



## Twelfth Grade

# Eight-Week Learning Plan

Everything you need to provide 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



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# Introduction

You should expect to spend approximately 30 minutes reviewing this section prior to beginning the Eight-Week Learning Plan.

## Getting Started

### Welcome Texas students!

This packet provides students with everything needed to support at-home learning. Easy-to-use daily schedules cover eight weeks of important grade-level content to keep skills sharp while schools are closed.

### What's included for you in this packet:

- Introductory guidance to get your student set up to learn
- Eight weeks of planned at-home learning, including detailed daily schedules with specific activities for each subject
- Subject-specific activities and text that follow the daily schedules

### How do you get started?

1. Establish a daily routine. Providing some regular structure can help make the home learning plan easy to follow. Review the “[Recommended Daily Routine](#)” section for tips on what schedule to set up.
2. Think through how to make sure students get the most out of home learning. Review the “[Learning Goals for Students](#)” sections for tips.
3. Prepare for your first day's lessons. Review the “[Prepare for Your First Day](#)” section so you know what to expect each day. This will help give you an idea of how to complete assigned activities throughout the eight-week plan.

### Note to Parents/Caregivers:

We know many caregivers are balancing home learning with other priorities, so you are encouraged to support your student in a way that works best for your family. For example, some caregivers may check in with students a few times per day while others may check in with students only in the early mornings or evenings.

Each daily schedule includes the following suggested check in guidance that will help caregivers see what the student was able to finish, what was challenging to learn, and what questions remain to ask the teacher. For example, a caregiver might ask:

- 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?

The caregiver may also want to work with the student's teachers to send copies or pictures of student work or share information about the student's learning progress.

## Recommended Daily Routine

It is recommended that students establish a consistent, daily routine that can be followed each day of the eight-week learning plan. This regular structure can help make daily activities easier to follow and enhance home learning.

For example, students may start each day off eating breakfast and getting some exercise before they start the first lesson. Then, students can spend the same amount of time on each subject in the same order each day.

To make following the schedule easy, this packet includes a daily recommended schedule. All daily activities included in the eight-week learning plan will follow this recommended routine.

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

The recommended routine is included in the chart on the next page. Each recommended daily routine will include time to focus on activities in each subject area, including reading and writing, math, science, social studies. Daily guidance will be provided for these activities, and they are will be shaded on the daily schedule. There is also time for choice reading where students select the book of their choosing.

In addition to time focused on each subject area, the daily routine also includes reserved time for exercise, breaks, and meals. There is no specific daily guidance provided in these areas, so students are encouraged to do what is best for their family. These activities are not shaded in the chart.

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

## Learning Goals for Students

The eight-week learning plan in this packet provides a daily, step-by-step guide for students to follow in each of the main academic subject areas: reading and writing, math, science, and social studies. This section includes the high-level learning goals for students in each of the main academic subject areas.



### English

The goal of our at-home learning plan for ELAR is to provide families with a series of grade-appropriate thematically and/or topically aligned “text sets” containing shorter passages of various genres intended to build students’ back-ground and content knowledge of the selected theme or topic. Students should read, annotate and write about their reading every day, following an enjoyable at-home reading routine. Printable book options are included in this packet to correspond with the reading lesson plans.

#### Tips for Students

- 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.



## Choice Reading

Thirty minutes of choice reading (e.g., student selects a choice text with approval from caregiver) of any genre or topic is built into the schedule. Students are encouraged to select a book(s) readily available at home.

Students may also select from these common 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)

For choice reading, Caregivers are encouraged to:

- Discuss the book together.
- Ask questions such as: 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 child to talk about the book with a family member or friend.

Tips for Students

- Read and annotate the selected text, deciding to read the passages independently or with a family member.
- Discuss what the passages and choice reading sections are about.
- Write a short summary or analysis of what you have read.



## Math

Students will complete activities and practice problems that cover foundational content and skills for Precalculus.

Tips for Students

- 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 physics content.

### Tips for Students

- 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 to activities that focus on government and economics concepts.

### Tips for Students

- Readings provide information that can be used to support claims and answer questions.

## Prepare for Your First Day

Now that you have reviewed the daily routine and the learning goals, it is time to prepare for the first day of learning! This section will walk students and caregivers what is expected in a daily schedule during the next eight weeks. The image below captures how each daily schedule is designed with tips for students on how to get started using the resource.

**Week One Lesson Plan**

Activities change each day for the shaded academic subject areas. For each activity in the schedule (e.g., worksheets, reading a book, etc.), refer to the corresponding page numbers to find the materials for the activity.

**Week One: Monday**

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-9:20 a.m.	Phonics Find Specific Sounds xx
9:20-10:00 a.m.	Reading and Writing • Introduce the Daily Reading Routine xx • Read <i>Talking About Forces</i> xx (or choose a different book)
10:00-10:30 a.m.	Snack and Break
10:30-11:30 a.m.	Math Zearn Word Problem Lesson 1 xx
11:30-12:00 p.m.	Lunch
12:00-12:30 p.m.	Quiet Time
12:30-1:00 p.m.	Science The Engineering and Design Process • Read the Engineering and Design Process Background Information. xx • Talk to your child about the engineering and design process. • Have your child look at their toothbrush and think about how the design of the toothbrush could be improved. • Ask your child to draw a picture of the improved toothbrush design. Have your child explain how the new design makes it better.
1:00-1:15 p.m.	Break
1:15-1:45 p.m.	Choice Learning
1:45-2:30 p.m.	Outdoor/Indoor Exercise
2:30-3:00 p.m.	Art or Play

Select the right day of the week

Use the times to guide student's daily activities.  
Note: Times can be adjusted based on a household's needs

Find the right week

Follow the step-by-step instructions included in the shaded activities. The listed page numbers will take you to the section of the packet with material you need for the activity.

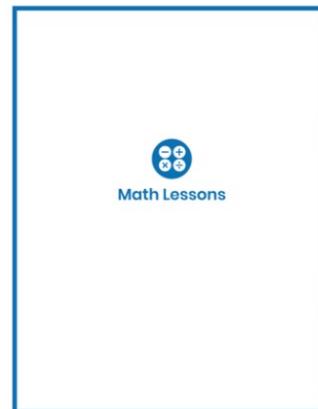
Do what you think best during non-shaded activities.

### Completing Shaded Activities in the Schedule

The shaded activities in the schedule will focus on supporting students in each subject area, including reading and writing, math, science, social studies, and choice reading time.

The packet includes sections for each of these subject areas with all the materials needed for the eight weeks of learning. Each section also includes a cover page to help students find materials for that subject.

The daily activities will provide students the specific page they should flip to so the described activity can be completed.



For example, the daily schedule may read:

<b>10:30-11:30 a.m.</b>	<b>Science</b> Roller Coaster Science <ul style="list-style-type: none"><li>• Read <i>Everyday Mysteries: Why don't I fall out of an upside-down roller coaster?</i> (p. xx).</li><li>• Use the information in the article to explain why riders do not fall out of a roller coaster when it turns upside down.</li></ul>
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Note: The xx represents be a specific page number that will direct students to the page in the packet with the materials they need to complete the activity.

When the student flips to the page provided in the daily activity, they will be able to complete the work. Students will flip to different sections of the packet throughout the day as they work on the different subject areas.

There is one block in the daily schedule titled “Choice Reading” that provides students with multiple book options. The learning plan seeks to offer students time to focus on what is interesting to them, so students are encouraged to pick the book that excites them the most.

### Completing Non-Shaded Activities in the Schedule

In addition to time focused on each subject area, the daily routine also includes reserved time for exercise, breaks, and meals. Since there are no assigned activities for these sections, they are **NOT** shaded in the chart. Students are encouraged to adapt this time to do what is best.

- **Indoor/Outdoor Exercise:** Regular physical activity during the day helps build strength and develop healthy habits, both of which can enhance academic performance. Students are encouraged to use this time to engage in indoor/outdoor activities that get the heart rate up.
- **Snack and Break:** It is important to carve out time throughout the day for students to take brain breaks! Brain breaks are mental breaks taken at regular intervals that usually involve a simple physical activity. For example, a student may go on a short walk outside. This time could also be used to grab a healthy snack for a new boost of energy. These breaks are designed to increase oxygen to the brain which helps students stay focused and relaxed throughout the day and solidify their learning.
- **Enrichment / Art:** A chance for students to explore their creative side doing an art project or practicing music.

Reminder, all daily activities will follow the same routine for the entire eight weeks, so once you get through your first day, you will have a better understanding of how home learning can work. Students can also make adjustments to the schedule based on their daily experience.

**Congratulations, you are now ready to begin your first day of home learning!**



## Eight-Week Daily and Weekly Schedule

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





# Week One Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week One: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Read and annotate the satirical poem “A Description of a City Shower” (p. 96).</li><li>• Answer text dependent questions 1-5. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Deriving Force <ul style="list-style-type: none"><li>• Complete the warm-up and getting started sections (p. 276).</li><li>• Complete activity 1.1.</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Wave Behavior and Sound <ul style="list-style-type: none"><li>• Perform the experiment and recording finding for “Experiment: What do you hear underwater?” (p. 436).</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Supply and Demand <ul style="list-style-type: none"><li>• Read and annotate “Principles of economics: Demand and supply at work in labor markets” (p. 532).</li><li>• Answer the questions: How can a labor market reach equilibrium? Share an example to help explain your response.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week One: Tuesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Re-read the satirical poem “A Description of a City Shower” (p. 96).</li><li>• Respond in writing to the discussion questions. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Deriving Force <ul style="list-style-type: none"><li>• Complete activity 1.2 (p. 279).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Wave Behavior and Sound <ul style="list-style-type: none"><li>• Based on your findings in the experiment yesterday, answer the questions: Do patterns appear? What can you conclude about how humans perceive sound?</li><li>• Try variations on the experiment to see if the sound seems different when you close your eyes or cover your ear. Record your findings.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Supply and Demand <ul style="list-style-type: none"><li>• Re-read “Principles of economics: Demand and supply at work in labor markets” (p. 532).</li><li>• Answer the text-based quiz questions.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week One: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Read and annotate the satire “Roughing It” (p. 101).</li><li>• Answer text dependent questions 1-5. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Deriving Force <ul style="list-style-type: none"><li>• Complete activity 1.3 (p. 282).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Wave Behavior and Sound <ul style="list-style-type: none"><li>• Read “What do you hear underwater?” (p. 440).</li><li>• Relate your findings in the experiment with what your read.</li><li>• Answer the question: Why does sound seem different underwater as compared to in air?</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Supply and Demand <ul style="list-style-type: none"><li>• Read and annotate “The definition and importance of the supply and demand model” (p. 532).</li><li>• Write a short summary of the graphs provided to help illustrate your understanding of supply and demand.</li><li>• Answer the quiz questions.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week One: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Re-read “Roughing It” (p. 101 ).</li><li>• Respond in writing to the discussion questions. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Deriving Force <ul style="list-style-type: none"><li>• Complete activity 1.4 and Talk the Talk (p. 284).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Wave Behavior and Sound <ul style="list-style-type: none"><li>• Read “How dolphins communicate with whistles and click” (p. 445).</li><li>• Consider how dolphins use sound waves to communicate and travel.</li><li>• Summarize your understanding of sound and waves based on your readings.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Supply and Demand <ul style="list-style-type: none"><li>• Respond to the following using 2-3 paragraphs: Explain the law of supply and demand in your own words.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week One: Friday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Read “An Uncomfortable Bed” (p. 109).</li><li>• Answer text dependent questions 1-5. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond in writing to. Use evidence from the text to support your answer.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Deriving Force <ul style="list-style-type: none"><li>• Complete the assignment section (p. 288).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Wave Behavior and Sound <ul style="list-style-type: none"><li>• Consider different ways that sound and other types of waves are used every day. Make a list of how you use sound and wave behaviors daily.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Supply and Demand <ul style="list-style-type: none"><li>• Create a storyboard of an imaginary or real product to a store of your choice. Include where the product was produced, a connection to “supply”, a connection to “demand” and the final location where the product was sold.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Two Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Two: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Read and annotate <i>On Tragedy</i> (p. 115).</li><li>• Answer text dependent questions 1-5. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> A sense of Déjà Vu <ul style="list-style-type: none"><li>• Complete the activity 2.1 (p. 293).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Static Electricity <ul style="list-style-type: none"><li>• Read “Everyday Mysteries: What is static electricity?” (p. 449).</li><li>• Try to generate electricity around your home. Try to shock someone by generating electricity.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Read and annotate “Factors of production” (p. 544).</li><li>• Answer the questions: What are factors of production? How are productive factors classified?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Two: Tuesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Re-read <i>On Tragedy</i> (p. 115).</li><li>• Respond in writing to the discussion questions. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> A sense of Déjà Vu <ul style="list-style-type: none"><li>• Complete activity 2.2 and Talk the Talk (p. 299).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Static Electricity <ul style="list-style-type: none"><li>• Consider when the generation of static electricity can be dangerous. List some examples of when people would need to be cautious of this phenomenon.</li><li>• Create a public service announcement to share the dangers of static electricity.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Re-read “Factors of production” (p. 544).</li><li>• Summarize the article to be able to explain to someone else.</li><li>• Share your summary with a member of your household or a friend.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Two: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Read and annotate the soliloquy “To Be or Not To Be” from <i>Hamlet</i> (p. 120).</li><li>• Answer text dependent questions 1-5. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> A sense of Déjà Vu <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 302).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Static Electricity <ul style="list-style-type: none"><li>• Read “What causes lightning and thunder?” (p. 451).</li><li>• Answer the questions: What causes lightning and thunder? Why is there a delay between lightning and thunder?</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Read and annotate “What is human capital?” (p. 546).</li><li>• Create a table to organize and record the concepts discussed in the article.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Two: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Re-read the soliloquy “To Be or Not To Be” from <i>Hamlet</i> (p. 120).</li><li>• Respond in writing to the discussion questions. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Knights of the Round Table <ul style="list-style-type: none"><li>• Complete the warm-up and getting started sections (p. 306).</li><li>• Complete activity 3.1.</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Static Electricity <ul style="list-style-type: none"><li>• Perform the experiment and record your findings using “Thunderstorms and homemade lightning.” (p. 456).</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Re-read “What is human capital?” (p. 546).</li><li>• Review the graphic organizer you created yesterday.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Two: Friday

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Comedy and Tragedy <ul style="list-style-type: none"><li>• Read and annotate President Lincoln’s Second Inaugural Address (speech),(p. 125).</li><li>• Answer the text dependent questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> The Knights of the Round Table <ul style="list-style-type: none"><li>• Complete activity 3.2 and Talk the Talk (p. 311).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Static Electricity <ul style="list-style-type: none"><li>• Complete the summary of results from the experiment yesterday. Share your findings with someone else.</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Respond to following in 3-5 sentences: Explain why an employer would invest in human capital.</li><li>• Summarize each of the four factors of production and give an example for each factor.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Three Lesson Plan

**Activities with specific guidance around academic subjects are shaded in the chart.** For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Three: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resisting and Embracing Change <ul style="list-style-type: none"><li>• Read and annotate the article “Opposing Innovation” (p. 129).</li><li>• Answer text dependent questions 1 - 6. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond in writing to. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Knights of the Round Table <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 316).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Magnetism <ul style="list-style-type: none"><li>• Read “Sea turtles are natural ocean navigators” (p. 460).</li><li>• Write a summary of how sea turtles use magnetic fields to navigate.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Read and annotate “Profile of an entrepreneur” (p. 551).</li><li>• Summarize your understanding of what it means to be an entrepreneur.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



### Week Three: Tuesday

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Resisting and Embracing Change <ul style="list-style-type: none"><li>• Read and annotate the article “Millennials Hands-on When Giving to Charity” (p. 136).</li><li>• Answer text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> What Goes Around <ul style="list-style-type: none"><li>• Complete the warm up and getting started section (p. 318).</li><li>• Complete activity 4.1.</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Magnetism <ul style="list-style-type: none"><li>• Read “Magnets and Magnetism” (p. 464).</li><li>• Answer the questions: What causes magnetism? Are all metals magnetic? What are some uses of magnets?</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Re-read “Profile of an entrepreneur” (p. 551).</li><li>• List and describe risks of being an entrepreneur.</li><li>• Answer the text dependent quiz questions.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



### Week Three: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resisting and Embracing Change <ul style="list-style-type: none"><li>• Read and annotate the excerpt from <i>Walden</i>: “Where I Lived and What I Lived For” (p. 140).</li><li>• Answer text dependent questions 1 - 7. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> What Goes Around <ul style="list-style-type: none"><li>• Complete activity 4.2 (p. 322).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Magnetism <ul style="list-style-type: none"><li>• Based on the readings you have done, explain how the Earth can contain magnetic particles and how animals (including people) can use this property in navigation systems.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Read and annotate “Influencers: The modern entrepreneur” (p. 555).</li><li>• Respond to the following: What is an influencer? Do you think influencers are entrepreneurs? Why or why not?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



### Week Three: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resisting and Embracing Change <ul style="list-style-type: none"><li>• Re-read the excerpt from <i>Walden</i>: “Where I Lived and What I Lived For” (p. 140).</li><li>• Answer text dependent question 8 and respond in writing to the discussion questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> What Goes Around <ul style="list-style-type: none"><li>• Complete activity 4.3 and Talk the Talk (p. 324).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Magnetism <ul style="list-style-type: none"><li>• Read “What is a compass?” (p. 467).</li><li>• Based on your reading, explain how compasses work and are used in navigation.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Imagine that you could create your own brand, product or company.</li><li>• Write a description of what you would produce and identify the target market.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



