadic, many Maasai have begun to integrate themselves into the societies of Kenya and Tanzania.

Another pastoralist group are the Tuareg in North and West Africa. The harsh climate of the Sahara and the Sahel has influenced Tuareg culture for centuries. The Tuareg traditionally wear head wraps. called cheches, which protect them from the Saharan sun. Light, sturdy gowns called bubus allow for cool airflow while deflecting heat and sand. Tuaregs are often called the "blue men of the Sahara" for the bluecolored bubus they wear in the presence of women, strangers and in-laws.

A third major group are the Bambuti, which include four populations in Central Africa: the Sua, Aka, Efe and Mbuti. The Bambuti live primarily in the



Congo Basin and Ituri Forest. Sometimes, these groups are called "pygmies," although the term is often considered offensive. Pygmy is a term used to describe various ethnic groups who are usually less than 5 feet tall.

The Bambuti have been living in the same area for 4,500 years. Their ancestors were likely some of the first modern humans to migrate out of Africa.

The "Cradle Of Humankind"

The African continent is widely believed to be the "cradle of humankind." Most scientists believe human beings first appeared in Africa, then spread to the rest of the world. This human movement, or migration, plays a key role in Africa and the world's history. It began tens of thousands of years ago.

Two other major migrations helped shape Africa. These are the Bantu Migration and the African slave trade.

The Huge Bantu Migration

The Bantu Migration was a huge migration of people across Africa. It began about 2,000 years ago, and lasted for 1,500 years. The migrants were a people whose language belonged to the Kongo-Niger language group. "Bantu" is a common Kongo-Niger word for human being.

Historians do not know why the Bantu moved away from their homes near the Niger river in West Africa. They first moved southeast, through the rain forests of Central Africa. Eventually, they migrated to the southern parts of the continent.

Bantu migrants introduced many new skills into the areas they entered. These skills included growing crops and forging tools and weapons from metal. Such skills allowed Africans to cultivate

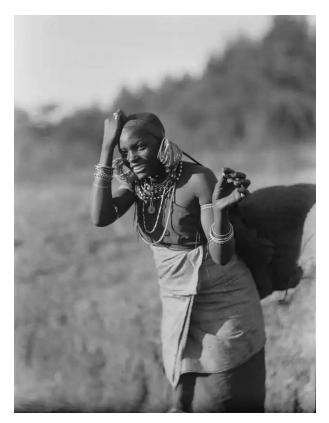
many new regions. Many hunter-gatherer communities were absorbed into the more technologically advanced Bantu culture.

Today, much of the African population is at least partly descended from these Bantu migrants. This is especially true in East, Central and Southern Africa.

The Slave Trade

The third major human migration in Africa was caused by the slave trade.

Between the 1400s and 1800s, European slave traders forced more than 15 million Africans into slavery. These slaves were transported across the Atlantic Ocean to be sold in North and South America. Millions of slaves were also transported within the continent. Most were taken from Central Africa and Madagascar. They were then brought to North Africa and the European colony of South Africa.



Millions of Africans died in the slave trade. Thousands died during the forced migration to trading centers, and even more lost their lives during the dangerous voyage across the Atlantic Ocean. Altogether, slavery may have cut Africa's population growth in half.

The Great West African Kingdoms

Before the slave trade, western Africa had seen the rise and fall of three great kingdoms between 800 and the 1500s. The first was the Kingdom of Ghana, which became a powerful empire through its gold trade. The Ghanaian trade routes spread far and wide, into the rest of Africa and as far as Europe. Ghanaian kings controlled the region for about 400 years.

Next came the Kingdom of Mali, which took over and continued the Kingdom of Ghana's gold trade. In addition, it developed a profitable trade in salt and copper. The Kingdom of Mali's great wealth allowed it to develop important learning centers that drew scholars from around the world. In particular, Mali became a center for Islam, one of the great world religions along with Christianity, Buddhism and Hinduism.

The Kingdom of Songhai took over the Kingdom of Mali, and expanded even further. Songhai kings



expanded trade routes, set up a new system of laws, expanded the military and encouraged scholarship.

Colonization And Problems Today

Colonization by Western powers dramatically changed Africa. From the 1880s to the 1900s, almost all of Africa was exploited and colonized. European powers saw Africa as a source of raw materials and a market for manufactured goods. The European colonizers included Britain, France, Germany, Belgium and Italy.

The effects of colonialism haunt Africa today. Natural resources, including diamonds and gold, were overexploited. European business owners became wealthy from trade in these natural resources, while their African workers labored in poor conditions for little pay.



European powers drew new political borders that divided established governments and cultural groups. These new boundaries also forced different cultural groups to live together, which led to tensions and conflicts that last to this day.

After World War II (1939–1945), Africans quickly rose up against colonial rule. By 1966, all but six African countries were independent nation-states.

However, many parts of Africa still face poverty, hunger and lack of medical resources. Another problem is global warming, which is the warming of the planet due to gases from cars and factories. In many parts of Africa, and the world, global warming is making it harder and harder to survive. Many communities in Africa are forced to relocate and become refugees in other countries.

Africa will need foreign assistance in order to react against climate change. For this to become a reality, leaders within and outside of Africa will need to seek greater international cooperation.



Quiz

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1 Read the section "Major Cultural Groups."

Which paragraph in this section BEST supports the conclusion that the traditions of some African cultural groups are changing?

2 Read the inference below.

The slave trade devastated civilization on the continent of Africa.

Which sentence from the section "The Slave Trade" provides the BEST support to the statement above?

- (A) Between the 1400s and 1800s, European slave traders forced more than 15 million Africans into slavery.
- (B) Millions of slaves were also transported within the continent.
- (C) Thousands died during the forced migration to trading centers, and even more lost their lives during the dangerous voyage across the Atlantic Ocean.
- (D) Altogether, slavery may have cut Africa's population growth in half.
- Read the section "The Great West African Kingdoms."

HOW does this section contribute to the article's MAIN idea?

- (A) It shows that challenges in modern Africa are the product of a series of poor leaders in the African kingdoms.
- (B) It demonstrates the role that Islam played in the rise of large, powerful civilizations in Africa.
- (C) It explains the advances and innovations of the African kingdoms that would later spread across the globe.
- (D) It describes the achievements of the African kingdoms that would later be decimated by the slave trade.
- Read the section "Major Cultural Groups."

What does this section show that other sections do NOT?

- (A) It shows the wide variety of cultures in Africa and how these cultures have adapted to modern times.
- (B) It explains the conflict between three major cultural groups in modern Africa.
- (C) It explains the differences between life in African cities and life for nomadic pastoralists.
- (D) It shows the diversity of cultures in Africa and how traditional practices have been replaced by modern technology.

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Australia and Oceania: Human geography

By National Geographic, adapted by Newsela staff on 09.20.17 Word Count **1,443** Level **1040L**



Dugout canoes, introduced by Macassan trepangers hundreds of years ago. Northern Territory, Australia. Photo by: Auscape/UIG/Getty Images.

Oceania is a region made up of thousands of islands throughout the Central and South Pacific Ocean. It includes Australia, the smallest continent in terms of total land area. Most of Oceania is in the Pacific, a vast body of water that is larger than all of the landmasses on Earth combined. The name "Oceania" fairly establishes the Pacific Ocean as the defining characteristic of the region.

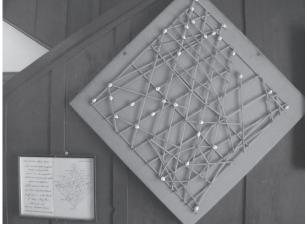
Australia takes up much of Oceania. There are two other major landmasses. One is the country of New Zealand. The other is the island of New Guinea. It is made up of the nation of Papua New Guinea on one-half of the island and Papua (owned by Indonesia) on the other half.

Oceania also includes three island regions: Melanesia, Micronesia and Polynesia (which includes the U.S. state of Hawaii). Melanesia, Micronesia and Polynesia are each made up of many islands. Some are independent nations while others belong to countries like France and the United States.

Historic Cultures

Indigenous cultures are closely tied to the geography of Oceania. Polynesian culture, for example, developed as Southeast Asian sailors explored the South Pacific. This seafaring culture developed almost entirely from its geography.





Beginning about 1500 B.C., sailors began moving east from the island of New Guinea. The farther they traveled, the more advanced their navigation became. Polynesians developed large, double-hulled boats called outrigger canoes. Polynesian culture also relied on a sophisticated navigation system based on observations of the stars, oceans and birds.

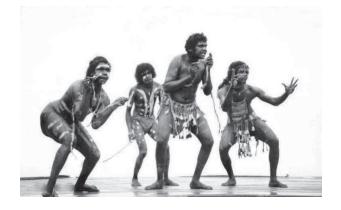
Polynesians were able to domesticate plants and animals and transport them to islands that lacked them. This allowed Polynesians to establish stable, permanent communities throughout the islands of the South Pacific. By the year A.D. 1000, these seafarers had colonized the islands of Melanesia, Micronesia and Polynesia. In the process, they established a unique, ocean-oriented culture that persists today.

Indigenous cultures of Oceania also changed the environments in which they lived. As they explored the South Pacific, Polynesians brought agriculture to isolated islands, for example.

In another example, the Maori people had a significant effect on New Zealand's forests and animals. Between the 14th and the 19th centuries, Maori reduced New Zealand's forest cover by about half, largely through controlled fires used to clear land for agriculture.