### Week Three: Friday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resisting and Embracing Change <ul style="list-style-type: none"><li>• Read and annotate the excerpt from the poem <i>Song of Myself</i> (p. 148).</li><li>• Answer text dependent questions 1 - 8. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond to in writing. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> What Goes Around <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 332).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Magnetism <ul style="list-style-type: none"><li>• If you have a device with a compass or can get a compass app, take a walk and track your location using the compass. Share your location based on the compass reading.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Fundamentals of Economics <ul style="list-style-type: none"><li>• Review what you wrote yesterday about a product, service, or brand you would provide for profit.</li><li>• Write a pitch (persuasive message) that you would use to get others to invest in your product, service, or brand.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Four Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Four: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Read and annotate the short story “The Open Boat” (p. 155).</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Sines They Are A-Changin' <ul style="list-style-type: none"><li>• Complete the warm-up and getting started sections (p. 334).</li><li>• Complete activity 5.1.</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Force, Motion, and Energy <ul style="list-style-type: none"><li>• Read “How roller coasters work” (p. 473).</li><li>• List the properties of motion, force, and energy discussed in the article.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Financial Literacy <ul style="list-style-type: none"><li>• Read and annotate “What is credit?” (p. 558).</li><li>• Answer the questions: What are the advantages and disadvantages that should be examined when making credit decisions? What is the difference between a secured and unsecured loan?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Four: Tuesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Re-read the short story “The Open Boat” (p. 155).</li><li>• Answer the text dependent questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond to in writing. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Sines They Are A-Changin' <ul style="list-style-type: none"><li>• Complete activity 5.2 (p. 338).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Force, Motion, and Energy <ul style="list-style-type: none"><li>• Consider other amusement park rides or water slides.</li><li>• Pick one to describe and identify the specific properties of force, motion, and energy.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Financial Literacy <ul style="list-style-type: none"><li>• Re-read “What is credit?” (p. 558).</li><li>• List and describe the types of lenders that provide credit.</li><li>• Answer the text dependent quiz questions.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Four: Wednesday

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Read and annotate the myth “The Transformation of Arachne Into a Spider” (p. 180).</li><li>• Answer text dependent questions 1-4. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> The Sines They Are A-Changin' <ul style="list-style-type: none"><li>• Complete activity 5.3 and Talk the Talk (p. 338).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Force, Motion, and Energy <ul style="list-style-type: none"><li>• Read “An explanation of two types of energy: potential and kinetic” (p. 477).</li><li>• Think of something your used or did today that involved potential and kinetic energy. Explain how it you used the form of energy.</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Economics</b> Financial Literacy <ul style="list-style-type: none"><li>• Read and annotate “How do taxes work in the U.S. government?” (p. 561).</li><li>• Summarize your understanding of taxes based on the reading.</li><li>• Answer the text dependent quiz questions.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Four: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Re-read the myth “The Transformation of Arachne Into a Spider” (p. 180).</li><li>• Answer text dependent questions 5-10. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond to in writing. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Sines They Are A-Changin' <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 346).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Force, Motion, and Energy <ul style="list-style-type: none"><li>• Perform the experiment and record findings using “Experiment: Swinging with a pendulum” (p. 481).</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Economics</b> Financial Literacy <ul style="list-style-type: none"><li>• Respond to the following in 2-3 paragraphs: Explain the purpose of taxes and how the government collects taxes.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Four: Friday

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Read and annotate the poem “Ozymandias” (p. 191).</li><li>• Answer the text dependent questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Respond in writing to the discussion questions. Use evidence from the text to support your answers.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> Farmers Tan <ul style="list-style-type: none"><li>• Complete the warm-up and getting started section (p. 348).</li><li>• Complete activity 6.1.</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Force, Motion, and Energy <ul style="list-style-type: none"><li>• Perform the experiment you did yesterday again, but this time change a different variable such as mass or initial angle.</li><li>• Explain the impact the variable had on the pendulum's period or total time.</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Economics</b> Financial Literacy <ul style="list-style-type: none"><li>• Imagine you have a monthly income of \$3,000. Create a budget that includes the following expenses: rent, food, utilities, car payments, and miscellaneous spending. In your budget, determine how much you can spend on each expense per month.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Five Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Five: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> <ul style="list-style-type: none"><li>• Read and annotate the excerpt from Walden: “The Ponds” (p. 195).</li><li>• Answer the text dependent questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond to in writing. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Farmers Tan <ul style="list-style-type: none"><li>• Complete activity 6.2 (p. 355).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Newton's Laws <ul style="list-style-type: none"><li>• Read “A history of rockets” (p. 485).</li><li>• Explain the physics concepts discussed in the article.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Citizenship <ul style="list-style-type: none"><li>• Read and annotate the article “Rights and responsibilities of U.S. Citizens” (p. 565).</li><li>• Write a paragraph that explains the central idea of the article. Use at least two details from the text to support your response.</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



**Week Five: Tuesday**

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Read and annotate the article “To Earn Trust for Autonomous Vehicles, Company Gives Them Virtual Eyes” (p. 199)</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Respond in writing to the following prompt: What is something (an object, item, product) that you know has evolved and been modified over time? Why do you think these changes and modifications were made?</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> Farmers Tan <ul style="list-style-type: none"><li>• Complete activity 6.3 and Talk the Talk (p. 359).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Newton’s Laws <ul style="list-style-type: none"><li>• Read “How does gravity pull things down to Earth?” (p. 491).</li><li>• List Newton’s three laws of motion and write a short description of each.</li><li>• Identify the relationship between the laws and the examples provided in the readings.</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Government</b> Citizenship <ul style="list-style-type: none"><li>• Re-read “Rights and Responsibilities of U.S. citizens” (p. 565).</li><li>• Respond to the following prompt in 2-3 paragraphs: Why are the rights and responsibilities of citizens important to democracy in the United State? Use evidence from the text to support your answer.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Five: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Read and annotate the excerpt from the novel Frankenstein; or the Modern Prometheus (p. 203)</li><li>• Answer the text dependent questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Farmers Tan <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 364).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Newton's Laws <ul style="list-style-type: none"><li>• Consider Newton's laws in your everyday life. Identify examples of all three that you experienced today.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Citizenship <ul style="list-style-type: none"><li>• Read and annotate "Primary Sources: The Bill of Rights" (p. 570).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Respond to the following prompt in 2-3 paragraphs: Provide an explanation of the Bill of Rights, including the structure the authors used to develop the document.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Five: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Re-read the excerpt from the novel Frankenstein; or the Modern Prometheus (p. 203).</li><li>• Respond in writing to the discussion questions. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Skills Practice: Trigonometric Relationships <ul style="list-style-type: none"><li>• Complete section I (p. 366).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Newton's Laws <ul style="list-style-type: none"><li>• Perform the experiment and record findings using "Experiment: How to build a balloon-powered car" (p. 458).</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Citizenship <ul style="list-style-type: none"><li>• Read and annotate "How Government Works: What is citizenship" (p. 575).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Respond to the following prompt: What is one question you still have after reading this article? Why is this an important question to answer?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Five: Friday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Man VS. Nature <ul style="list-style-type: none"><li>• Read and annotate the poem “We Grow Accustomed to the Dark” (p. 208).</li><li>• Answer the text dependent questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond to in writing. Use evidence from the text to support your answers.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Skills Practice: Trigonometric Relationships <ul style="list-style-type: none"><li>• Complete section II (p. 370).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Newton’s Laws <ul style="list-style-type: none"><li>• Consider factors that could influence a balloon-powered car.</li><li>• Write an experiment someone else could perform to test the impact of adjusting a particular variable on the balloon-powered car.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Citizenship <ul style="list-style-type: none"><li>• Consider the article you have read this week.</li><li>• Respond to the following prompt in 2-3 paragraphs: What did you learn this week that you didn't know before? What would you like to learn more about?</li><li>• Discuss your responses with a friend or someone in your household.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Six Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Six: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Read and annotate the excerpt from Narrative of the Life of Frederick Douglass (p. 212).</li><li>• Answer text dependent questions 1-3. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Skills Practice: Trigonometric Relationships <ul style="list-style-type: none"><li>• Complete section III (p. 373).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Quantum Physics <ul style="list-style-type: none"><li>• Read “Time travel may be possible for certain tiny particles, but probably not” (p. 493).</li><li>• Take a position on whether or not you believe time travel is possible and use evidence from the article to support your claim.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Checks and Balances <ul style="list-style-type: none"><li>• Read and annotate the article “Our System of Checks and Balances” (p. 578).</li><li>• Write a paragraph that explains the central idea of the article. Use at least two details from the text to support your response.</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



**Week Six: Tuesday**

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Re-read the excerpt from Narrative of the Life of Frederick Douglass (p. 212).</li><li>• Answer text dependent questions 4-10. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• Select <b>one</b> of the discussion questions to respond to in writing. Use evidence from the text to support your answers.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> Skills Practice: Trigonometric Relationships <ul style="list-style-type: none"><li>• Complete section IV (p. 377).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Quantum Physics <ul style="list-style-type: none"><li>• Read “The Sun, an engine of nuclear energy” (p. 498).</li><li>• Answer the questions: What is nuclear fusion? What are two key parts that make up nuclear fusion?</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Government</b> Checks and Balances <ul style="list-style-type: none"><li>• Re-read “Our System of Checks and Balances” (p. 578).</li><li>• Respond to the following prompt in 2-3 paragraphs: How does the checks and balance system created by the Founding Fathers ensure a fair government? Compare and contrast the different government branches. Use information and examples from the article to support your explanation .</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Six: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Read and annotate President Roosevelt’s “First Fireside Chat” speech (p. 227)</li><li>• Answer text dependent questions 1-4. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Skills Practice: Trigonometric Relationships <ul style="list-style-type: none"><li>• Complete section V (p. 381).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Quantum Physics <ul style="list-style-type: none"><li>• Re-read “The Sun, and engine of nuclear energy” (p. 498).</li><li>• Write a short summary about the cycle of a star as related to nuclear fusion.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Checks and Balances <ul style="list-style-type: none"><li>• Read and annotate “Primary Sources: James Madison's Federalist Paper No. 51” (p. 582).</li><li>• Write a paragraph that explains the central idea of the article. Use at least two details from the text to support your response.</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Six: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Re-read President Roosevelt’s “First Fireside Chat” speech (p. 227)</li><li>• Answer text dependent questions 1-4. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Chasing Theta <ul style="list-style-type: none"><li>• Complete the warm-up and getting started sections (p. 386).</li><li>• Complete activity 1.1.</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Quantum Physics <ul style="list-style-type: none"><li>• Read “Explainer: the difference between radiation and radioactivity” (p. 503).</li><li>• Explain the difference between radiation and radioactivity and give examples of each.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Checks and Balances <ul style="list-style-type: none"><li>• Re-read “Primary Sources: James Madison's Federalist Paper No. 51” (p. 582).</li><li>• Respond to the following prompt: Imagine you are a citizen of New York, reading Federalist Number 51 in 1788. Did this article help convince you that checks and balances are needed? Why or why not?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Six: Friday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Read and annotate the short story “To Build a Fire” (p. 234).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Chasing Theta <ul style="list-style-type: none"><li>• Complete activity 1.2 (p. 391).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Quantum Physics <ul style="list-style-type: none"><li>• Consider uses of radioactivity and radiation to help people. List and describe some examples.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Checks and Balances <ul style="list-style-type: none"><li>• Consider the articles you have read this week.</li><li>• Respond to the following prompt in 2-3 paragraphs: what is meant by ‘a system of checks and balances?’ Support your answer with evidence from the texts you have read this week.</li><li>• Discuss your responses with a friend or someone in your household.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Seven Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Seven: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Read and annotate the article “2 Degrees, Flies Planes, Author, Works at NASA. His age? 17” (p. 246).</li><li>• Answer text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Chasing Theta <ul style="list-style-type: none"><li>• Complete activity 1.3 (p. 393).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Space Physics <ul style="list-style-type: none"><li>• Read “The nature of dark matter” (p. 508).</li><li>• Write a short summary to help explain to someone else about dark</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> The Judicial Branch <ul style="list-style-type: none"><li>• Read and annotate the article “The Judicial Branch” (p. 587).</li><li>• Write a paragraph that explains the central idea of the article. Use at least two details from the text to support your response.</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



**Week Seven: Tuesday**

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Re-read and annotate the article “2 Degrees, Flies Planes, Author, Works at NASA. His age? 17” (p. 246).</li><li>• Respond in writing to the following prompt: how are joy, choice, and success related to each other? Support your answer with at least two details from the article.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> Chasing Theta <ul style="list-style-type: none"><li>• Complete activity 1.4 and Talk the Talk (p. 395).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Space Physics <ul style="list-style-type: none"><li>• Read “What is a black hole?” (p. 512).</li><li>• Answer the questions: What is a black hole? How can scientists detect black holes?</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Government</b> The Judicial Branch <ul style="list-style-type: none"><li>• Re-read “The Judicial Branch” (p. 587).</li><li>• Respond to the following prompt in 2-3 paragraphs: Describe what you think the author’s purpose was for writing this text and whether they were successful in this purpose. Support your response with specific details from the text.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Seven: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Read and annotate the article “Japanese-American Leagues Help Girls Get the Jump on Prep Basketball” (p. 250).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Chasing Theta <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 398).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Space Physics <ul style="list-style-type: none"><li>• Re-read the previous two articles and then consider the impact black holes and dark matter have on life.</li><li>• Take the quizzes.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> The Judicial Branch <ul style="list-style-type: none"><li>• Read and annotate “How US Supreme Court Justices Interpret the Constitution” (p. 590).</li><li>• Write a paragraph that explains the central idea of the article. Use at least two details from the text to support your response.</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Seven: Thursday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Re-read the article “Japanese-American Leagues Help Girls Get the Jump on Prep Basketball” (p. 250).</li><li>• Answer the following writing prompt: Write a paragraph that explains the central idea of the article. Use at least two details from the article to support your response.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Wascally Wabbits <ul style="list-style-type: none"><li>• Complete the warm-up and getting started sections (p. 400).</li><li>• Complete activity 2.1 (p. 402).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Space Physics <ul style="list-style-type: none"><li>• Read “Wanted: An orbiting garbage collector to clean” (p. 516).</li><li>• What are your thoughts about how space garbage can be collected and/or disposed? Write a short summary of your thoughts and how principles of physics can be leveraged.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> The Judicial Branch <ul style="list-style-type: none"><li>• Re-read ““How US Supreme Court justices interpret the Constitution” (p. 590).</li><li>• Interview a minimum of three friends or family members about the Supreme Court Cases they remember. What were the case and what can they remember about them?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Seven: Friday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Resilience and Success <ul style="list-style-type: none"><li>• Read and annotate the article “Fishing Lures a Hit for Small-town Teen Entrepreneurs” (p. 254).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li><li>• 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.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Wascally Wabbits <ul style="list-style-type: none"><li>• Complete activity 2.2 and Talk the Talk (p. 405).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Space Physics <ul style="list-style-type: none"><li>• Propose a solution to the space garbage problem based on what you have learned and your understanding of physics.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> The Judicial Branch <ul style="list-style-type: none"><li>• Consider the articles you have read this week.</li><li>• Respond to the following prompt in 2-3 paragraphs: What did you learn this week that you didn't know before? What would you like to learn more about?</li><li>• Discuss your responses with a friend or someone in your household.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)





# Week Eight Lesson Plan

Activities with specific guidance around academic subjects are shaded in the chart. For each activity in the schedule (e.g, worksheets, reading a book, etc.), refer to the corresponding page numbers in the packet to find the materials for the activity.

## Week Eight: Monday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Personal Growth <ul style="list-style-type: none"><li>• Read and annotate the short story “A Pair of Silk Stockings” (p. 259).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> The Wheel Deal <ul style="list-style-type: none"><li>• Complete the warm-up and getting started sections (p. 412).</li><li>• Complete activity 3.1 and Talk the Talk.</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Science Professions <ul style="list-style-type: none"><li>• Read “Dream Jobs: Food Chemist” (p. 519).</li><li>• Answer the questions: What did you find interesting about the job? What did you learn about food chemistry?</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Legislative Branch <ul style="list-style-type: none"><li>• Read and annotate “The power of Congress” (p. 593).</li><li>• Create a table to organize and record the following information: exclusive power of the House of Representatives, exclusive powers of the Senate, and additional powers that have been added over time.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



**Week Eight: Tuesday**

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Personal Growth <ul style="list-style-type: none"><li>• Re-read the short story “A Pair of Silk Stockings” (p. 259).</li><li>• Answer the following writing prompt: What is a theme of this text? Identify a theme and describe how the author develops that theme through the characters, plot, and other aspects of the text.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> The Wheel Deal <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 420).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Science Professions <ul style="list-style-type: none"><li>• Read “Dream Jobs: Particle physicist” (p. 522).</li><li>• Answer the questions: What did you find interesting about the job? What did you learn about particle physics?</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Government</b> Legislative Branch <ul style="list-style-type: none"><li>• Re-read “The powers of Congress” (p. 593).</li><li>• Write a short summary describe the power and responsibilities of Congress.</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Eight: Wednesday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Personal Growth <ul style="list-style-type: none"><li>• Read and annotate the article “Can't Keep Your New Year's Resolutions? Try Being Kind to Yourself” (p. 264).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Springs Eternal <ul style="list-style-type: none"><li>• Complete the warm-up and getting started (p. 422).</li><li>• Complete activity 4.1.</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Science Professions <ul style="list-style-type: none"><li>• Read “Dream Jobs: Doctor and researcher” (p. 526).</li><li>• Answer the questions: What did you find interesting about the job? What did you learn and medical research?</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Legislative Branch <ul style="list-style-type: none"><li>• Read and annotate “How a bill becomes a law” (p. 597).</li><li>• Create a diagram that illustrates the path a bill takes to become a law.</li><li>• Answer the text dependent quiz questions.</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



**Week Eight: Thursday**

<b>8:00-9:00 a.m.</b>	Outdoor/Indoor Exercise
<b>9:00-10:00 a.m.</b>	<b>English IV</b> Personal Growth <ul style="list-style-type: none"><li>• Re-read the article “Can't Keep Your New Year's Resolutions? Try Being Kind to Yourself” (p. 264).</li><li>• Answer the following writing prompt: make a clear, defensible claim about the topic of the text. Write a paragraph to support your claim with clear reasons and relevant evidence from the text.</li></ul>
<b>10:00-10:15 a.m.</b>	Break
<b>10:15-11:15 a.m.</b>	<b>Precalculus</b> Spring Eternal <ul style="list-style-type: none"><li>• Complete activity 4.2 and Talk the Talk (p. 426).</li></ul>
<b>11:15-11:30 a.m.</b>	Break
<b>11:30-12:00 p.m.</b>	Choice Reading
<b>12:00-12:30 p.m.</b>	Lunch
<b>12:30-1:30 p.m.</b>	<b>Physics</b> Science Professions <ul style="list-style-type: none"><li>• Consider careers you are potentially interested in for the future.</li><li>• Answer the question: Is there a connection to science?</li><li>• Make a list of careers you might like to explore or learn more about.</li></ul>
<b>1:30-1:45 p.m.</b>	Break
<b>1:45-2:45 p.m.</b>	<b>Government</b> Legislative Branch <ul style="list-style-type: none"><li>• Consider the reading from this week and your knowledge of government.</li><li>• Respond the following prompt in 2-3 paragraphs: Evaluate the process of a bill becoming a law. Do you think the process is a good process? If you could change something about the process, what would you change and why?</li></ul>
<b>2:45-3:30 p.m.</b>	Enrichment (Art, Indoor/Outdoor Exercise)



## Week Eight: Friday

8:00-9:00 a.m.	Outdoor/Indoor Exercise
9:00-10:00 a.m.	<b>English IV</b> Personal Growth <ul style="list-style-type: none"><li>• Read and annotate the article “Happiness Can Be a Prime Predictor of Whether We’ll Find Success in Life” (p. 270).</li><li>• Answer the text dependent quiz questions. As you work, go back into the text and highlight the evidence that supports your answer choices.</li></ul>
10:00-10:15 a.m.	Break
10:15-11:15 a.m.	<b>Precalculus</b> Springs Eternal <ul style="list-style-type: none"><li>• Complete the Assignment section (p. 432).</li></ul>
11:15-11:30 a.m.	Break
11:30-12:00 p.m.	Choice Reading
12:00-12:30 p.m.	Lunch
12:30-1:30 p.m.	<b>Physics</b> Science Professions <ul style="list-style-type: none"><li>• Draft a plan for yourself to explore new careers that you might be interested in learning more about. Reach out to your teacher or a family member to help you explore career options.</li></ul>
1:30-1:45 p.m.	Break
1:45-2:45 p.m.	<b>Government</b> Legislative Branch <ul style="list-style-type: none"><li>• Consider the reading from this week and your knowledge of government.</li><li>• Answer the questions: Why is the house of Representative considered to be closer to the people? Do you know who your representative is for your area?</li></ul>
2:45-3:30 p.m.	Enrichment (Art, Indoor/Outdoor Exercise)



# English IV



Name: \_\_\_\_\_ Class: \_\_\_\_\_

## A Description of A City Shower

By Jonathan Swift  
1710

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

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



*"Untitled" by MichaelGaida is licensed under CC0.*

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

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

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

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

## Text-Dependent Questions

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

1. PART A: Which of the following statements best identifies a theme of the poem?
  - A. When exposed, life in the city is actually quite dirty and miserable.
  - B. Human civilization is no match for the sheer strength of nature.
  - C. Serious problems like poverty plague cities and cannot be washed away easily.
  - D. Civilizations experience a kind of rebirth and renewal whenever it rains.
  
2. PART B: Which of the following quotes best supports the answer to Part A?
  - A. "A coming shower your shooting corns presage, / Old achès throb, your hollow tooth will rage. / Sauntering in coffeehouse is Dulman seen; / He damns the climate and complains of spleen." (Lines 9-12)
  - B. "Now in contiguous drops the flood comes down, / Threatening with deluge this devoted town. / To shops in crowds the daggled females fly, / Pretend to cheapen goods, but nothing buy." (Lines 31-34)
  - C. "Boxed in a chair the beau impatient sits, / While spouts run clattering o'er the roof by fits, / And ever and anon with frightful din / The leather sounds; he trembles from within." (Lines 43-46)
  - D. "Sweepings from butchers' stalls, dung, guts, and blood, / Drowned puppies, stinking sprats, all drenched in mud, / Dead cats, and turnip tops, come tumbling down the flood." (Lines 61-63)
  
3. What effect did the author most likely intend with the comparison drawn in lines 43-52 between the beau and the Greeks?
  - A. The author mocks the Greeks by comparing them to a man sitting in his carriage, implying that the warriors' trick with the wooden horse was cowardly.
  - B. The author seems to suggest that the rain is just as fearful as when one's enemies stabbing a spear into one's hideout.
  - C. The author mocks the beau sitting in his carriage trembling because of the rain by comparing him to the Greeks fearfully waiting to attack their enemies.
  - D. The author seems to suggest that the beau is clever for sitting in his carriage because, like the Greeks, it allows him to proceed through the city without trouble.
  
4. What impact does the author's choice of resolution have on the overall meaning of the text?
  - A. The conclusion of the poem describes the filth of the city being washed away, a shocking ending that nevertheless implies that only a little hard work is needed to improve the city.
  - B. The conclusion of the poem focuses on the great force of the flood and therefore suggests that nature will soon destroy all that humans have created.
  - C. The conclusion of the poem describes dead animals being washed away, meant to shock and sadden the reader, thereby emphasizing the need for compassion in the city.
  - D. The conclusion of the poem focuses on the sheer filth found in the city, meant to shock and disgust the reader, thereby emphasizing the poem's criticism of city life.

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

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Name: \_\_\_\_\_ Class: \_\_\_\_\_

## Excerpts from Roughing It

By Mark Twain  
1872

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

### Prefatory

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



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

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

THE AUTHOR.

[...]

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

## Chapter 42

What to do next?

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

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

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

What to do next?

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

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

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

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

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

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

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16. Mr. Higbie is a character who appears earlier in *Roughing It* and who prospects for silver with Twain.

17. Virginia City, Nevada

18. A “blind lead” is a style of writing in newspapers in which writers hurry into a story without including too many facts in the lead, or first paragraph, of the story. This strategy aims to keep readers from being overwhelmed so that they will continue reading.

19. The Talmud is a Jewish religious text central to Rabbinic teachings and written originally in Hebrew.

20. **Misgiving (noun):** a feeling of doubt about something

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

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

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

“It isn’t sensational or exciting, but it fills up and looks business like.”

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

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

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

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

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

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

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

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29. **Emigrant** (*noun*): those who have left their own land or country for a new land

30. **Judicious** (*adj.*): of good judgment or sense

## Text-Dependent Questions

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

1. How are the details about Twain's failures in his odd jobs important to our understanding of the character?
  - A. They reinforce the notion that the character is lazy, does not want to work, and is not capable of working hard.
  - B. They detail how prospects in the American West were much dimmer than advertised, making for a harder life for those who sought fame and fortune in the new frontier.
  - C. They mark his development from an inexperienced easterner trying to make-it-rich to an experienced yet cynical Western writer.
  - D. They show that he is eager to work but has few useful skills, making him a loveable but pathetic figure.
  
2. PART A: Which statement best expresses a central theme of the text?
  - A. The West is a great place for people with no skills to succeed.
  - B. Stories of the West are often invented myths of exaggerated characters and events.
  - C. Twain supports liars because lying is the key to impressing others.
  - D. Book knowledge is more important to success than personal experience.
  
3. PART B: What phrase from the text best supports the answer to Part A?
  - A. "Yes, take it all around, there is quite a good deal of information in the book." (Paragraph 2)
  - B. "I did long to stand behind a wheel again and never roam any more" (Paragraph 6)
  - C. "Unassailable certainty is the thing that gives a newspaper the firmest and most valuable reputation." (Paragraph 13)
  - D. "(I) found one wretched old hay truck dragging in from the country... I multiplied it by sixteen... and got up such another sweat about hay as Virginia City had never seen" (Paragraph 17)
  
4. What effect does the comedic resolution of this excerpt have on the passage's overall meaning?
  - A. It provides insight into Twain's uncertainty about his future out West and the opportunities in the new territory.
  - B. It suggests that in the end, everything works out well for Western adventurers when individuals reflect on their experiences.
  - C. It relieves tension regarding the constant possibility of uncertainty and tragedy awaiting Westerners in an unfamiliar context.
  - D. It undermines the seriousness of any moral lesson that might be found in *Roughing It* and highlights the personal narrative of Twain.

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

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## Discussion Questions

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

1. In your opinion, is Twain's use of exaggeration and hyperbole amusing or does it make him an unreliable narrator? Why?
2. What allows Twain to succeed out West? Do you think that he wants readers to follow in his footsteps? Why or why not?
3. *Roughing It* is loosely based on Twain's own experiences out West. Think of a time when you have embellished or altered the truth of a story for an audience, and what was your motivation? (ex. comedy, tragedy, joy, defeat, glory)
4. Theatre experts claim that the only difference between comedy and tragedy lies in the ending of a story. Yet Twain alters happy or semi-happy endings of news stories into tragedies in order to sensationalize and sell a story. What does Twain's mingling of the comic and the tragic reveal about the absurdity of the world around us, especially in the "Wild West?"



Name: \_\_\_\_\_ Class: \_\_\_\_\_

## An Uncomfortable Bed

By Guy de Maupassant  
1909

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Oh, how they all laughed that day!

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

## Text-Dependent Questions

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

1. PART A: Which of the following statements best describes a theme of the text?
  - A. Practical jokes have a price, often a friendship.
  - B. Paranoia can make fools out of people.
  - C. True friends are never cruel.
  - D. Better to be paranoid and wrong than oblivious.
  
2. PART B: Which of the following passages best supports the answer to Part A?
  - A. Paragraph 1
  - B. Paragraph 6
  - C. Paragraph 12
  - D. Paragraph 17
  
3. In the passage, what causes the conflict between the narrator and his friends?
  - A. The narrator secretly despises his friends for their mean-spirited pranks, and he visits only to get the better of them.
  - B. The friends' laughter causes the narrator to be anxious, for he interprets it as a joke on his behalf.
  - C. The friends' exaggerated merriment and predilection to prank the narrator make him paranoid when he visits.
  - D. The narrator dislikes the lodgings given to him by his friends.
  
4. Reread the following quote from paragraph 6: "I smelled a practical joke in the air, as a dog scents game." How does this figurative language impact the tone of the story?
  - A. The comparison of an animal smelling game to the narrator sniffing out a practical joke is inappropriate, adding to the mocking tone of the piece.
  - B. The comparison of an animal smelling game to the narrator sniffing out a practical joke is silly and deluded (since, as a victim of pranks, he is normally the prey), adding to the comedic tone of the piece.
  - C. The word "game" implies that the narrator is the true predator when it comes to pranks, adding to the ironic and cruel tone of the story.
  - D. The comparison of an animal smelling game to the narrator sniffing out a practical joke creates a frightened mood, adding to the dark and anxious tone of the story.

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

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Name: \_\_\_\_\_ Class: \_\_\_\_\_

## On Tragedy

By Aristotle  
c. 335 BCE

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

### Chapter 13

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

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



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

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

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

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

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

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

## Text-Dependent Questions

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

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

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2. How does paragraph 1 contribute to the development of ideas in the article/passage?
- A. It captures the reader’s attention by making the topic of the text seem relatable to the experience of the reader.
  - B. It summarizes the central idea of the text: that poets should avoid constructing complicated plot lines when crafting a work of tragedy.
  - C. It introduces the purpose of the subsequent paragraphs: to advise writers on the components of an ideal tragedy.
  - D. It summarizes central ideas relating to how poets construct plot as described in earlier parts of the book (not included in this excerpt).
3. PART A: What does the word “spectacle” most closely mean as it is used in paragraph 2?
- A. Tragic hardship or misfortune
  - B. Success as the result of deceit or foul play
  - C. A boring or mundane story
  - D. A dramatic scene often involving scandal
4. PART B: Which phrase from the paragraph best supports the answer to Part A?
- A. “change of fortune”
  - B. “prosperity to adversity”
  - C. “moves neither pity nor fear”
  - D. “merely shocks us”

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

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## Discussion Questions

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

1. Why do you think tragedy is a popular genre? Is tragedy entertaining? What benefit do people derive from watching the downfall of a tragic hero?
2. What is the significance of pity and fear in tragedy?
3. How does what Aristotle calls our “moral sense” play into the concept of tragedy?
4. Aristotle says that the tragic hero must be similar to the audience in order to evoke fear. How do we see ourselves in literary characters?



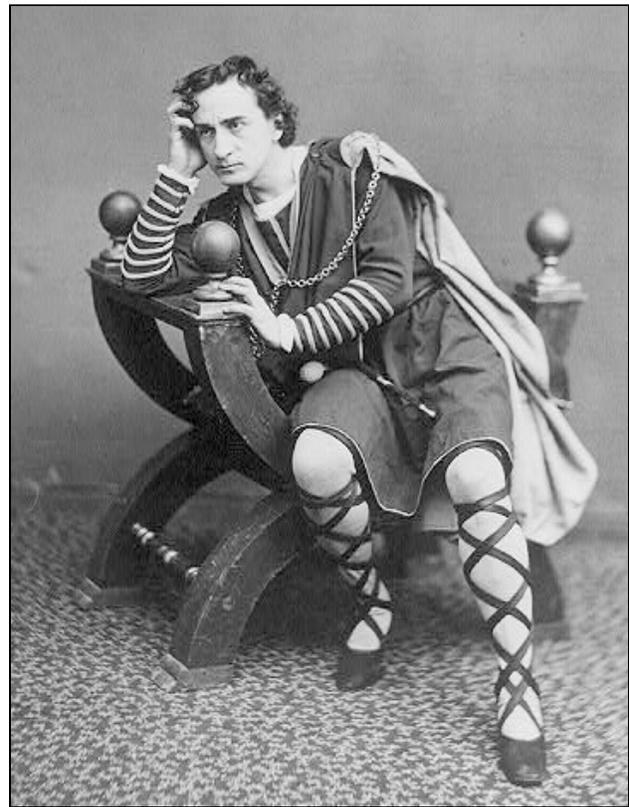
Name: \_\_\_\_\_ Class: \_\_\_\_\_

## 'To Be Or Not To Be' Soliloquy

By William Shakespeare  
c. 1599

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

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



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

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

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

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

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

## Text-Dependent Questions

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

1. PART A: Which of the following best states a theme of the soliloquy?
  - A. Suicide is not only tragic but morally wrong, and should be discouraged.
  - B. When life is full of pain and struggle, it is worthwhile to end one's life rather than suffer.
  - C. It is better to take one's own life rather than take another's in the name of revenge.
  - D. Life is full of struggle, but the great unknown of death is far more fearsome.
  
2. PART B: Which of the following quotes best supports the answer to Part A?
  - A. "To die, to sleep — / No more — and by a sleep to say we end / The heartache, and the thousand natural shocks / That flesh is heir to. 'Tis a consummation / Devoutly to be wished." (Lines 5-9)
  - B. "For who would bear the whips and scorns of time, / Th' oppressor's wrong, the proud man's contumely / The pangs of despised love, the law's delay, / The insolence of office, and the spurns / That patient merit of th' unworthy takes, / When he himself might his quietus make" (Lines 15-20)
  - C. "The undiscovered country, from whose bourn / No traveller returns, puzzles the will, / And makes us rather bear those ills we have / Than fly to others that we know not of?" (Lines 24-27)
  - D. "And thus the native hue of resolution / Is sicklied o'er with the pale cast of thought, / And enterprise of great pitch and moment / With this regard their currents turn awry / And lose the name of action." (Lines 29-33)
  
3. PART A: How does Shakespeare use figurative language to talk about death?
  - A. Shakespeare compares life to a nightmare and death to peaceful sleep.
  - B. Shakespeare compares life to crossing into new countries and death to being in a fixed state.
  - C. Shakespeare compares life and death to battles in which one has the choice of fighting.
  - D. Shakespeare compares death to sleep and dreams to the afterlife.
  
4. PART B: Which TWO quotes from the text support the answer to Part A?
  - A. "'tis nobler in the mind to suffer / The slings and arrows of outrageous fortune" (Lines 2-3)
  - B. "take arms against a sea of troubles / And by opposing end them." (Lines 4-5)
  - C. "and by a sleep to say we end / The heartache, and the thousand natural shocks / That flesh is heir to." (Lines 6-8)
  - D. "For in that sleep of death what dreams may come / When we have shuffled off this mortal coil, / Must give us pause." (Lines 11-13)
  - E. "That patient merit of th' unworthy takes, / When he himself might his quietus make / With a bare bodkin?" (Lines 19-21)
  - F. "But that the dread of something after death, / The undiscovered country, from whose bourn / No traveller returns" (Lines 23-25)

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

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# President Lincoln's Second Inaugural Address

By President Abraham Lincoln  
1865

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

[1] Fellow Countrymen:

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



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

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

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

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

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

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

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

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

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

## Text-Dependent Questions

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

1. PART A: Which statement identifies the central idea of the speech?
  - A. President Lincoln believes that the Civil War was God's way of punishing the United States for its history of slavery.
  - B. President Lincoln believes that the South is to blame for the casualties of war, as it refused to give up slavery.
  - C. The nation has changed in many positive ways since President Lincoln's last inauguration.
  - D. The Civil War continued after the abolishment of slavery, proving that slavery was never the true cause of the war.
  