Nearly 40 species of birds died out during this brief period of time. This was due to habitat destruction, hunting and competition with new species. Dogs and rats, for example, were introduced to the islands of New Zealand by the Maori.

Aboriginal Australian cultures often had strong relationships with the local environment. They developed myths to explain the landscape. Modern scientific research has proven that many of these myths are fairly accurate historic records of the land and how the environment changed.



Contemporary Cultures

Oceania's vast, ocean-focused geography continues to influence modern cultures. Cultural groups and practices focus on uniting despite their isolated locations and small populations.

Papua New Guinea is one of the most varied countries in the world, with more than 700 indigenous groups and 850 languages. The government recognizes that traditional, tribal land belongs to the indigenous community. Almost all of the land in Papua New Guinea fits this category. Less than 3 percent of the land is privately owned.

But there are disagreements over land use and rights to farm and do mining between indigenous groups, the government and corporations.

Rugby is a very popular sport throughout the continent — more popular than soccer, baseball or cricket. The tournaments and games that occur between these countries make rugby a unifying sport in Oceania.

The arts are another unifying cultural practice in Oceania. The Festival of Pacific





Arts is a festival hosted every four years in a different country. The festival encourages different expressions of Pacific-wide culture, focusing on traditional song and dance.

Tourism is the continent's largest industry, creating jobs and spreading money throughout the Pacific Islands.

Tourism, however, also can negatively affect economies and ecosystems. It can lead to overcrowding and depletion of isolated islands' scarce resources. The waters have been overfished. Pollution from boats and cruise ships can litter the tropical ocean, while runoff from the islands may also contain pollutants.

Historic Issues

The European colonization of Australia and Oceania defined the continent's early political geography. Exploration began in the 16th century when Portuguese explorer Ferdinand Magellan landed on the Mariana Islands. Today, many countries in Oceania have majority European

populations and a strong European culture. English is the main language throughout most of the continent.

Indigenous populations were treated harshly during the colonial period. Colonizers implemented their own systems of governance, land management and trade. These efforts had severe consequences that continue to affect indigenous groups and their cultural systems today.

During the Cold War, the isolated islands of Australia and Oceania were used for nuclear weapons testing by the American, British and French. The most wellknown of these experiments were carried out on the Bikini Atoll, part of the Marshall Islands. The U.S. began testing atomic weapons at the Bikini Atoll in 1946.

These tests had devastating human and environmental impacts on the islands. Many people were forcibly removed from their island homes. People who witnessed the tests suffered from high



rates of cancer. The ecosystem and habitats of the island were permanently changed.

Contemporary Issues

Over the last half-decade, Oceania's indigenous groups have fought to extend their rights in their home countries.

The Maori Party represents the rights of the Maori in New Zealand. The party founded the Maori Economic Taskforce to increase economic opportunity and secured a multimillion-dollar economic package for environmental initiatives. It also created a fund of \$5 million a year to help Maori

doctors develop culturally appropriate programs.

Aboriginal Australians, much like the Maori, can be defined as a marginalized population, or a group of people who are treated as less significant than the majority population. Aborigines suffer from higher rates of disease, imprisonment and unemployment. Aborigines' life expectancy is about 18 to 19 years less than non-indigenous people.

Aborigines have a tense relationship with their home country. In 2007, the Northern Territory National Emergency Response, a federal program, was created



to address concerns about aboriginal communities in Australia's isolated Northern Territory.

The government of Australia is working to resolve these tensions. In 2010, Ken Wyatt became the first Aboriginal Australian elected to the Australian House of Representatives. In 2008, former Prime Minister Kevin Rudd issued a public apology to members of the "Stolen Generations." The Stolen Generations were aboriginal children taken from their families and raised under European supervision in group homes. This policy began in 1869 and officially ended in 1969.

Future Issues

Oceania's political and financial future rests largely on minimizing the effects of climate change. In fact, many scientists argue that Australia and Oceania is the continent that will be most affected by

climate change because of its climate and geography.

The heavily coastal populations of the continent's small islands are in danger of flooding and erosion because of sea level rise. Warming temperatures have severely damaged many coral reef ecosystems and contributed to major droughts. Glaciers are also melting faster. That increases the height of the sea level.

Governments and agencies in Australia and Oceania are taking steps to minimize the effects of climate



change. Countries such as Australia and New Zealand agreed to reduce carbon emissions. Other Oceanic countries argued that the international agreement unfairly disadvantages developing countries, especially small island states.

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The following sentence from the section "Contemporary Cultures" helps prove the claim that indigenous groups have had some success at protecting their rights.

The government recognizes that traditional, tribal land belongs to the indigenous community.

Which sentence from the section "Contemporary Issues" provides further support for this claim?