2. PART B: Which quote from the text best supports the answer to Part A?
  - A. "The progress of our arms, upon which all else chiefly depends, is as well known to the public as to myself; and it is, I trust, reasonably satisfactory and encouraging to all." (Paragraph 2)
  - B. "One eighth of the whole population were colored slaves, not distributed generally over the Union, but localized in the Southern part of it." (Paragraph 4)
  - C. "Neither anticipated that the cause of the conflict might cease with, or even before, the conflict itself should cease." (Paragraph 4)
  - D. "having continued through His appointed time, He now wills to remove, and that He gives to both North and South, this terrible war, as the woe due to those by whom the offence came," (Paragraph 6)
  
3. According to the text, how does the difference of four years (between inaugural speeches) alter the context of the speeches?
  - A. The first speech was longer, as the people needed explanation as they anxiously entered war, but the second, in light of the casualties of war, is briefer and more solemn.
  - B. The second speech is far more triumphant than the first, which was given in an uncertain time at the beginning of the war.
  - C. The second speech is more emotional and filled with more hatred towards the Confederacy, which the Union has almost defeated.
  - D. The first speech was longer as President Lincoln praised the strength of the Union, whereas in the second speech the Union is no longer so intimidating.

4. What distinction does President Lincoln make in paragraph 3 about both sides of the war?
- A. Lincoln argues that the Union wanted to avoid war all together, while the Confederacy wanted nothing more than to fight.
  - B. Lincoln acknowledges that the Union was the first to declare war in order to maintain the United States and that, perhaps, they should have let the Confederacy peacefully secede.
  - C. Lincoln emphasizes the fault of the Confederacy for seeking to destroy the larger union, with all states united, but does not condemn them as blood-thirsty.
  - D. Lincoln stresses the idea that neither side actively sought war; their motivations may have been different, but neither party wanted to declare war if negotiation was possible.
5. PART A: Upon whom does Lincoln cast blame for the civil war and to what effect?
- A. Lincoln blames the Confederate States, particularly those states that first seceded, for refusing to negotiate.
  - B. Lincoln does not actively blame anyone for the civil war, likely to avoid future hostility, but points to the institution of slavery as the cause of the war.
  - C. Lincoln does not actively blame either side; rather he blames individual supporters of slavery, thus emphasizing the evils of the institution of slavery.
  - D. Lincoln blames divine intervention for this war, for he sees the civil war as a form of senseless violence caused by an angry God.
6. PART B: Which of the following best supports the answer to Part A?
- A. "On the occasion corresponding to this four years ago all thoughts were anxiously directed to an impending civil war." (Paragraph 3)
  - B. "Neither party expected for the war the magnitude or the duration which it has already attained. Neither anticipated that the cause of the conflict might cease with or even before the conflict itself should cease. (Paragraph 4)
  - C. "Both read the same Bible and pray to the same God, and each invokes His aid against the other." (Paragraph 4)
  - D. "Yet, if God wills that it continue until all the wealth piled by the bondsman's two hundred and fifty years of unrequited toil shall be sunk, and until every drop of blood drawn with the lash shall be paid by another drawn with the sword, as was said three thousand years ago, so still it must be said "the judgments of the Lord are true and righteous altogether."" (Paragraph 6)
7. How does paragraph 6 contribute to the development of ideas in the text?

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# Opposing Innovation

## *The Luddite Lesson*

By Mike Kubic  
2016

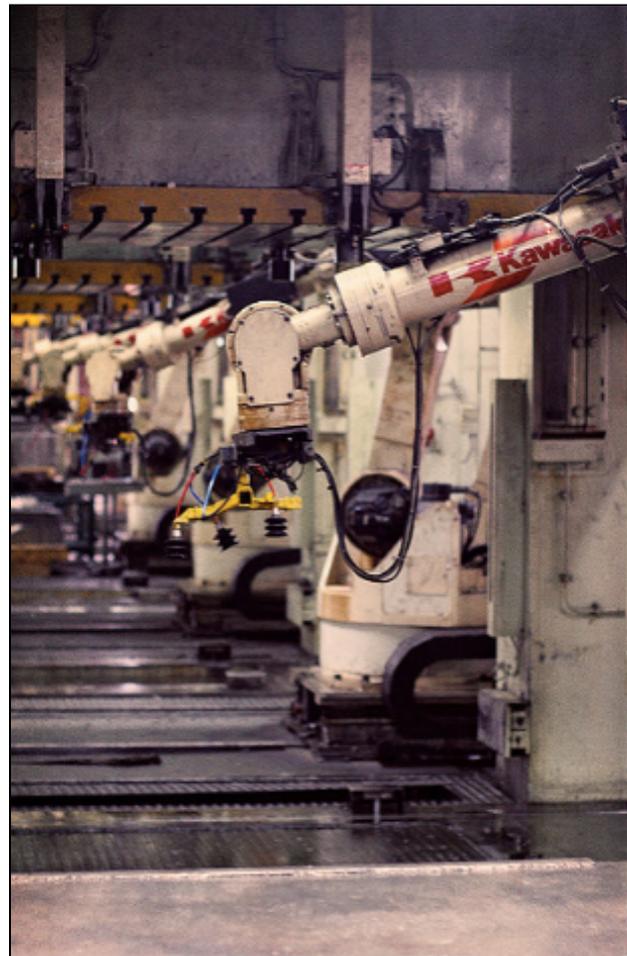
*In this article, Mike Kubic, a former Newsweek correspondent, examines the history of the term "Luddite." The Luddites were bands of English workers who, believing technological advancements would threaten their livelihood, banded together to destroy new machinery between 1811 and 1816. Cotton and woolen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

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

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

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

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



*"Factory - Robotic Arms" by Jason Armstrong is licensed under CC BY-NC-ND 2.0.*

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

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

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

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

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

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

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

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

## The Age of Robotics

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

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4. a statement of beliefs

5. **Grievous** (*adjective*): causing great suffering

6. to disrupt the usual status or order of (something)

7. A spindle rod is a bar on a spinning wheel that twists the thread.

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

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

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

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

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

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

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

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

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

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8. **Exacerbate** (*verb*): to make something bad even worse

9. Automation, or automatic control, is the use of various technological control systems to operate equipment such as machinery to reduce or eliminate human intervention.

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

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

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

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

## Text-Dependent Questions

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

1. PART A: Which of the following TWO phrases best identify the central ideas of this article?
  - A. Automated services are a cheaper, more effective, and less error-prone alternative to employing humans in secretarial positions.
  - B. The original Luddites, fearful of their jobs being rendered obsolete by technology, tried in vain to prevent that technology from being implemented.
  - C. George Devol's invention, Unimate, caused civil unrest by revolutionizing the structure of the American economy.
  - D. Unskilled factory jobs are increasingly difficult to hold onto; within 100 years there will likely be no more factory jobs left in America.
  - E. Technological advancement may have both negative and positive economic effects; what is certain is that it is a force that cannot be slowed.
  - F. The Industrial Revolution doomed progressive efforts to reduce income inequality between the upper and lower classes.
  
2. PART B: Which TWO phrases from the text best support the answers to Part A?
  - A. "[The Luddites] fear[ed] that the introduction of mechanized equipment would make their skills worthless, and that they would lose their jobs as a result. ...this anxiety turned into anger and a destructive force." (Paragraph 3)
  - B. "By the 1860s, England had launched the historical Industrial Revolution, which brought unprecedented economic, technological, and social progress." (Paragraph 6)
  - C. "Devol's invention of a digitally operated programmable robotic arm triggered an explosive change in the manufacturing industry" (Paragraph 12)
  - D. "Statistics show that those low-level starting jobs of yesteryear are increasingly performed by robots." (Paragraph 14)
  - E. "They were replaced by Internet firms that provide, more cheaply, a wide variety of services that range from maintaining calendars to planning foreign travel." (Paragraph 16)
  - F. "But the unstoppable drive to innovate will no doubt bring dramatic changes and new challenges. We need to do all we can to be ready." (Paragraph 24)
  
3. PART A: What does the phrase "sea change" most closely mean as it is used in Paragraph 13?
  - A. a period of substantial technological advancement
  - B. a time of increased demand for specialized labor
  - C. a profound or notable transformation
  - D. a disruptive and undesirable change
  
4. PART B: Which phrase from the text best supports the answer to Part A?
  - A. "replaced tens of thousands of workers" (Paragraph 12)
  - B. "a whirlwind of still more labor- and cost-saving innovations" (Paragraph 13)
  - C. "smart enough to command and operate other robots" (Paragraph 13)
  - D. "unskilled laborers fulfilled had some roles in factories" (Paragraph 13)

5. Which statement best describes how the author responds to the criticism that the adoption of new technologies intensifies the issue of income inequality?
- A. He emphasizes that increased economic activity that occurs in technologically advanced societies will offset this undesirable effect.
  - B. He acknowledges that this is one of several potential adverse consequences, but insists that history shows that America is equipped to recover from these negative side effects.
  - C. He suggests that the “safety net” that social programs provide to Americans will serve as a cure-all for those affected by income inequality.
  - D. He refutes the claim by demonstrating that, throughout history, people and societies have effectively rebounded from job loss and job reduction.
6. What is the author’s main purpose in writing this article? Cite evidence from the text in your response.

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## Discussion Questions

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

1. In Paragraphs 10-11, the author discusses social programs as a safeguard against the most harmful economic effects of new technologies. Do you think these are an effective solution to the potential problems presented in the text?
2. The author points out that America's "vast transformations have taken place in relative harmony, thanks to the uniquely American optimism" (Paragraph 23). Do you agree that optimism is characteristic of the United States citizenry? Cite historical examples to support your answer.
3. Based on the text and your knowledge of history, do you think the tale of the Luddites' resistance to technology is a common one?
4. While advances in technology have rendered some jobs obsolete, they have also continuously improved quality of life on a global scale. In the context of this article, what are the costs and benefits of technology? In your opinion, are the positive effects of technological advances worth the problems they create?
5. The article suggests that the Luddites' destructive impulses were motivated by concerns "that the introduction of mechanized equipment would make their skills worthless, and that they would lose their jobs as a result" (Paragraph 3). In the context of this article, why do people resist change? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

## Millennials hands-on when giving to charity

By Joyce Gannon, Pittsburgh Post-Gazette on 12.22.15

Word Count **704**

Level **MAX**



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

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

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

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

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

“(Millennials) really want to see a direct impact.”

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## Quiz

1 Read the sentence below.

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

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

- (A) consider
- (B) regard
- (C) evaluate
- (D) dismiss

2 Read the sentence below.

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

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

- (A) Positive; it is associated with the Thanksgiving holiday.
- (B) Positive; it is associated with the excitement of shopping.
- (C) Negative; Giving Tuesday is offered as a remedy for excessive spending.
- (D) Negative; the fundraising on Giving Tuesday is insignificant compared to money spent shopping.

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

- (A) The first paragraphs provide an anecdote of one Giving Tuesday event, while the final paragraphs use a quote from someone at that event to broaden the concept of volunteering.
- (B) The first paragraphs provide an anecdote of one Giving Tuesday event, while the final paragraphs provide comments encouraging people to become involved with that event in the future.
- (C) The first paragraphs use a quote from someone at a Giving Tuesday event to establish the concept of volunteering, then the final paragraphs use a quote from that person to describe the experience of volunteering on Giving Tuesday.
- (D) The first paragraphs use a quote from someone at a Giving Tuesday event to establish the concept of volunteering, then the final paragraphs encourage others to volunteer.

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

- (A) It illustrates the impact of Giving Tuesday from the perspective of a nonprofit organization.
- (B) It illustrates the experience of Giving Tuesday from the perspective of a volunteer.
- (C) It illustrates why millennials prefer to volunteer with organizations rather than only donating money.
- (D) It illustrates how the combination of digital and hands-on activities appeal to millennials.



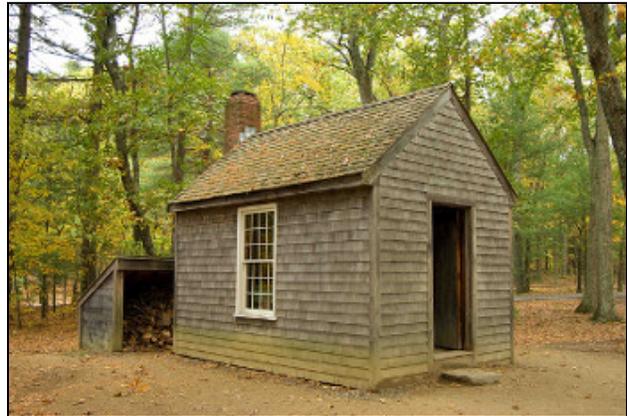
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## Excerpt from Walden: "Where I Lived and What I Lived For"

By Henry David Thoreau  
1854

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

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



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

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

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

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

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

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

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12. an old-fashioned term for Sydenham's chorea, a nervous disorder characterized by involuntary movements

13. guards

14. a basic principle or element; something unformed or undeveloped

15. **Myriad (adjective):** countless or great in number

16. relating to Spanish-Portuguese politics (1830s - 1840s)

17. **Succinct (adjective):** precise; without wasted words

18. **Lucid (adjective):** expressed clearly; easy to understand

19. the English Civil War

20. relating to money

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

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

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21. A character in *The Analects*, a book of philosophy with quotation attributed to Confucius. Today, we would spell his name Qu Boyu.

22. Confucius, also known as Kongzi

23. *The Analects*, 14.25

24. also known as *A Thousand and One Nights*, a medieval collection of Middle Eastern folktales

25. **Discern (verb):** to deduce or recognize

26. Hindu

27. uncivilized

28. Brahma, Hindu god of creation

29. In the Old Testament, according to the book of Genesis, Adam was the first man created by God.

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

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

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

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

## Text-Dependent Questions

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

1. PART A: Which of the following best describes a central idea of the text?
  - A. Time is fleeting and so people should live life to the fullest by experiencing everything it has to offer.
  - B. People should put art and academics before work and society because work and society are meaningless.
  - C. Life should be lived without complication or hurry in order to find meaning.
  - D. Technology is invasive and must be stopped before it takes over all aspects of one's life.
  
2. PART B: Which TWO of the following quotes best support the answer to Part A?
  - A. "Our life is frittered away by detail... Simplicity, simplicity, simplicity!" (Paragraph 2)
  - B. "Men think that it is essential that the Nation have commerce, and export ice, and talk through a telegraph, and ride thirty miles an hour" (Paragraph 2)
  - C. "Why should we live with such hurry and waste of life? We are determined to be starved before we are hungry." (Paragraph 3)
  - D. "Hardly a man takes a half-hour's nap after dinner, but when he wakes he holds up his head and asks, 'What's the news?'" (Paragraph 3)
  - E. "For my part, I could easily do without the post-office. I think that there are very few important communications made through it." (Paragraph 4)
  - F. "Men esteem truth remote, in the outskirts of the system, behind the farthest star, before Adam and after the last man." (Paragraph 6)
  
3. PART A: Which of the following best describes what the word "mean" conveys, as used in paragraph 1?
  - A. amazing
  - B. lowly
  - C. average
  - D. useful
  
4. PART B: Which of the following phrases best supports the answer to Part A?
  - A. "drive life into a corner" (Paragraph 1)
  - B. "reduce it" (Paragraph 1)
  - C. "of the devil or of God" (Paragraph 1)
  - D. "like ants" (Paragraph 2)

5. In paragraph 2, Thoreau states, "We do not ride on the railroad; it rides upon us." Which of the following statements best explains the figurative language used in this quote?
- A. Thoreau grieves for those whom the railroad industry has taken advantage of, specifically those who died while building it.
  - B. Thoreau predicts the end of small business craftsmanship in the face of an increasingly industrialized world represented by the train.
  - C. Thoreau comments on how aspects of modern life, such as the train, control the lives of the people who use them, rather than the other way around.
  - D. Thoreau denounces the use of public transportation, arguing that is pointless if it cannot take one exactly where one chooses.
6. How does the author respond to people's interest in the news, as shown in paragraph 3?
- A. He is saddened by the people's interest in gossip and tragedy rather than "real" news from around the world.
  - B. He mocks the news and the people who obsess over it, implying that they are blind to life and reality because of their news obsession.
  - C. He becomes angry because their obsession with the news prevents them from recognizing when something important, such as a fire, is actually happening nearby.
  - D. He mocks the news and the people who obsess over it, suggesting that they don't actually understand what they are reading.
7. How does the story of the prince in paragraph 6 contribute to the development of ideas in the passage?
- A. The story supports Thoreau's idea that one can see the "reality" of things when one looks past superficial circumstances.
  - B. The story supports Thoreau's argument that superficial titles are just distractions and have nothing to do with who a person really is.
  - C. Thoreau praises the story because the prince's childhood of living in the forest shows how going to the woods in order to "live deliberately" can be beneficial.
  - D. Thoreau uses the story to argue that what one thinks to be the truth can actually be false, and so there is no such thing as "reality."
8. Explain Thoreau's figurative use of the word "burrowing" in the final paragraph. What is he digging for? Cite evidence from the text in your answer.

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Name: \_\_\_\_\_ Class: \_\_\_\_\_

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

By Walt Whitman  
1855

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

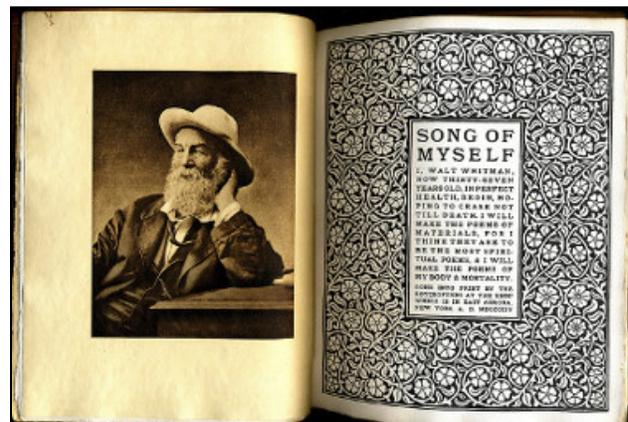
### 1

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

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

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

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



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

### 2

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

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

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

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

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

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

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

## 6

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

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

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

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

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

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

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

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

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

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

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

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

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

## 52

The spotted hawk swoops by and accuses me, he complains of my gab<sup>16</sup> and my loitering.

I too am not a bit tamed, I too am untranslatable,  
I sound my barbaric yawp<sup>17</sup> over the roofs of the world.

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13. deliberate for a specific purpose or effect

14. **Transpire (verb):** to occur

15. **Arrest (verb):** to stop

16. chatter

17. harsh cry

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

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

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

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

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

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

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18. flash; swift movement

19. **Effuse** (*verb*): to pour or flow

20. **Bequeath** (*verb*): to hand down

21. As a noun, fibre is matter or material; it also means an essential character or quality.

## Text-Dependent Questions

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

1. PART A: Which of the following best identifies one of the themes of the poem?
  - A. One must abandon all material objects to truly enjoy life.
  - B. All things and people are interconnected.
  - C. Real knowledge is gained from books and formal education.
  - D. Formal institutions such as religion and law have no purpose in society.
  
2. PART B: Which of the following quotes best supports the answer to Part A?
  - A. "For every atom belonging to me as good belongs to you." (Stanza 1)
  - B. "Creeds and schools in abeyance, / Retiring back a while sufficed at what they are, but never forgotten" (Stanza 4)
  - C. "Nature without check with original energy." (Stanza 4)
  - D. "I will go to the bank by the wood and become undisguised and naked" (Stanza 6)
  
3. PART A: What does the word "loafe" mean as it is used in stanza 2?
  - A. to begin
  - B. to sing
  - C. to relax
  - D. to examine
  
4. PART B: Which phrase best supports the answer to Part A?
  - A. "I Celebrate myself, and sing myself" (Stanza 1)
  - B. "invite my soul" (Stanza 2)
  - C. "at my ease" (Stanza 2)
  - D. "observing a spear of summer grass" (Stanza 2)
  
5. PART A: How does the symbol of grass develop the theme of section 6?
  - A. It reveals that God is in everything, whether that thing is aware of God's existence.
  - B. It reveals that life and death are cyclical and connect everything.
  - C. It reveals that nature is resilient and indifferent to mankind.
  - D. It reveals that unlearned children understand the universe better than learned adults.

6. PART B: Which quote from the text best supports the answer to Part A?
- A. "A child said What is the grass? fetching it to me with full hands; / How could I answer the child? I do not know what it is any more than he." (Stanza 11)
  - B. "Or I guess it is the handkerchief of the Lord, / A scented gift and remembrancer designedly dropt" (Stanza 13)
  - C. "What do you think has become of the young and old men? / And what do you think has become of the women and children?" (Stanza 20)
  - D. "They are alive and well somewhere, / The smallest sprout shows there is really no death, / And if ever there was it led forward life" (Stanza 21)
7. What is the author's likely purpose in having the speaker address "you" throughout the poem?
- A. to urge the reader to learn with and identify with the speaker
  - B. to depart from the more traditional approach of speaking about one's own life
  - C. to reveal that the speaker and the reader are born with shared knowledge
  - D. to allow the speaker to brag about their knowledge to the reader
8. How does the author use imagery from section 52 to develop the poem's themes? Cite evidence from multiple sections of the poem in your response.

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# The Open Boat

By Stephen Crane  
1901

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

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

I



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"The crew," said the cook.

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

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

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

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

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

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

## II

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

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

"That's right," said the correspondent.

The busy oiler nodded his assent.

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

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

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

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

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

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10. **Tumultuous** (*adjective*): disorderly, stormy, or violent

11. **Dogged** (*adjective*): stubbornly determined

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

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

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

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

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

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

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

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

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12. **Covey (noun):** a small flock of birds

13. **Painter (noun):** a rope attached to the front of a boat to tying to a quay

14. **Emphatic (adjective):** expressing something forcibly and clearly; with great emphasis

15. a structural crosspiece sometimes forming a seat for a rower in a boat

16. "of Sèvres" refers to a type of French porcelain

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

"Think we'll make it, captain?"

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

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

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

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

### III

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

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

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

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

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17. **Motley** (*adjective*): diverse (and sometimes poorly organized)

18. **Scull** (*verb*): to row or propel a boat

19. **Schooners** (*noun*): a type of sailing ship with two or more masts

"Did they?" said the captain.

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

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

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

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

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

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

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

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

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

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

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20. **Impetuous** (*adjective*): moving forcefully or rapidly

21. A spyglass, or handheld telescope

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

## IV

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

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

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

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

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

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

"Funny they don't see us."

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

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

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

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

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22. **Impudent** (*adjective*): showing little or no respect

23. **Opprobrious** (*adjective*): expressing scorn or criticism

24. **Epithet** (*noun*): an insult or term of abuse

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

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

"Yes! Go ahead!" said the captain.

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

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

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

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

"Funny they haven't seen us."

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

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

"St. Augustine?"

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

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25. **Admonition** (*noun*): gentle reproof; counsel, advice, or caution

26. **Preposterous** (*adjective*): absurd

27. great surging waves

28. **Squall** (*noun*): a sudden strong wind or storm

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

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

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

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

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

"Where?"

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

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

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

"He's waving at us!"

"So he is! By thunder!"

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

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

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

"What's he doing now?"

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

"Is he waving at us?"

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29. **Innumerable** (*adjective*): incapable of being counted

30. **Obstreperous** (*adjective*): resisting control or restraint; unruly

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

"Look! There comes another man!"

"He's running."

"Look at him go, would you."

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

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

"What the devil is that thing?"

"Why, it looks like a boat."

"Why, certainly it's a boat."

"No, it's on wheels."

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

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

"No, by — it's — it's an omnibus."

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

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

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

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

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

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

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

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

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

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

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

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

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

"There come more people."

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

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

"That fellow is still waving his coat."

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

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

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

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

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

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

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

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

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

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

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

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

"Why? What did he do?"

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

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

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

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

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

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

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

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

## V

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

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

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

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32. a yellowish-orange color

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## VI

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

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

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33. **Phosphorescence** (*noun*): luminescence

34. **Bereft** (*adjective*): deprived of or lacking something

35. **Abominable** (*adjective*): very bad or unpleasant; causing moral revulsion

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

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

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

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

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

"A soldier of the Legion lay dying in Algiers,

There was lack of woman's nursing, there was dearth of woman's tears;

But a comrade stood beside him, and he took that comrade's hand,

And he said: 'I shall never see my own, my native land.'"<sup>38</sup>

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

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

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

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36. **Pellet** (*verb*): to hit something, as if with pellets

37. **Pathos** (*noun*): a quality that evokes pity or sadness

38. This is a verse from the poem "Bingen on the Rhine" by Caroline Norton

39. **Myriad** (*adjective*): countless or great in number

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

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

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

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

"Wish I had known you were awake."

Later the correspondent spoke into the bottom of the boat.

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

[190] "Sure," said the oiler.

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

"Sure, Billie."

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

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

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

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40. **Roseate** (*adjective*): rose-colored

41. "Airs" is a term for "songs," meaning that the correspondent's chattering resembled music.

42. **Bequeath** (*verb*): to pass something on or leave something to another person

43. **Repose** (*noun*): a state of rest or sleep

44. **Ominous** (*adjective*): suggesting that something bad is going to happen

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

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

At last there was a short conversation.

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

[200] "Sure," said the oiler.

## VII

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

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

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

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

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

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45. a vivid crimson color

46. **Acquiesce** (*verb*): to accept or agree to something

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

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

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

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

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

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

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

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

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

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

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

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

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47. a long curling wave

48. **Implacable** (*adjective*): unable to be appeased

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"Come to the boat," called the captain.

"All right, captain." As the correspondent paddled, he saw the captain let himself down to bottom and leave the boat. Then the correspondent performed his one little marvel of the voyage. A large wave caught him and flung him with ease and supreme speed completely over the boat and far beyond it. It struck him even then as an event in gymnastics, and a true miracle of the sea. An overturned boat in the surf is not a plaything to a swimming man.

The correspondent arrived in water that reached only to his waist, but his condition did not enable him to stand for more than a moment. Each wave knocked him into a heap, and the under-tow pulled at him.

[235] Then he saw the man who had been running and undressing, and undressing and running, come bounding into the water. He dragged ashore the cook, and then waded towards the captain, but the captain waved him away, and sent him to the correspondent. He was naked, naked as a tree in winter, but a halo was about his head, and he shone like a saint. He gave a strong pull, and a long drag, and a bully heave at the correspondent's hand. The correspondent, schooled in the minor formulæ, said: "Thanks, old man." But suddenly the man cried: "What's that?" He pointed a swift finger. The correspondent said: "Go."

In the shallows, face downward, lay the oiler. His forehead touched sand that was periodically, between each wave, clear of the sea.

The correspondent did not know all that transpired afterward. When he achieved safe ground he fell, striking the sand with each particular part of his body. It was as if he had dropped from a roof, but the thud was grateful to him.

It seems that instantly the beach was populated with men with blankets, clothes, and flasks, and women with coffee-pots and all the remedies sacred to their minds. The welcome of the land to the men from the sea was warm and generous, but a still and dripping shape was carried slowly up the beach, and the land's welcome for it could only be the different and sinister hospitality of the grave.

When it came night, the white waves paced to and fro in the moonlight, and the wind brought the sound of the great sea's voice to the men on shore, and they felt that they could then be interpreters.

*The Open Boat by Stephen Crane is in the public domain.*

## Text-Dependent Questions

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

1. How is the first paragraph of the story important to the passage as a whole?
  - A. It focuses on the danger of the ocean as insurmountable.
  - B. It focuses on the ocean's importance over the sky and land, setting the sea as the primary setting.
  - C. It establishes the ocean as the primary focus and antagonist of the survivors.
  - D. It establishes the ocean as ugly and gray, as opposed to beautiful and blue.
  
2. How does paragraph 11 contribute to the development of the narrator's point of view?
  - A. It shows the men's predicament from a different perspective, emphasizing the narrator's view that nature is ultimately good and beautiful.
  - B. It shows the men's predicament from a different, more picturesque perspective, contrasting and emphasizing the terrible situation in which the men find themselves.
  - C. It places the validity of the narrator's point of view into question, given how beautiful the scene looks from another angle.
  - D. It widens the narrator's perspective to beyond the dinghy, suggesting the narrator is actually on the shore.
  
3. Which of the following best summarizes how the men interact with each other?
  - A. The men work together like a well-oiled machine, each with assigned duties to stay alive.
  - B. The men resent each other after being stuck on the dinghy for so long.
  - C. The men maintain their old titles and hierarchies from the ship.
  - D. The men love each other to the point of sacrificing themselves for one another.
  
4. In paragraph 44, how does the narrator describe their time at sea and the impact it has had on everyone, especially the correspondent?

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5. "If I am going to be drowned — if I am going to be drowned — if I am going to be drowned, why, in the name of the seven mad gods who rule the sea, was I allowed to come thus far and contemplate sand and trees?" What does this repetition (in paragraph 71, paragraph 144, and paragraph 173) contribute to the tone and overall piece?

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6. What does the incident with the shark in Part V reveal about the correspondent's and captain's points of view in this passage?
- A. The correspondent and captain were both terrified, but only the correspondent is willing to admit it.
  - B. Both were rather indifferent to the shark; the correspondent was more concerned with being alone (or not being alone) than the shark.
  - C. The shark prompts the captain to attempt rowing to shore, while the tired correspondent seems content with the predator circling them.
  - D. Both accept the shark as a sign of their impending deaths at sea.
7. PART A: Which of the following best explains the meaning and significance of the poem quoted after paragraph 179?
- A. The poem describes a man dying in a foreign place, just as the crewmen have died at sea.
  - B. The poem describes a soldier dying for a cause, in contrast to the ship suddenly sinking and the four survivors stranded in the ocean.
  - C. The poem describes a man dying alone, which is how the correspondent feels even though he is surrounded by three other men.
  - D. The poem describes a soldier dying, the meaning and impact of which never occurred to the correspondent before being himself confronted with the possibility of death.
8. PART B: How does the correspondent's attitude towards the soldier in the poem change?
- A. He becomes more aware of the soldier's death in the poem as a truly human thing, a description of suffering to which he was indifferent as a young man.
  - B. He becomes less affected by the soldier's plight because of his own suffering.
  - C. His attitude is equivalent to that of nature; he sees the poem now as an example of the cycle of life.
  - D. His attitude changes as he can finally sympathize with the comrade of the dying soldier, just as he witnesses his own companions wasting away.

9. PART A: How does the description of the windmill in paragraphs 201-203 contribute to the central ideas of the text?
- A. The windmill represents the men, its propellers mimicking the men rowing, thus contributing to the idea of the men as more of machines when it comes to survival.
  - B. The windmill represents the salvation of the men on the boat, contributing to the idea of a benevolent universe.
  - C. The windmill is described as towering and disinterested, contributing to the idea of an indifferent universe.
  - D. The windmill is described as monstrous and blind to the sea, implying that all of humanity is blinded to their plight and therefore cruel.
10. PART B: Which of the following quotes best supports the answer to Part A?
- A. "On the distant dunes were set many little black cottages, and a tall white windmill reared above them." (Paragraph 202)
  - B. "This tower was a giant, standing with its back to the plight of the ants." (Paragraph 203)
  - C. "The correspondent wondered if none ever ascended the tall wind-tower, and if then they never looked seaward." (Paragraph 203)
  - D. "...the mind was dominated at this time by the muscles, and the muscles said they did not care." (Paragraph 208)
11. Which of the following best explains the author's purpose in naming only one character?
- A. Billie is the only character whose title doesn't represent the entirety of his character's identity.
  - B. The author names him as a way of marking him as different, letting the audience know from the beginning that he is the protagonist.
  - C. The author names him as a way of suggesting that he is an average man, so that his death underscores the randomness of nature and its indifference to tragedy.
  - D. The author names the oiler Billie in order to reinforce the name's association with youth, making his death an even greater tragedy.
12. PART A: Select TWO choices from the list below that best identify the themes of the story.
- A. Man versus Nature
  - B. Brotherhood or community
  - C. Fate or destiny
  - D. Grief and loss
  - E. Faith or providence
  - F. Hope and optimism
13. PART B: Which of the following passages best supports the answer to Part A?
- A. Paragraph 44
  - B. Paragraph 71
  - C. Paragraph 143
  - D. Paragraph 175





Name: \_\_\_\_\_ Class: \_\_\_\_\_

## The Transformation of Arachne into a Spider

By Ovid

From *Metamorphoses* (Book Vi) • 8 A.D.

*Ovid (43 B.C.-17 A.D.) was a Roman poet well-known for his elaborate prose and fantastical imagery. Ovid was similar to his literary contemporary, Virgil, in that both authors played a part in reinventing classical poetry and mythology for Roman culture. Metamorphoses, one of Ovid's most-read works, consists of a series of short stories and epic poems whose mythological characters undergo transformation in some way or another. As you read, take notes on Ovid's choice of figurative language and imagery.*

- [1] Pallas,<sup>1</sup> attending to the Muse's<sup>2</sup> song,  
 Approv'd the just resentment of their wrong;  
 And thus reflects: While tamely<sup>3</sup> I commend  
 Those who their injur'd deities<sup>4</sup> defend,  
 [5] My own divinity affronted stands,  
 And calls aloud for justice at my hands;  
 Then takes the hint, asham'd to lag behind,  
 And on Arachne' bends her vengeful mind;  
 One at the loom<sup>5</sup>  
 so excellently skill'd,  
 [10] That to the Goddess<sup>6</sup> she refus'd to yield.  
 Low was her birth, and small her native town,  
 She from her art alone obtain'd renown.  
 Idmon, her father, made it his employ,  
 To give the spungy fleece<sup>7</sup>  
 a purple dye:  
 [15] Of vulgar strain her mother, lately dead,  
 With her own rank had been content to wed;  
 Yet she their daughter, tho' her time was spent  
 In a small hamlet,<sup>8</sup>  
 and of mean descent,  
 Thro' the great towns of Lydia gain'd a name,  
 [20] And fill'd the neighb'ring countries with her fame.