- (A) Over the last half-decade, Oceania's indigenous groups have fought to extend their rights in their home countries.
- (B) The party founded the Maori Economic Taskforce to increase economic opportunity and secured a multimillion-dollar economic package for environmental initiatives.
- (C) Aboriginal Australians, much like the Maori, can be defined as a marginalized population, or a group of people who are treated as less significant than the majority population.
- (D) In 2010, Ken Wyatt became the first Aboriginal Australian elected to the Australian House of Representatives.
- Read the sentences from the article.
 - 1. Today, many countries in Oceania have majority European populations and a strong European culture.
 - 2. Aborigines' life expectancy is about 18 to 19 years less than non-indigenous people.
 - 3. The Stolen Generations were aboriginal children taken from their families and raised under European supervision in group homes.
 - 4. In fact, many scientists argue that Australia and Oceania is the continent that will be most affected by climate change because of its climate and geography.

Which two sentences taken together provide the BEST evidence that colonization by other countries disrupted the indigenous culture of Oceania?

- (A) 1 and 2
- (B) 2 and 4
- (C) 1 and 3
- (D) 3 and 4

Examine the map in the introduction [paragraphs 1-3].

HOW does this image contribute to your understanding of Oceania?

- (A) by outlining the routes most often navigated by early indigenous people
- (B) by illustrating the vast ocean that early cultures traveled between islands
- (C) by contrasting the size of independent nations with those belonging to others
- (D) by showing how environmental changes have impacted the area's geography

Look at the images in the sections "Historic Issues" and "Future Issues."

4

Which option accurately compares and contrasts HOW each image affects your understanding of Oceania?

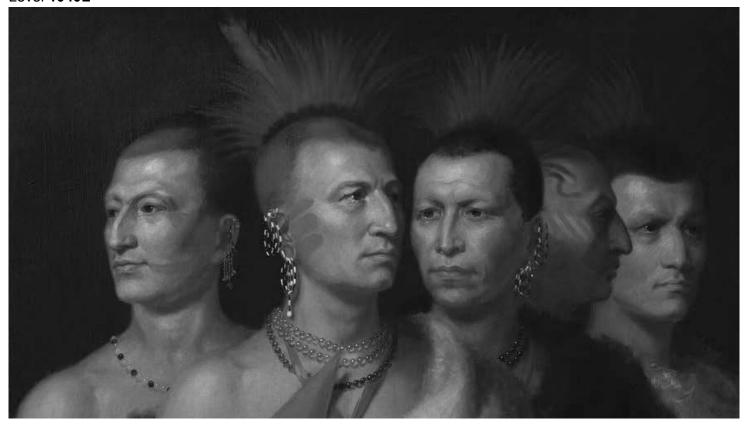
- (A) The first image shows a past cause of harm to Oceania's environment, and the other image shows an area that is now at risk.
- (B) The first image shows what Oceania's environment looked like in the past, and the other image shows what it looks like today.
- (C) The first image shows what colonial powers did to harm Oceania in the past, and the other image shows what they're doing now.
- (D) The first image shows an action taken while Oceania was under colonial rule, and the other image shows indigenous rule.

This article is available at 5 reading levels at https://newsela.com.

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North America: Human geography

By National Geographic, adapted by Newsela staff on 11.08.17 Word Count **1,353** Level **1040L**



A painting of (from left) Young Omahaw, War Eagle, Little Missouri and two Pawnees. Native Americans were some of the first inhabitants of North America. After centuries of wars, colonization and immigration, the continent is now inhabited by a wide range of people and cultures. Image from the public domain

North America extends from the tiny Aleutian Islands in the northwest to the Isthmus of Panama in the south. It is the third-largest continent in the world.

North America and South America are named after Italian navigator Amerigo Vespucci. Vespucci was the first European to suggest that the Americas were not part of the East Indies but an entirely separate landmass. The East Indies were the area of eastern Asia that includes today's countries of Indonesia, Malaysia and the Phillippines.

Today, North America is home to 23 countries and many territories. The countries of Canada, the United States, Greenland, Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama are part of North America. So are the island countries and territories of the Caribbean Sea and western North Atlantic Ocean.

North America's human landscape is varied, rich and constantly changing.

Historic Cultures

Native cultures shaped, and were shaped by, the





geography of North America. The first North

Americans are believed to have migrated from Siberia,

in northern Asia, by crossing a land bridge over the Bering Strait. From there, they spread south to Florida, California, Mexico and Central America.

The Olmec and the Maya people built the first cities on the continent in central Mexico. The great urban areas of Tenochtitlan, Texcoco and Tlacopan boasted sophisticated engineering and structures, such as canals, apartment buildings and irrigation systems.

Many of these early North American cultures were scientifically and agriculturally advanced. Mayan calendars and almanacs recorded celestial events such as eclipses and seasonal changes. The Mayans also invented a counting system that represented very large numbers using only three symbols. It included dots, lines and a football-shaped symbol that indicated a zero. The Mayans were, in fact, the first culture to have a written symbol for zero.