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1. Pallas is another name for Minerva (Athena) the goddess of wisdom and the arts (such as weaving).
2. The Muses are the three goddesses of poetic inspiration.
3. **Tamely** (*adverb*): calmly
4. **Deity** (*noun*): god or goddess
5. An instrument used for weaving
6. The Goddess refers to Minerva, also known as the Roman goddess Athena.
7. A sheep's skin
8. A town

Oft,<sup>9</sup> to admire the niceness of her skill,  
 The Nymphs<sup>10</sup> would quit their fountain, shade, or hill:  
 Thither, from green Tymolus,<sup>11</sup> they repair,  
 And leave the vineyards, their peculiar care;  
 [25] Thither, from fam'd Pactolus' golden stream,<sup>12</sup>  
 Drawn by her art, the curious Naiads<sup>13</sup> came.  
 Nor would the work, when finish'd, please so much,  
 As, while she wrought, to view each graceful touch;  
 Whether the shapeless wool in balls she wound,  
 [30] Or with quick motion turn'd the spindle round,  
 Or with her pencil drew the neat design,  
 Pallas her mistress shone in every line.  
 This the proud maid with scornful air denies,  
 And ev'n the Goddess at her work defies;  
 [35] Disowns her heav'nly mistress ev'ry hour,  
 Nor asks her aid, nor deprecates<sup>14</sup> her pow'r.  
 Let us, she cries, but to a tryal<sup>15</sup> come,  
 And, if she conquers, let her fix my doom.

The Goddess then a beldame's<sup>16</sup>  
 form put on,  
 [40] With silver hairs her hoary<sup>17</sup>  
 temples shone;  
 Prop'd by a staff, she hobbles in her walk,  
 And tott'ring thus begins her old wives' talk.

Young maid attend, nor stubbornly despise  
 The admonitions of the old, and wise;  
 [45] For age, tho' scorn'd, a ripe experience bears,  
 That golden fruit, unknown to blooming years:  
 Still may remotest fame your labours crown,  
 And mortals your superior genius own;  
 But to the Goddess yield, and humbly meek  
 [50] A pardon for your bold presumption seek;  
 The Goddess will forgive. At this the maid,  
 With passion fir'd, her gliding shuttle stay'd;  
 And, darting vengeance with an angry look,  
 To Pallas in disguise thus fiercely spoke.

9. Often

10. Nymphs are mythological woodland fairies.

11. Tymolus refers to a certain mountain.

12. According to myth, Midas rid himself of his golden touch in the Pactolus river.

13. Naiads are mythological water fairies.

14. **Deprecate (verb):** to belittle, slight; in this context, to show humility

15. A trial or challenge

16. Old woman

17. Old and grey

- [55] Thou doating<sup>18</sup>  
 thing, whose idle babbling tongue  
 But too well shews<sup>19</sup> the plague of living long;  
 Hence, and reprove, with this your sage<sup>20</sup> advice,  
 Your giddy daughter, or your awkward niece;  
 Know, I despise your counsel, and am still
- [60] A woman, ever wedded to my will;  
 And, if your skilful Goddess better knows,  
 Let her accept the tryal I propose.
- She does, impatient Pallas strait replies,  
 And, cloath'd with heavenly light, sprung from her odd disguise.
- [65] The Nymphs, and virgins of the plain adore  
 The awful<sup>21</sup> Goddess, and confess her pow'r;  
 The maid alone stood unappall'd; yet show'd  
 A transient<sup>22</sup> blush, that for a moment glow'd,  
 Then disappear'd; as purple streaks adorn
- [70] The opening beauties of the rosy morn;  
 Till Phoebus<sup>23</sup> rising prevalently bright,  
 Allays the tincture<sup>24</sup>  
 with his silver light.  
 Yet she persists, and obstinately<sup>25</sup> great,  
 In hopes of conquest hurries on her fate.
- [75] The Goddess now the challenge waves no more,  
 Nor, kindly good, advises as before.  
 Strait to their posts appointed both repair,  
 And fix their threaded looms with equal care:  
 Around the solid beam the web is ty'd,
- [80] While hollow canes the parting warp divide;<sup>26</sup>  
 Thro' which with nimble flight the shuttles play,  
 And for the woof prepare a ready way;  
 The woof and warp unite, press'd by the toothy slay.

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18. Senile

19. Shows

20. **Sage** (*adjective*): wise; used sarcastically in this case

21. **Awful** (*adjective*): (archaic) inspiring awe

22. **Transient** (*adjective*): momentary or brief

23. Phoebus is another name for the sun god (Apollo in Greek mythology). It is also a term used to refer literally to the sun.

24. Tinge of color

25. **Obstinately** (*adverb*): stubbornly

26. Warp, shuttles, woof, and slay are terms used in weaving; parts of the loom.

- Thus both, their mantles button'd to their breast,  
 [85] Their skilful fingers ply with willing haste,  
 And work with pleasure; while they chear<sup>27</sup> the eye  
 With glowing purple of the Tyrian dye:  
 Or, justly intermixing shades with light,  
 Their colourings insensibly unite.
- [90] As when a show'r transpierc'd<sup>28</sup>  
 with sunny rays,  
 Its mighty arch along the heav'n displays;  
 From whence a thousand diff'rent colours rise,  
 Whose fine transition cheats the clearest eyes;  
 So like the intermingled shading seems,
- [95] And only differs in the last extremes.  
 Then threads of gold both artfully dispose,  
 And, as each part in just proportion rose,  
 Some antique fable in their work disclose.
- Pallas in figures wrought the heav'nly Pow'rs,  
 [100] And Mars's<sup>29</sup> hill among th' Athenian tow'rs.  
 On lofty thrones twice six celestials<sup>30</sup>  
 sate,  
 Jove<sup>31</sup> in the midst, and held their warm debate;  
 The subject weighty, and well-known to fame,  
 From whom the city shou'd receive its name.
- [105] Each God by proper features was exprest,  
 Jove with majestick mein<sup>32</sup> excell'd the rest.  
 His three-fork'd mace the dewy sea-God shook,  
 And, looking sternly, smote the ragged rock;  
 When from the stone leapt forth a spritely steed,
- [110] And Neptune<sup>33</sup> claims the city for the deed.
- Herself she blazons, with a glitt'ring spear,  
 And crested helm that veil'd her braided hair,  
 With shield, and scaly breast-plate, implements of war.  
 Struck with her pointed launce,<sup>34</sup> the teeming Earth  
 [115] Seem'd to produce a new surprizing birth;  
 When, from the glebe,<sup>35</sup> the pledge of conquest sprung,  
 A tree pale-green with fairest olives hung.

27. Cheer

28. Penetrated

29. Mars is the god of war, also known as the Greek god Ares.

30. Gods

31. Jove is the mythological god of thunder and king of the gods; Roman name for Zeus.

32. **Mein** (*noun*): the outward manifestation of personality or attitude

33. Neptune is the mythological god of the sea, also known as Poseidon in Greek mythology.

34. A lance: a long weapon for thrusting with a wooden shaft and a pointed steel head

35. A "glebe" is a plot of land.

And then, to let her giddy rival learn  
 What just rewards such boldness was to earn,  
 [120] Four tryals at each corner had their part,  
 Design'd in miniature, and touch'd with art.  
 Haemus in one, and Rodope of Thrace  
 Transform'd to mountains,<sup>36</sup> fill'd the foremost place;  
 Who claim'd the titles of the Gods above,  
 [125] And vainly us'd the epithets<sup>37</sup> of Jove.  
 Another shew'd, where the Pigmaean dame,<sup>38</sup>  
 Profaning Juno's venerable name,  
 Turn'd to an airy crane, descends from far,  
 And with her Pigmy subjects wages war.  
 [130] In a third part, the rage of Heav'n's great queen,  
 Display'd on proud Antigone,<sup>39</sup> was seen:  
 Who with presumptuous boldness dar'd to vye,  
 For beauty with the empress of the sky.  
 Ah! what avails her ancient princely race,  
 [135] Her sire a king, and Troy her native place:  
 Now, to a noisy stork transform'd, she flies,  
 And with her whiten'd pinions cleaves the skies.  
 And in the last remaining part was drawn  
 Poor Cinyras<sup>40</sup> that seem'd to weep in stone;  
 [140] Clasp'g the temple steps, he sadly mourn'd  
 His lovely daughters, now to marble turn'd.  
 With her own tree the finish'd piece is crown'd,  
 And wreaths of peaceful olive all the work surround.

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36. In Greek mythology, King Haemus of Thrace compared himself and his wife Rhodope to Zeus and Hera (Jove and Juno). For this arrogance, the gods changed them into mountains.

37. **Epithet (noun):** an adjective or phrase expressing a quality characteristic of the person or thing mentioned

38. Oinoe refused to honor the goddess Hera/Juno and was turned into a crane.

39. Antigone of Troy claimed her hair was more beautiful than Hera/Juno's and was turned into a stork for her arrogance.

40. King Cinyras of Cyprus

Arachne drew the fam'd intrigues of Jove,  
 [145] Chang'd to a bull to gratify his love;  
 How thro' the briny tide all foaming hoar,  
 Lovely Europa<sup>41</sup> on his back he bore.  
 The sea seem'd waving, and the trembling maid  
 Shrunk up her tender feet, as if afraid;  
 [150] And, looking back on the forsaken strand,  
 To her companions wafts her distant hand.  
 Next she design'd Asteria's<sup>42</sup> fabled rape,  
 When Jove assum'd a soaring eagle's shape:  
 And shew'd how Leda<sup>43</sup> lay supinely press'd,  
 [155] Whilst the soft snowy swan sate hov'ring o'er her breast,  
 How in a satyr's form the God beguil'd,  
 When fair Antiope<sup>44</sup> with twins he fill'd.  
 Then, like Amphytrion,<sup>45</sup> but a real Jove,  
 In fair Alcmena's<sup>46</sup> arms he cool'd his love.  
 [160] In fluid gold to Danae's<sup>47</sup> heart he came,  
 Aegina<sup>48</sup> felt him in a lambent<sup>49</sup> flame.  
 He took Mnemosyne<sup>50</sup> in shepherd's make,  
 And for Deois was a speckled snake.

She made thee, Neptune, like a wanton<sup>51</sup> steer,<sup>52</sup>  
 [165] Pacing the meads for love of Arne<sup>53</sup> dear;  
 Next like a stream, thy burning flame to slake,  
 And like a ram, for fair Bisaltis<sup>54</sup> sake.  
 Then Ceres<sup>55</sup> in a steed your vigour try'd,  
 Nor cou'd the mare the yellow Goddess hide.  
 [170] Next, to a fowl transform'd, you won by force  
 The snake-hair'd mother of the winged horse;  
 And, in a dolphin's fishy form, subdu'd  
 Melanthe<sup>56</sup> sweet beneath the oozy flood.

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41. Europa was the mother of King Minos of Crete. Zeus/Jove was enamoured with her and transformed into a bull to abduct her.
  42. Asteria was the daughter of a Titan and desired by Jove/Zeus. She fled from him, but he chased her as an eagle.
  43. Leda was the wife of a Spartan king and seduced by Jove/Zeus in the form of a swan.
  44. Jove/Zeus transformed into a satyr to seduce Antiope. She later gave birth to twins, one of whom was fathered by the god.
  45. Amphytrion was a Thebean general and the son of the Alcaeus.
  46. Alcmena was the mother of the hero Hercules/Heraclides, son of Jove/Zeus.
  47. Danae was the mother of the hero Perseus, son of Jove/Zeus. The god appeared to her in the form of a shower of gold.
  48. Aegina was the mother of the hero king Aeacus, son of Jove/Zeus.
  49. **Lambent (adjective):** glowing, gleaming, or flickering with a soft radiance
  50. Mnemosyne was the personification of memory in Greek mythology, a Titan, and the mother of the Muses by Jove/Zeus.
  51. **Wanton (adjective):** uncontrollable
  52. A steer is an ox.
  53. Arne gave birth to twins sired by Neptune/Poseidon in bull form.
  54. Bisaltis was taken by Neptune/Poseidon in the form of a ram.
  55. Ceres was a goddess of agriculture, a counterpart to the goddess Demeter. She was pursued by Neptune/Poseidon.
  56. Melanthe was the daughter of Deucalion and was seduced by Neptune/Poseidon as a dolphin.

All these the maid with lively features drew,  
 [175] And open'd proper landskips to the view.  
 There Phoebus, roving like a country swain,  
 Attunes<sup>57</sup> his jolly pipe along the plain;  
 For lovely Isse's<sup>58</sup> sake in shepherd's weeds,  
 O'er pastures green his bleating flock he feeds,  
 [180] There Bacchus,<sup>59</sup> imag'd like the clust'ring grape,  
 Melting bedrops Erigone's<sup>60</sup> fair lap;  
 And there old Saturn,<sup>61</sup> stung with youthful heat,  
 Form'd like a stallion, rushes to the feat.  
 Fresh flow'rs, which twists of ivy intertwine,  
 [185] Mingling a running foliage, close the neat design.

This the bright Goddess passionately mov'd,  
 With envy saw, yet inwardly approv'd.  
 The scene of heav'nly guilt with haste she tore,  
 Nor longer the affront with patience bore;  
 [190] A boxen shuttle in her hand she took,  
 And more than once Arachne's forehead struck.  
 Th' unhappy maid, impatient of the wrong,  
 Down from a beam her injur'd person hung,<sup>62</sup>  
 When Pallas, pitying her wretched state,  
 [195] At once prevented, and pronounc'd her fate:  
 Live; but depend, vile wretch, the Goddess cry'd,  
 Doom'd in suspense for ever to be ty'd;  
 That all your race, to utmost date of time,  
 May feel the vengeance, and detest the crime.

[200] Then, going off, she sprinkled her with juice,  
 Which leaves of baneful aconite<sup>63</sup> produce.  
 Touch'd with the pois'nous drug, her flowing hair  
 Fell to the ground, and left her temples bare;  
 Her usual features vanish'd from their place,  
 [205] Her body lessen'd all, but most her face.  
 Her slender fingers, hanging on each side  
 With many joynts, the use of legs supply'd:  
 A spider's bag the rest, from which she gives  
 A thread, and still by constant weaving lives.

*The Transformation of Arachne into a Spider by Ovid is in the public domain.*

57. Harmonizes to

58. Isse, also known as Amphissa, was a lover of Phoebus/Apollo, who first seduced her as a shepherd.

59. Bacchus is the mythological god of wine and revelry, also known as the Greek god Dionysus.

60. Erigone was the daughter of Icarius of Athens. Icarius was cordial to Bacchus/Dionysus but was killed by his drunken shepherds. Erigone, upon finding her father, hanged herself and became the constellation Virgo.

61. Saturn is the mythological god of agriculture and commerce.

62. Arachne hangs herself after Pallas tears her weaving and hits Arachne.

63. Aconite is a type of poisonous root.

## Text-Dependent Questions

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

1. PART A: Which of the following best describes a central theme of the text?
  - A. Revenge can drive people to do strange, cruel things.
  - B. Confidence is needed in order to succeed.
  - C. Talent is more innate than from practice.
  - D. Faith is more important than humility.
  
2. PART B: Which of the following quotes best supports the answer to Part A?
  - A. "That to the Goddess she refus'd to yield. / Low was her birth, and small her native town, / She from her art alone obtain'd renown." (Lines 10-12)
  - B. "Nor would the work, when finish'd, please so much, / As, while she wrought, to view each graceful touch; / Whether the shapeless wool in balls she wound, / Or with quick motion turn'd the spindle round, / Or with her pencil drew the neat design, / Pallas her mistress shone in every line." (Lines 27-32)
  - C. "Yet she persists, and obstinately great, / In hopes of conquest hurries on her fate. / The Goddess now the challenge waves no more, / Nor, kindly good, advises as before." (Lines 73-76)
  - D. "When Pallas, pitying her wretched state, / At once prevented, and pronounc'd her fate: / Live; but depend, vile wretch, the Goddess cry'd, / Doom'd in suspence for ever to be ty'd; / That all your race, to utmost date of time, / May feel the vengeance, and detest the crime." (Lines 194-199)
  
3. PART A: Which of the following best describes why Pallas wants revenge on Arachne?
  - A. Pallas believes Arachne has been claiming Pallas's work as her own.
  - B. Pallas is tired of Arachne's challenges and wants to end their feud.
  - C. Pallas wants revenge because Arachne weaves pictures of the gods' follies rather than their glories.
  - D. Pallas wants revenge because Arachne refuses to acknowledge the Muse's or Pallas's inspiration in her weaving.
  