Cultures throughout southern North America harvested corn, squash and beans. People were not limited to producing food and shelter for their families. Some could work in the food and construction industries while others became engineers, artists and political leaders. The leading North American civilizations included the Maya and Aztec, in what is now Mexico, and the Iroquois in southeastern Canada and the northeastern United States.

In the north, other native communities followed favorable weather, natural agricultural cycles and animal migrations. The Plains Indians, for example, followed the seasonal grazing and migration of the American bison. Plains Indians include Lakota, Blackfoot and Nez Perce. They ate bison meat and used hides and bones to create dwellings, tools and clothing. Plains Indian communities and bison were dependent on each other. The extinction of bison dramatically weakened the power and influence of the Plains people.



The environment also impacted traditional beliefs and social structure. For instance, the Inuit in the Arctic were deeply influenced by the aurora borealis, or Northern Lights. They believed the amazing light displays were images of their family and friends in the afterlife, or the souls of animals and spirits.

Contemporary Cultures

Contemporary North American societies are also greatly influenced by the continent's environment. North America's economy is centered largely on the extraction, development and trade of natural resources.

Tourism is also an important part of North America's economy, especially for the small Caribbean nations. Their coral reefs are among the best diving destinations in the world. The islands see about 20 million visitors every year. In 2010, tourism brought in \$39 billion.

North America's multicultural history is another defining feature of the continent's human geography. Immigrants have sought opportunities, particularly in the U.S. and Canada, for hundreds of years. Immigrants or children of immigrants to North America have become scientific, business and cultural leaders.

The strong presence of immigrants is reflected in present-day ethnic neighborhoods. There is the Cuban "Little Havana" in Miami, Florida; the Somali "Little Mogadishu" in Minneapolis, Minnesota; the Korean "Koreatown" in Toronto, Canada; and the North African "Little Maghreb" in Montreal, Quebec.

Many immigrants are also refugees. Refugees may be fleeing economic hardship or political or social pressure. They are escaping civil war, political oppression, violence and earthquakes.

Historic Issues

Contact between the indigenous people of North America and European explorers was a defining moment. Many Europeans followed Italian explorer Christopher Columbus' landing on Caribbean soil in 1492. They sought to claim and colonize North American land. Colonists in the present-day U.S. pushed Native Americans to the west. Many native communities were killed by disease, war and forced migration, and large indigenous territories were reduced to isolated reservations.

Cooperation and conflict have dramatically affected the relationships between North American countries. The United States and Canada have the longest peaceful border in the world, for instance. However, most of North America's history is dotted with conflict. The Mexican-American War, which lasted from 1846 to 1848, resulted in the U.S. taking 500,000 square miles of Mexican territory.

Conflicts have also caused tensions among residents of a single country. Britain gained French territory east of the Mississippi River following the Seven Years' War, which ended in 1763. It created divisions between French-speaking and English-speaking Canadians that still influence Canadian politics.

North American countries have also suffered through civil wars. The civil wars in Honduras, Nicaragua, Guatemala and El Salvador, which took place between the 1970s and 1990s, killed tens of thousands of civilians. Many were forced to immigrate to Mexico, the United States and Canada. Meanwhile, the U.S. aimed to protect its economic and political interests by backing certain military governments and groups.



Contemporary Issues

Today, North America's political geography is deeply influenced by economic and demographic trends. Two important trade agreements have reduced or eliminated duties and tariffs. A duty is a kind of tax charged for items purchased outside the country. A tariff is another kind of tax, charged on imports and exports. The first agreement is the North American Free Trade Agreement (NAFTA), which was signed in 1994. The second is the 2004 Dominican Republic-Central America Free Trade Agreement.

These agreements have also caused major political and economic problems. Many Mexican corn farmers could not compete against lower U.S. or Canadian corn prices, and lost their livelihoods. NAFTA is also believed to have pushed many industries out of the U.S. and into Mexico, Central America and the Caribbean. It is less expensive for companies to manufacture goods in these places. Wages are lower and there are fewer health and safety regulations.

Immigration is perhaps the most sensitive aspect of North America's political geography. Most immigration is fueled by poverty. People from North America's underdeveloped nations, such as Haiti, frequently immigrate to the continent's developed countries, such as the U.S.

Many impoverished immigrants from Mexico, the Caribbean and Central America have illegally settled in developed countries. They migrate for the same reasons legal immigrants do — to look for better economic and political opportunities.



Future Issues

After the terror attacks of September 11, 2001, the United States became more concerned with safety. National security continues to be an important issue. Meanwhile, drug trafficking has become worse recently and has damaged political relations between Mexico and the U.S.