4. PART B: Which of the following quotes best supports the answer to Part A?
  - A. "Oft, to admire the niceness of her skill, / The Nymphs would quit their fountain, shade, or hill: / Thither, from green Tymolus, they repair, / And leave the vineyards, their peculiar care" (Lines 21-24)
  - B. "Pallas her mistress shone in every line. / This the proud maid with scornful air denies, / And ev'n the Goddess at her work defies; / Disowns her heav'nly mistress ev'ry hour, / Nor asks her aid, nor deprecates her pow'r." (Lines 32-36)
  - C. "Let us, she cries, but to a tryal come, / And, if she conquers, let her fix my doom." (Lines 37-38)
  - D. "This the bright Goddess passionately mov'd, / With envy saw, yet inwardly approv'd. / The scene of heav'nly guilt with haste she tore, / Nor longer the affront with patience bore" (Lines 186-189)

5. PART A: Why does Pallas most likely present herself to Arachne as she does?
- A. Pallas disguises herself as an old woman to see how young Arachne treats her elders.
  - B. Pallas disguises herself as an old woman to give Arachne a chance to yield to the goddess and ask for forgiveness.
  - C. Pallas disguises herself to trick Arachne into thinking she is a harmless old woman so she has the element of surprise.
  - D. Pallas disguises herself to trick Arachne into insulting the gods, not knowing that she was actually a goddess.
6. PART B: Which of the following quotes best supports the answer to Part A?
- A. "The Goddess then a beldame's form put on, / With silver hairs her hoary temples shone" (Lines 39-40)
  - B. "Young maid attend, nor stubbornly despise / The admonitions of the old, and wise" (Lines 43-44)
  - C. "But to the Goddess yield, and humbly meek / A pardon for your bold presumption seek; / The Goddess will forgive." (Lines 49-51)
  - D. "And, if your skilful Goddess better knows, / Let her accept the trial I propose. / She does, impatient Pallas strait replies, / And, cloath'd with heavenly light, sprung from her odd disguise." (Lines 61-64)
7. PART A: In stanza 7, to what does the speaker compare Pallas and Arachne's works?
- A. Glowing light in many different forms
  - B. The formation of a rainbow
  - C. Quick strikes of lightning
  - D. The emergence of the sun from a storm
8. PART B: Which of the following quotes best supports the answer to Part A?
- A. "Thus both, their mantles button'd to their breast, / Their skilful fingers ply with willing haste, / And work with pleasure; while they chear the eye / With glowing purple of the Tyrian dye" (Lines 84-87)
  - B. "Or, justly intermixing shades with light, / Their colourings insensibly unite" (Lines 88-89)
  - C. "As when a show'r transpierc'd with sunny rays, / Its mighty arch along the heav'n displays; / From whence a thousand diff'rent colours rise" (Lines 90-92)
  - D. "Then threads of gold both artfully dispose, / And, as each part in just proportion rose, / Some antique fable in their work disclose." (Lines 96-98)

9. Compare the imagery both Pallas and Arachne weave into their work. How do these images develop the myth's overall meaning? Cite evidence in your answer.

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10. Which of the following best summarizes the culmination of Pallas' revenge?
- A. Pallas accuses Arachne of cheating, and for this Pallas decides to turn her into a venomous spider.
  - B. Pallas declares herself the winner, even though Arachne clearly won; to make sure Arachne does not challenge her again, Pallas turns her into a spider.
  - C. Arachne wins the challenge and Pallas, bitter over losing, offers her a gift for her weaving; Arachne accepts and is turned into a spider, so that she may spin thread forever.
  - D. Arachne hangs herself in response to Pallas's envy and abuse, but pitying her Pallas keeps her alive; Pallas then transforms her into a spider to complete her vengeance.

## Discussion Questions

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

1. Transformation is a theme that constantly recurs in mythology from all different cultures. What might be significant about the theme of transformation?
2. Can you think of modern-day stories that involve transformation or disguise as a central theme?
3. How are the gods portrayed in Greek and Roman mythology? What can we learn about ourselves from these portrayals? Do you believe they reflect human beings?
4. Consider the way Ovid portrayed Minerva (Athena) and Arachne. Whose side is he on?
5. It is clear that, throughout time, human beings have been drawn to mythological portrayals. Some have suggested that humans used mythology to explain scientific phenomena beyond our grasp. Why else are we drawn to mythology? What can we learn about ourselves from our attraction to mythology?
6. In your opinion, was Minerva's act of revenge justified? Why or why not? When -- if ever -- is revenge justified? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.



Name: \_\_\_\_\_ Class: \_\_\_\_\_

# Ozymandias

By Percy Bysshe Shelley  
1818

*Percy Bysshe Shelley, who lived from 1792-1822, was an important poet during a literary and artistic period that's known as the era of English Romanticism. He is regarded by some as one of the most influential poets in the English language. Ozymandias is one of his best-known works. As you read, take notes on contrasting images in the poem.*

- [1] I met a traveller from an antique<sup>1</sup> land  
Who said: "Two vast and trunkless legs of stone  
Stand in the desert... Near them, on the sand,  
Half sunk, a shattered visage<sup>2</sup> lies, whose frown,  
[5] And wrinkled lip, and sneer of cold command,  
Tell that its sculptor well those passions read  
Which yet survive, stamped on these lifeless  
things,  
The hand that mocked them, and the heart that  
fed:  
And on the pedestal these words appear:  
[10] 'My name is Ozymandias,<sup>3</sup> king of kings:  
Look on my works, ye Mighty, and despair!  
Nothing beside remains. Round the decay  
Of that colossal<sup>4</sup> wreck, boundless and bare  
The lone and level sands stretch far away."



*"Ramesseum in Egypt. The Ozymandias Colossus:" by Christopher Michel is licensed under CC BY 2.0.*

*"Ozymandias" by Percy Bysshe Shelley (1818) is in the public domain.*

1. ancient
2. **Visage (noun):** a person's face, with reference to their expression
3. Ozymandias is another name for the pharaoh Ramses II who ruled Ancient Egypt from 1279-1213 BC.
4. **Colossal (adjective):** extremely large

## Text-Dependent Questions

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

1. PART A: Which statement best expresses the theme of this poem?
  - A. Ancient ruins are an important part of history.
  - B. People are easily corrupted by pride.
  - C. Be wary of the stories travelers tell.
  - D. Power and greatness will not last forever.
  
2. PART B: Which section from the text best develops the theme identified in PART A?
  - A. "I met a traveller from an antique land / Who said: 'Two vast and trunkless legs of stone / Stand in the desert...'" (Lines 1-3)
  - B. "And wrinkled lip, and sneer of cold command, / Tell that its sculptor well those passions read / Which yet survive, stamped on these lifeless things," (Lines 5-7)
  - C. "And on the pedestal these words appear: / My name is Ozymandias, king of kings" (Lines 9-10)
  - D. "Look on my works, ye Mighty, and despair! / Nothing beside remains. Round the decay" (Lines 11-12)
  
3. What is the effect of the speaker hearing about this statue from someone else as opposed to seeing it with his own eyes?
  - A. It helps emphasize how the story has been passed on and the reader should doubt the reliability of the description.
  - B. It emphasizes how powerful the king was and how much his legend continues to impact culture.
  - C. It helps emphasize how the story is a tale that is being passed on to the reader, indicating that there is a message to be heeded.
  - D. It demonstrates the speaker's own susceptibility to the influence of others.
  
4. For what purpose did the author include the inscription on the statue, "Look on my works, ye Mighty, and despair!" (Line 11)?
  - A. It lets the reader know that Ozymandias was a cruel leader.
  - B. It emphasizes the contrast between the king's arrogance and the ruin his statue has become.
  - C. It demonstrates the negative attitude the sculptor had about the king.
  - D. It compares Ozymandias to other famous kings by alluding to a classic Arthurian legend.

5. How does the author use irony to develop the theme of the poem? Cite evidence from the text to support your response.

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Name: \_\_\_\_\_ Class: \_\_\_\_\_

## Excerpt from Walden: “The Ponds”

By Henry David Thoreau  
1854

*Henry David Thoreau (1817-1862) was an American author, essayist, and philosopher. He was one of the major figures of Transcendentalism, a movement that valued the spiritual over the material. The following excerpt comes from his best-known work, Walden, in which he reflects upon his two years spent living in the wilderness near Walden Pond in Massachusetts. As you read, take notes on the words Thoreau uses to describe the scene before him.*

[1] It is a soothing employment, on one of those fine days in the fall when all the warmth of the sun is fully appreciated, to sit on a stump on such a height as this, overlooking the pond, and study the dimpling circles which are incessantly<sup>1</sup> inscribed on its otherwise invisible surface amid the reflected skies and trees. Over this great expanse there is no disturbance but it is thus at once gently smoothed away and assuaged, as, when a vase of water is jarred, the trembling circles seek the shore and all is smooth again. Not a fish can leap or an insect fall on the pond but it is thus reported in circling dimples, in lines of beauty, as it were the constant welling up of its fountain, the gentle pulsing of its life, the heaving of its breast. The thrills of joy and thrills of pain are undistinguishable. How peaceful the phenomena of the lake! Again the works of man shine as in the spring. Ay, every leaf and twig and stone and cobweb sparkles now at mid-afternoon as when covered with dew in a spring morning. Every motion of an oar or an insect produces a flash of light; and if an oar falls, how sweet the echo!



*"Pond" by Josh is licensed under CC BY-NC 2.0*

In such a day, in September or October, Walden is a perfect forest mirror, set round with stones as precious to my eye as if fewer or rarer. Nothing so fair, so pure, and at the same time so large, as a lake, perchance, lies on the surface of the earth. Sky water. It needs no fence. Nations come and go without defiling it. It is a mirror which no stone can crack, whose quicksilver will never wear off, whose gilding Nature continually repairs; no storms, no dust, can dim its surface ever fresh; — a mirror in which all impurity presented to it sinks, swept and dusted by the sun's hazy brush, — this the light dust-cloth, — which retains no breath that is breathed on it, but sends its own to float as clouds high above its surface, and be reflected in its bosom still.

A field of water betrays the spirit that is in the air. It is continually receiving new life and motion from above. It is intermediate in its nature between land and sky. On land only the grass and trees wave, but the water itself is rippled by the wind. I see where the breeze dashes across it by the streaks or flakes of light. It is remarkable that we can look down on its surface. We shall, perhaps, look down thus on the surface of air at length, and mark where a still subtler spirit sweeps over it.

1. **Incessant** (*adjective*): continuing without pause or interruption

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

## Text-Dependent Questions

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

1. PART A: What is the meaning of “assuaged” as it is used in paragraph 1?
  - A. calmed
  - B. alerted
  - C. reflected
  - D. muted
  
2. PART B: Which phrase from paragraph 1 provides context for the meaning of “assuaged”?
  - A. “fully appreciated”
  - B. “smooth again”
  - C. “welling up”
  - D. “circling dimples”
  
3. PART A: What is Thoreau’s purpose in the passage from “Walden”?
  - A. to describe his reasons for visiting Walden Pond and its surroundings
  - B. to argue for the preservation and reclamation of Walden Pond in the face of human intrusion
  - C. to explain why most people are not able to appreciate the beauty of nature
  - D. to describe the permanence of a natural scene
  
4. PART B: Select TWO quotations that most clearly reveal Thoreau’s purpose in the passage.
  - A. “It is a soothing employment, on one of those fine days in the fall when all the warmth of the sun is fully appreciated, to sit on a stump on such a height as this, overlooking the pond” (Paragraph 1)
  - B. “Over this great expanse there is no disturbance but it is thus at once gently smoothed away and assuaged” (Paragraph 1)
  - C. “Not a fish can leap or an insect fall on the pond but it is thus reported in circling dimples, in lines of beauty” (Paragraph 1)
  - D. “In such a day, in September or October, Walden is a perfect forest mirror, set round with stones as precious to my eye as if fewer or rarer.” (Paragraph 2)
  - E. “It is a mirror which no stone can crack, whose quicksilver will never wear off, whose gilding Nature continually repairs” (Paragraph 2)
  - F. “It is intermediate in its nature between land and sky.” (Paragraph 3)



# To earn trust for autonomous vehicles, company gives them "virtual eyes"

By Peter Holley, Washington Post on 09.10.18

Word Count **614**

Level **MAX**



To create trust between pedestrians and self-driving vehicles, Jaguar Land Rover has developed a driverless pod with eyes that signal the vehicle's intent to human observers. Photo: Jaguar Land Rover

One of the biggest challenges facing car companies developing driverless vehicles has little to do with sophisticated robotics or laser technology.

Instead, they must engineer something far more amorphous but no less important: human trust, the kind that is communicated when human drivers and pedestrians make eye contact at a crosswalk.

Surveys indicate that large portions of the public harbor deep reservations about the safety of self-driving technology, so Jaguar Land Rover enlisted cognitive psychologists to learn "how vehicle behavior affects human confidence in new technology," the British automaker said in a news release.

Their solution: virtual eyes, a large, cartoonish pair that bring to mind the plastic googly eyes you probably glued onto projects in elementary school.

The eyes have been fitted to autonomous vehicles known as "intelligent pods." Devised by a team of engineers, the eyes seek out nearby pedestrians before "looking" directly at them — silently signaling that the vehicle sees them and plans to remain stationary so they can pass, the company said.

Before and after the interaction, engineers record trust levels to determine whether human test subjects experienced sufficient levels of confidence in the pod, the company said. So far more than 500 people have been observed interacting with the expressive vehicles, but the company hasn't released details about the interactions.

"It's second nature to glance at the driver of the approaching vehicle before stepping into the road," Pete Bennett, future mobility research manager at Jaguar Land Rover, said in a statement. "Understanding how this translates in tomorrow's more automated world is important."

Other industries have applied eyes to robots as well. The industrial robot Baxter has a tablet-like face with eyes designed to communicate the robot's intentions to nearby human workers, such as concentration when the machine is working or sadness when it's broken.

People are uneasy about not only interacting with but riding inside self-driving vehicles. An American Automobile Association study this year found that 63 percent of U.S. drivers report feeling afraid to ride in a fully self-driving vehicle, down from 78 percent a year earlier.

Male drivers and millennials are most trusting of autonomous technology, with only half reporting fear of riding inside a fully autonomous car, according to AAA, which has begun urging automakers to educate consumers about autonomous transportation. Even though human error causes more than 90 percent of crashes, most drivers consider their driving skills better than average and are leery of handing control over to a machine.

"Americans are starting to feel more comfortable with the idea of self-driving vehicles," AAA Automotive Engineering and Industry Relations Director Greg Brannon said in February. "Compared to just a year ago, AAA found that 20 million more U.S. drivers would trust a self-driving vehicle to take them for a ride."

Jaguar Land Rover is not the only company exploring how to broadcast messages between autonomous vehicles and pedestrians.

This summer a Mountain View, California-based startup known as Drive.ai launched a pilot program in Frisco, Texas, in the Dallas-Fort Worth metroplex. The bright orange vehicles autonomously ferry people around a geo-fenced office-park complex where about 10,000 people work, eat and shop.

The words "self-driving vehicle" wrap around their Nissan NV200 vans, and the vehicles include exterior panels with messages — such as "waiting for you to cross" — to take the place of a human driver making eye contact or gesturing with a pedestrian at a crosswalk.

Company officials have pointed out that self-driving cars still "don't understand certain complex situations such as a construction worker communicating using hand gestures."

Jaguar Land Rover's intelligent pods have yet to venture into the real world and instead operate on a "fabricated street scene in Coventry," the company said.

## Quiz

1 Read the following paragraphs from the article.

*The eyes have been fitted to autonomous vehicles known as "intelligent pods." Devised by a team of engineers, the eyes seek out nearby pedestrians before "looking" directly at them — silently signaling that the vehicle sees them and plans to remain stationary so they can pass, the company said.*

*The words "self-driving vehicle" wrap around their Nissan NV200 vans, and the vehicles include exterior panels with messages — such as "waiting for you to cross" — to take the place of a human driver making eye contact or gesturing with a pedestrian at a crosswalk.*

Which of the following conclusions can be drawn from these paragraphs?

- (A) Self-driving car companies are testing several different ways for the vehicles to interact with and acknowledge pedestrians.
- (B) Self-driving car companies have determined that placing fake eyes on the vehicles appeals to many pedestrians.
- (C) Self-driving cars are likely to be seen on the road more frequently now that they have been approved by psychologists.
- (D) Self-driving cars are much safer now than they were in the past and will soon be available for sale to the public.

2 Which of the following claims does the author support the LEAST in the article?

- (A) Human drivers are more dangerous than self-driving vehicles.
- (B) More Americans approve of self-driving vehicles now than in the past.
- (C) Companies have begun testing out self-driving vehicles.
- (D) Pedestrians like to make eye contact with drivers to ensure their safety.

3 How did concern about the safety of driverless cars affect car manufacturers' design of their vehicles?

- (A) People's concern that driverless cars would result in unsafe driving conditions was caused by driverless car manufacturers' decision to market their vehicles to male drivers and millennials.
- (B) People's concern that driverless cars would present an additional danger to pedestrians was caused by driverless car manufacturers' failure to program the vehicles to navigate construction zones.
- (C) People's concern that driverless cars would not stop for pedestrians led driverless car manufacturers to place virtual eyes on the vehicles that would reassure pedestrians that it was safe to cross the road.
- (D) People's concern that driverless cars would lead to more car accidents led driverless car manufacturers to place virtual eyes in the vehicles to monitor their driving and report back to the companies.

Read the following two summaries of the article.

1. *Automated technology is the newest innovation, ranging from self-driving cars to robots that can perform tasks. As a result of very informative feedback from a recent survey, developers have implemented interactive features on their automated technology. Now, driverless cars and industrial robots can communicate with humans and convey emotion.*
2. *Automated technology such as driverless cars and robots that can perform tasks is being developed and tested. Surveys conducted by AAA indicated reservations about the safety of self-driving cars. Therefore, research was done to incorporate interactive elements within the technology that would relay the technology's awareness of the people around it.*

Which option provides an accurate, objective summary of the article, and why?

- (A) Option 1; it highlights how well automated technology can mimic human actions.
- (B) Option 1; it emphasizes the important role of automated technology in the modern world.
- (C) Option 2; it outlines the overall reaction to automated technology and companies' responses to it.
- (D) Option 2; it explains how automated technology senses and avoids dangerous situations.