Another important problem is climate change, which will have a great impact on North America's political and financial future. Climate change is caused by the emission of fossil fuels like oil and coal into the atmosphere. Both the U.S. and Costa Rica promised to reduce emissions as part of a 2009 agreement called the Copenhagen Accord.

Quiz

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- What is the MAIN reason the author includes the section "Contemporary Cultures."
 - (A) to demonstrate the importance of immigrants to tourism in North America
 - (B) to explain the various reasons refugees might flee their home countries
 - (C) to describe how ethnic neighborhoods are changing cities across North America
 - (D) to show how North America's diversity has influenced and enriched life on this continent

Why does the author include information about the Central American civilizations in the section "Historic Cultures"?

- (A) to argue that North American societies were advanced long before European settlers arrived
- (B) to emphasize the importance of mathematics to North American cultures
- (C) to demonstrate how people immigrated from modern Mexico throughout North America
- (D) to suggest that North American civilizations in Mexico traded with other, more advanced societies
- Examine the image in the section "Contemporary Issues."

How does this image contribute to your understanding of immigration?

- (A) The image demonstrates how groups of refugees immigrate to new countries.
- (B) The image suggests that most immigrants illegally enter countries in North America.
- (C) The image explains how legal immigrants are usually young men looking for work.
- (D) The image shows the extreme lengths immigrants will go to to find better lives in wealthier nations.

Which conclusion is supported in BOTH the second image and the section "Historic Cultures"?

- (A) Early Native Americans were well known for their advanced societies and complex social structures.
- (B) Native Americans in the modern United States invented a complex system of mathematics.
- (C) Some Native Americans were nomads. Others were stationary and built large settlements.
- (D) The decline in the bison population led to diminished power for all early North American societies.

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South America: Human geography

By National Geographic Society, adapted by Newsela staff on 09.14.17 Word Count **1,567** Level **980L**



Kids pick teams before playing a pickup soccer game at Botafogo beach in Rio de Janeiro, Brazil, May 31, 2014. Photo: AP Photo/Felipe Dana

South America extends from the Isthmus of Panama to the Tierra del Fuego archipelago in the south. It is the world's fourth largest continent.

South America and North America are named after Italian navigator Amerigo Vespucci. He was the first European to realize that the Americas were not part of the East Indies and its own separate landmass.

Today, South America is divided into many countries and territories. They include Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Uruguay and Argentina, Chile, Peru, Ecuador, Bolivia and Paraguay. The continent also includes several islands: the Galapagos Islands are part of Ecuador and Easter Island is part of Chile. The Falkland Islands are part of the United Kingdom, but Argentina also claims these islands.

South America's culture is deeply influenced by indigenous people and their connection to their environment.



Indigenous peoples are the descendants of those who lived on the continent before European explorers and settlers arrived. The first human populations of South America probably either arrived from Asia into North America via the Bering Land Bridge, and migrated southwards or alternatively from Polynesia across the Pacific.



Today, at least 22 million people in South America belong to an indigenous group. They speak several hundred languages. In Brazil alone, for instance, 135 languages have been confirmed.

Cultural Geography: Historic Cultures

The cultures of South America developed in three main geographical regions. They are the Pacific coast, the major rivers of the Amazon basin, and the Andes mountains.

The Inca Empire is the most well-known indigenous culture of South America. The Inca Empire was established in 1438 in Cuzco, Peru. The city is high in the Andes. The empire expanded to include parts of present-day Peru, Bolivia, Ecuador, Chile, Argentina and Colombia.

To communicate across this vast region, the Inca built an expansive network of roads. It was made up of two main north-south roads. One ran along the Pacific coast and another through the Andes.

Colonization of the continent by Spain and Portugal left a lasting legacy. The importation of African slaves represented a major shift in the cultural landscape of South America. Most slaves were brought to Brazil. Their culture integrated indigenous beliefs and European rituals.

Slave owners and church leaders put slaves under



intense pressure to convert to Catholicism. Over time, some slave religions added parts of Christianity, like crosses and saints.

Other historic cultures of South America developed. A gaucho, or "cowboy," culture developed in the Pampas, for instance. The Pampas are an extensive region of grasslands, located in Argentina,

Brazil and Uruguay. Much like the North American cowboy, the gaucho was idealized as free-spirited, strong and honest.

Contemporary Cultures

Indigenous societies continue to have a strong presence in South America.

Religion remains the backbone of many South American cultures. Catholicism dominates the continent. Other spiritual beliefs have influenced both spiritual and secular activities.

The Carnival of Rio de Janeiro, Brazil, is a Christian festival held every year about 40 days before Easter. It is also a huge party and attracts millions of Brazilian and foreign tourists.

Political Geography

Political geography is the relationship between governments and citizens. South America's history and development have been shaped by its political geography.





The Treaty of Tordesillas of 1494 granted Spain and Portugal the right to colonize all lands outside of Europe. Spain colonized most of South America and Portugal colonized present-day Brazil.

The dominance of the Spanish and Portuguese languages on the continent can be attributed to Catholic missionaries, who taught them to the native peoples. The missionaries also developed writing systems for indigenous languages such as Quechua, Nahuatl and Guarani. Marriages between European colonizers and native populations established the mestizo class. Mestizos are people of mixed indigenous and European ancestry.

The successful Cuban revolution of 1959 brought communism to Cuba. Communism is a political system in which the government owns all property and people have few freedoms. The United States and other western nations feared that communism would spread throughout Latin America. Communist leaders did gain some power in South America during the 1960s. Hoping to destroy them, the United States helped overthrow the governments of Argentina, Brazil, Chile, Paraguay and Uruguay.

Dictatorships replaced the communist governments. They arrested tens of thousands of political prisoners, and killed many of them.

Contemporary Issues

Today, South America is trying to reduce the influence of other countries.

Nationalization is a type of ownership where the state controls an industry. Some South American nations have nationalized industries like electricity or oil.

Many believe that





nationalization has improved the lives of local people. The poor strongly support it. Others argue that

nationalization has made services worse and given too much control to the government.

Some South American countries have done the opposite of nationalization. They have privatized industries. In these countries, such as Brazil and Argentina, the government has sold industries to private companies. Privatization has had mixed results. Many industries produce more goods. Services such as water and sewage are also more reliable. However, more people are unemployed, and privatization has led to higher prices.

Indigenous populations of South America have continued fighting for basic rights, such as the right to live on ancestral lands. In 2009, Bolivia passed an important new constitution. It guaranteed that indigenous groups would have more seats in the national legislature.

Future Issues

In general, the countries in South America are considered to be part of the developing world. These are countries with lower levels of income, health care and education than "developed" countries like the United States or Japan. They also tend to have a smaller middle class. There is no agreed-upon definition of what makes a country a "developed" or "developing" country.



As a result, some people might say that the wealthier countries in South America like Argentina and Chile are developed countries, while others might not. Regardless, Latin America, which includes South America and Central America, is the most urbanized of the world's developing regions. It is the only developing region with more poor people in cities than in rural areas.

This has put a lot of pressure on major cities in South America. Housing, crime and transportation problems are just a few of the challenges cities are facing. Many cities in South America have huge slums. These are extremely crowded areas whose residents tend to live in extreme poverty. Living conditions in slums are often unsafe — homes may not be very sturdy and services like electricity, water and sewage may not be reliable.

Rapid urbanization is destroying the unique environments of South America. The Amazon rainforest is being burned at a rate of one acre every second. Trees are harvested for the timber

industry, while the plains of the rainforest are turned into ranches, farms and towns. Air and water pollution are becoming bigger problems.

In rural areas, less money is spent on education, health care, and housing. Some of the continent's poorest communities are indigenous populations in the mountains of Bolivia, Peru and Ecuador.

Another important factor is climate change.

The earth is warming up. Reducing carbon emissions is the most important way to reduce global warming. Carbon emissions comes from burning fossil fuels, like coal and oil. As part of an international agreement, Brazil agreed to reduce emissions by more than a third by 2025.



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Read the following inference.

The Inca Empire was an advanced civilization.

Which sentence from the section "Cultural Geography: Historic Cultures" supports this inference?

- (A) The Inca Empire is the most well-known indigenous culture of South America.
- (B) The empire expanded to include parts of present-day Peru, Bolivia, Ecuador, Chile, Argentina and Colombia.
- (C) To communicate across this vast region, the Inca built an expansive network of roads.
- (D) One ran along the Pacific coast and another through the Andes.

Which selection from the section "Contemporary Issues" reflects poor South Americans' MAIN opinion about privatization?

- (A) In these countries, such as Brazil and Argentina, the government has sold industries to private companies.
- (B) Privatization has had mixed results. Many industries produce more goods.
- (C) Services such as water and sewage are also more reliable.
- (D) However, more people are unemployed, and privatization has led to higher prices.
- 3 Read the following sentence from the section "Future Issues." Then, fill in the blank.

Rapid urbanization is destroying the unique environments of South America.

The word "unique" in the sentence above tells the reader that _____.

- (A) these environments possess valuable resources
- (B) these environments offer a special kind of beauty
- (C) these environments are unlike any others in the world
- (D) these environments are precious to indigenous people
- Read the sentence from the section "Cultural Geography: Historic Cultures."

Much like the North American cowboy, the gaucho was idealized as free-spirited, strong and honest.

Which of the following words, if it replaced the word "idealized" in the sentence above, would CHANGE the meaning of the sentence?

- (A) remembered
- (B) glorified
- (C) celebrated
- (D) admired

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Humans are affecting species' biological carrying capacity

By ThoughtCo.com, adapted by Newsela staff on 08.11.19 Word Count **590** Level **1040L**



Image 1. Passengers cram into subway cars during rush hour in New York City. Photo by: Robert Nickelsberg/Getty Images

Biological carrying capacity is defined as the maximum number of individuals of a species that can exist in a habitat for an indefinite period of time. The individuals must do this without threatening other species in that habitat. Factors such as available food and water affect biological carrying capacity. Availability of cover, as well as of prey and predator species also affect the carrying capacity.

When a species exceeds its biological carrying capacity, that species is overpopulated. This is a topic of much debate in recent years due to the rapidly expanding human population. Some scientists believe that humans have already exceeded their own biological carrying capacity.

Shelter, Food And Pollution All Play A Role

The term "carrying capacity" was originally used to describe how much a species could graze on a portion of land before permanently damaging the land's food production. The term was expanded

later to include more complex interactions between species. One of these interactions is predatorprey dynamics. Another would be the recent impact of modern civilization on native species.

However, competition for shelter and food aren't the only factors that determine a species' carrying capacity. That capacity also depends on environmental factors not necessarily caused by natural processes. Consider, for example, pollution and extinctions of prey species caused by humans.

Ecologists and biologists determine the carrying capacity of individual species by weighing all of these factors. These scientists use this data to prevent species overpopulation. The data also helps them to prevent species extinction. Either of these could be destructive to their delicate ecosystems and the global food web at large.

Overpopulation Can Devastate Resources

Species tend to match the conditions of their environment. Those conditions include the presence of food and prey, predators, water, etc. We call that match a niche. When a species exceeds its carrying capacity in a niche environment, that species is considered overpopulated in the area. This condition leads to devastating results if not corrected. Fortunately, the natural life cycles of and dynamic between predators and prey typically keep these outbreaks of overpopulation under control, at least in the long term.

Sometimes, though, a certain species will overpopulate resulting in the devastation of shared resources. If this animal happens to be a predator, it might over-consume the prey population. That leads to that prey species' local extinction. It also leads to unrestrained reproduction of the predator species. On the other hand, if a creature of prey overpopulates, it might destroy all sources of edible vegetation, resulting in a decrease in other prey species' populations. Sometimes, the entire ecosystem risks destruction.

The Human Population Is On The Rise

One of the most common examples of how close to the edge some ecosystems are to this destruction is the arguable overpopulation of the human race. Since the end of the bubonic plague at the turn of the 15th century, the human population has been steadily increasing. The increase has been most significant within the last 70 years.

Scientists have determined the carrying capacity of humans on Earth. The number lies somewhere between 4 billion and 15 billion people. The human population of the world as of 2019 is 7.7 billion. The United Nations estimates an additional 3.5 billion population growth by the year 2100.

Humans are in a position where they have to work on their ecological footprint. An ecological footprint is the impact that a person or community has on the environment. Humans must work on their footprints if they hope to survive the next century on this planet.

1

3

Read the selection from the section "Shelter, Food, And Pollution All Play A Role."

Ecologists and biologists determine the carrying capacity of individual species by weighing all of these factors. These scientists use this data to prevent species overpopulation.

Which two words would BEST replace "weighing" and "prevent" in the selection above?

- (A) limiting; estimate
- (B) disregarding; avoid
- (C) generating; begin
- (D) considering; stop

2 Read the paragraph from the section "The Human Population Is On The Rise."

Humans are in a position where they have to work on their ecological footprint. An ecological footprint is the impact that a person or community has on the environment. Humans must work on their footprints if they hope to survive the next century on this planet.

Which phrase from the paragraph shows a cautionary tone?

- (A) Humans are in a position
- (B) a person or community
- (C) if they hope to survive
- (D) on this planet

Which section of the article BEST explains how exceeding carrying capacity can be very damaging to an ecosystem?

- (A) Introduction [paragraphs 1-2]
- (B) "Shelter, Food, And Pollution All Play A Role"
- (C) "Overpopulation Can Devastate Resources"
- (D) "The Human Population Is On The Rise"
- 4 Which piece of evidence explains how scientists' view of biological carrying capacity has changed over time?
 - (A) Biological carrying capacity is defined as the maximum number of individuals of a species that can exist in a habitat for an indefinite period of time. The individuals must do this without threatening other species in that habitat.
 - (B) The term "carrying capacity" was originally used to describe how much a species could graze on a portion of land before permanently damaging the land's food production. The term was expanded later to include more complex interactions between species.
 - (C) When a species exceeds its carrying capacity in a niche environment, that species is considered overpopulated in the area. This condition leads to devastating results if not corrected.
 - (D) Scientists have determined the carrying capacity of humans on Earth. The number lies somewhere between 4 billion and 15 billion people.