Name: \_\_\_\_\_ Class: \_\_\_\_\_

## Excerpt from Frankenstein; or the Modern Prometheus

By Mary Shelley  
1823

*Mary Shelley (1797-1851) was an English novelist, short story writer, and dramatist, best known for her gothic novel, Frankenstein. In the novel, Victor Frankenstein, a brilliant scientist, succeeds in creating life in his laboratory, only to be horrified by his own creation. The novel begins with a series of letters written by an explorer, who eventually brings Frankenstein onto his ship. As you read, take notes on the speaker's feelings about his journey.*

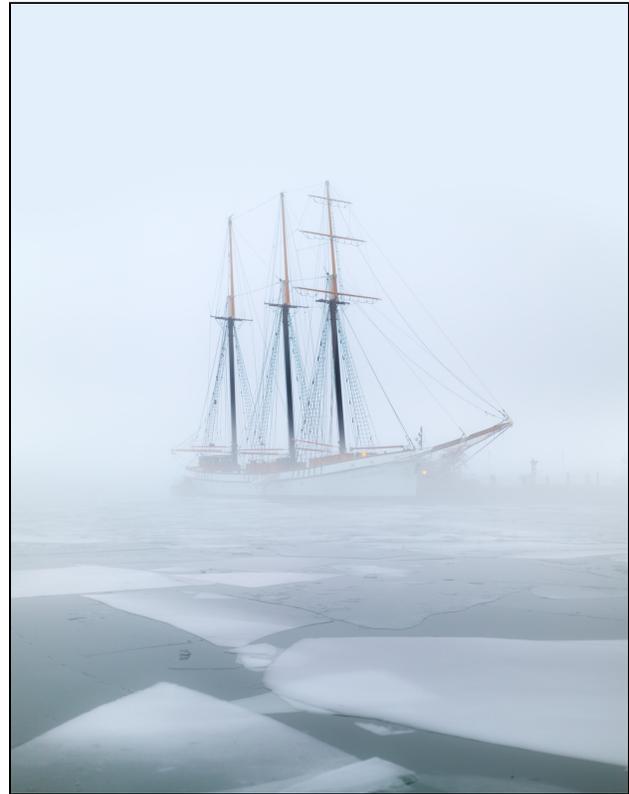
[1] LETTER III.

*To Mrs. Saville, England.*

July 7th, 17—

My dear Sister,

[5] I write a few lines in haste to say that I am safe — and well advanced on my voyage. This letter will reach England by a merchantman<sup>1</sup> now on its homeward voyage from Archangel; more fortunate than I, who may not see my native land, perhaps, for many years. I am, however, in good spirits: my men are bold and apparently firm of purpose, nor do the floating sheets of ice that continually pass us, indicating the dangers of the region towards which we are advancing, appear to dismay them. We have already reached a very high latitude; but it is the height of summer, and although not so warm as in England, the southern gales,<sup>2</sup> which blow us speedily towards those shores which I so ardently desire to attain, breathe a degree of renovating<sup>3</sup> warmth which I had not expected.



*"Foggy Ship" by Filip Mros is licensed under CC0*

No incidents have hitherto befallen us that would make a figure in a letter. One or two stiff gales and the springing of a leak are accidents which experienced navigators scarcely remember to record, and I shall be well content if nothing worse happen to us during our voyage.

1. a commercial ship
2. a strong wind
3. a term that has the archaic meaning "to refresh; reinvigorate"

Adieu,<sup>4</sup> my dear Margaret. Be assured that for my own sake, as well as yours, I will not rashly encounter danger. I will be cool, persevering, and prudent.<sup>5</sup>

But success *shall* crown my endeavours. Wherefore not? Thus far I have gone, tracing a secure way over the pathless seas, the very stars themselves being witnesses and testimonies of my triumph. Why not still proceed over the untamed yet obedient element? What can stop the determined heart and resolved will of man?

My swelling heart involuntarily pours itself out thus. But I must finish. Heaven bless my beloved sister!

[10] R.W.

LETTER IV.

*To Mrs. Saville, England*

August 5th, 17—

So strange an accident has happened to us that I cannot forbear recording it, although it is very probable that you will see me before these papers can come into your possession.

[15] Last Monday (July 31st) we were nearly surrounded by ice, which closed in the ship on all sides, scarcely leaving her the sea-room in which she floated. Our situation was somewhat dangerous, especially as we were compassed round by a very thick fog. We accordingly lay to,<sup>6</sup> hoping that some change would take place in the atmosphere and weather.

About two o'clock the mist cleared away, and we beheld, stretched out in every direction, vast and irregular plains of ice, which seemed to have no end. Some of my comrades groaned, and my own mind began to grow watchful with anxious thoughts, when a strange sight suddenly attracted our attention and diverted our solicitude<sup>7</sup> from our own situation. We perceived a low carriage, fixed on a sledge and drawn by dogs, pass on towards the north, at the distance of half a mile; a being which had the shape of a man, but apparently of gigantic stature, sat in the sledge and guided the dogs. We watched the rapid progress of the traveller with our telescopes until he was lost among the distant inequalities of the ice.

This appearance excited our unqualified<sup>8</sup> wonder. We were, as we believed, many hundred miles from any land; but this apparition<sup>9</sup> seemed to denote that it was not, in reality, so distant as we had supposed. Shut in, however, by ice, it was impossible to follow his track, which we had observed with the greatest attention.

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4. goodbye

5. **Prudent (adjective):** acting with or showing care and thought for the future

6. to bring a ship into the wind and keep stationary

7. care or concern for something

8. **Unqualified (adjective):** without reservation or limitation; total

9. a ghostlike image of a person

About two hours after this occurrence we heard the ground sea, and before night the ice broke and freed our ship. We, however, lay to until the morning, fearing to encounter in the dark those large loose masses which float about after the breaking up of the ice. I profited of this time to rest for a few hours.

In the morning, however, as soon as it was light, I went upon deck and found all the sailors busy on one side of the vessel, apparently talking to someone in the sea. It was, in fact, a sledge, like that we had seen before, which had drifted towards us in the night on a large fragment of ice. Only one dog remained alive; but there was a human being within it whom the sailors were persuading to enter the vessel.

*"Frankenstein; or the Modern Prometheus" by Mary Shelley (1823) is in the public domain.*

## Text-Dependent Questions

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

1. PART A: The full title of Mary Shelley's novel is *Frankenstein; or the Modern Prometheus*. The subtitle refers to Prometheus, a mythological figure who symbolizes both the nobility of the quest for knowledge and the danger of overreaching in that quest. In the passage from *Frankenstein*, how do the two ideas symbolized by Prometheus interact and build on one another?
  - A. R.W. possesses advanced geographic knowledge as a result of his explorations, but he has sacrificed personal happiness to gain that knowledge.
  - B. R.W. believes firmly in his ability to achieve his goals, but he is challenged by the natural world he seeks to conquer.
  - C. R.W. is extremely educated about his surroundings, but he makes a costly mistake about his location within those surroundings.
  - D. R.W. is the only member of his crew to care about science for its own sake, but he overestimates what science can accomplish.
  
2. PART B: Select the TWO quotations that, taken together, best support the answer to Part A?
  - A. "I am, however, in good spirits: my men are bold, and apparently firm of purpose" (Paragraph 1)
  - B. "I shall be well content if nothing worse happens to us during our voyage." (Paragraph 2)
  - C. "But success shall crown my endeavours." (Paragraph 4)
  - D. "it is very probable that you will see me before these papers can come into your possession." (Paragraph 6)
  - E. "This appearance excited our unqualified wonder." (Paragraph 9)
  - F. "Shut in, however, by ice, it was impossible to follow his track, which we had observed with the greatest attention." (Paragraph 9)
  
3. PART A: Mrs. Saville's brother uses the word "ardently" to describe his desire to reach an unexplored land. What does the word "ardently" mean in this context?
  - A. anxiously
  - B. passionately
  - C. greedily
  - D. religiously
  
4. PART B: Which quotation from the passage best supports the answer to Part A?
  - A. "indicating the dangers of the region towards which we are advancing" (Paragraph 1)
  - B. "for my own sake, all well as yours, I will not rashly encounter." (Paragraph 3)
  - C. "the very stars themselves being witnesses and testimonies" (Paragraph 4)
  - D. "What can stop the determined heart and resolved will of man?" (Paragraph 4)





Name: \_\_\_\_\_ Class: \_\_\_\_\_

## We Grow Accustomed to the Dark

By Emily Dickinson  
c. 1862

*Emily Dickinson (1830-1886) was an American poet who lived a mostly introverted, secluded life, maintaining friendships through written letters. She wrote over 1800 poems in her seclusion, most of which were published after her death. As you read, take notes on the meaning of "darkness" throughout the poem.*

[1] We grow accustomed to the Dark –  
When light is put away –  
As when the Neighbor holds the Lamp  
To witness her Goodbye –

[5] A Moment – We uncertain step  
For newness of the night –  
Then – fit our Vision to the Dark –  
And meet the Road – erect –

And so of larger – Darkneses –  
[10] Those Evenings of the Brain –  
When not a Moon disclose a sign –  
Or Star – come out – within –

The Bravest – grope a little –  
And sometimes hit a Tree  
[15] Directly in the Forehead –  
But as they learn to see –

Either the Darkness alters –  
Or something in the sight  
Adjusts itself to Midnight –  
[20] And Life steps almost straight.



["Moon"](#) by Ana Sofia Guerreirinho is licensed under CC BY-NC-ND 2.0

*We Grow Accustomed to the Dark by Emily Dickinson is in the public domain.*

## Text-Dependent Questions

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

1. Which of the following best describe the speaker's point of view?
  - A. The speaker's point of view is that of the neighbor walking at night.
  - B. The speaker's point of view is that of a group of people discussing darkness and death.
  - C. The speaker's point of view is that of someone participating in the events described in the poem.
  - D. The speaker's point of view is that of a removed or distant narrator who speaks for humanity.
  
2. How does the word choice in stanzas 4-5 affect the tone of the poem?
  - A. The words "learn" and "Adjusts" shift the tone from uncertain to hopeful as the speaker affirms the ability for people to withstand difficulty.
  - B. The phrase "hit a tree" makes the tone even more serious and tragic as the speaker considers the pain that darkness causes.
  - C. The phrase "learn to see" shifts the tone from gloomy to more joyful when the speaker realizes that darkness initiates a learning process.
  - D. The words "Either" and "alters" make the tone even more mysterious as the speaker reveals the disorienting effect that darkness can have.
  
3. Which statement best expresses a theme in the poem?
  - A. A strong support system is necessary to overcome adversity.
  - B. Gaining confidence with a new task requires independence and attention to detail.
  - C. It takes time and courage to endure unfamiliar circumstances.
  - D. Friends can inspire us to embrace the mystery of the unknown.
  
4. How does the author use symbolism to develop the theme of the poem? Cite evidence from the text in your answer.

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5. How does the poem's stylistic form (i.e. punctuation and capitalization) contribute to its meaning?

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Name: \_\_\_\_\_ Class: \_\_\_\_\_

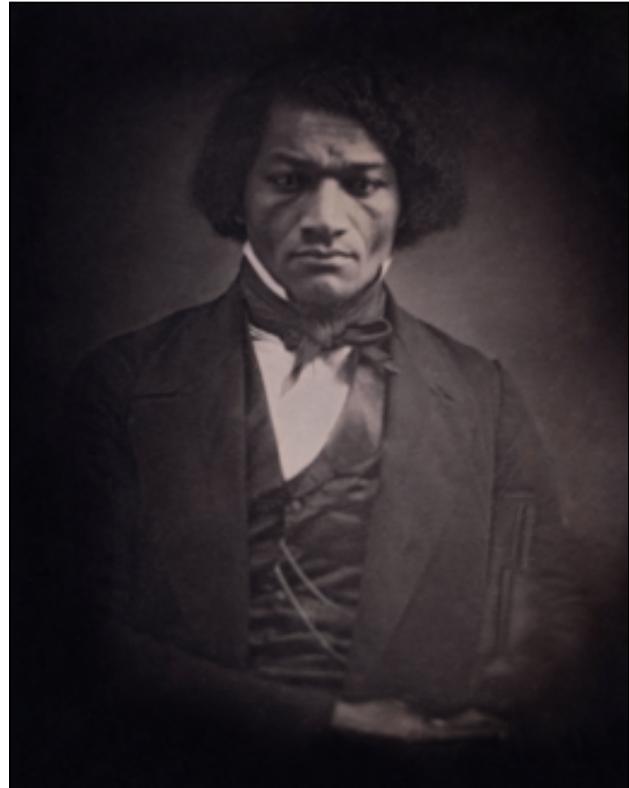
# The Narrative of the Life of Frederick Douglass: Excerpt from Chapter 11

By Frederick Douglass  
1845

*Frederick Douglass (1818 –1895) was born a slave but became a social reformer, abolitionist, orator, writer, and statesman. As a child, Douglass began learning to read and write with the help of his master’s wife, Lucretia Auld. Understanding the value of education, he continued to teach himself. After Douglass escaped from slavery, he became a leader of the abolitionist movement, gaining note for his dazzling oratory and incisive antislavery writings. He stood as a living counter-example to slaveholders’ arguments that slaves lacked the intellectual capacity to function as independent American citizens. As you read the story of his escape, keep track of how Douglass describes his feelings about finally becoming a free man.*

## Chapter XI

[1] I now come to that part of my life during which I planned, and finally succeeded in making, my escape from slavery. But before narrating any of the peculiar circumstances, I deem it proper to make known my intention not to state all the facts connected with the transaction. My reasons for pursuing this course may be understood from the following: First, were I to give a minute statement of all the facts, it is not only possible, but quite probable, that others would thereby be involved in the most embarrassing difficulties. Secondly, such a statement would most undoubtedly induce greater vigilance on the part of slaveholders than has existed heretofore<sup>1</sup> among them; which would, of course, be the means of guarding a door whereby some dear brother bondman<sup>2</sup> might escape his galling<sup>3</sup> chains. I deeply regret the necessity that impels me to suppress anything of importance connected with my experience in slavery. It would afford me great pleasure indeed, as well as materially add to the interest of my narrative, were I at liberty to gratify a curiosity, which I know exists in the minds of many, by an accurate statement of all the facts pertaining to my most fortunate escape. But I must deprive myself of this pleasure, and the curious of the gratification which such a statement would afford. I would allow myself to suffer under the greatest imputations<sup>4</sup> which evil-minded men might suggest, rather than exculpate<sup>5</sup> myself, and thereby run the hazard of closing the slightest avenue by which a brother slave might clear himself of the chains and fetters<sup>6</sup> of slavery.



*"Frederick Douglass c.1850" by Unknown is in the public domain.*

1. **Heretofore** (*adverb*): before this time; until now  
2. **Bondman** (*noun*): slave; a man bound to service without wages

I have never approved of the very public manner in which some of our western friends have conducted what they call the *underground railroad*,<sup>7</sup> but which I think, by their open declarations, has been made most emphatically the *upper-ground railroad*. I honor those good men and women for their noble daring, and applaud them for willingly subjecting themselves to bloody persecution, by openly avowing<sup>8</sup> their participation in the escape of slaves. I, however, can see very little good resulting from such a course, either to themselves or the slaves escaping; while, upon the other hand, I see and feel assured that those open declarations are a positive evil to the slaves remaining, who are seeking to escape. They do nothing towards enlightening the slave, whilst they do much towards enlightening the master. They stimulate him to greater watchfulness, and enhance his power to capture his slave. We owe something to the slave south of the line as well as to those north of it; and in aiding the latter on their way to freedom, we should be careful to do nothing which would be likely to hinder the former from escaping from slavery. I would keep the merciless slaveholder profoundly ignorant of the means of flight adopted by the slave. I would leave him to imagine himself surrounded by myriads<sup>9</sup> of invisible tormentors, ever ready to snatch from his infernal<sup>10</sup> grasp his trembling prey. Let him be left to feel his way in the dark; let darkness commensurate<sup>11</sup> with his crime hover over him; and let him feel that at every step he takes, in pursuit of the flying bondman, he is running the frightful risk of having his hot brains dashed out by an invisible agency. Let us render the tyrant no aid; let us not hold the light by which he can trace the footprints of our flying brother. But enough of this. I will now proceed to the statement of those facts, connected with my escape, for which I am alone responsible, and for which no one can be made to suffer but myself.

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3. **Galling** (*adjective*): causing someone to feel angry or annoyed; markedly irritating
  4. **Imputations** (*noun*): attributing something dishonest or criminal; accusation
  5. **Exculpate** (*verb*): to clear from fault or guilt
  6. **Fetters** (*noun*): something that confines; chains or shackles for feet
  7. The "Underground Railroad" was a network of secret routes and safe houses used by 19th-century enslaved people of African descent in the United States in efforts to escape to free states and Canada.
  8. **Avowing** (*verb*): to declare or state something in a public way
  9. **Myriads** (*noun*): a very great number of persons
  10. **Infernal** (*adjective*): hellish; diabolical
  11. **Commensurate** (*verb*): to be equal or similar in size, amount, or degree

In the early part of the year 1838, I became quite restless. I could see no reason why I should, at the end of each week, pour the reward of my toil into the purse of my master. When I carried to him my weekly wages, he would, after counting the money, look me in the face with a robber-like fierceness, and ask, "Is this all?" He was satisfied with nothing less than the last cent. He would, however, when I made him six dollars, sometimes give me six cents, to encourage me. It had the opposite effect. I regarded it as a sort of admission of my right to the whole. The fact that he gave me any part of my wages was proof, to my mind, that he believed me entitled to the whole of them. I always felt worse for having received any thing; for I feared that the giving me a few cents would ease his conscience, and make him feel himself to be a pretty honorable sort of robber. My discontent grew upon me. I was ever on the look-out for means of escape; and, finding no direct means, I determined to try to hire my time, with a view of getting money with which to make my escape. In the spring of 1838, when Master Thomas came to Baltimore to purchase his spring goods, I got an opportunity, and applied to him to allow me to hire my time. He unhesitatingly refused my request, and told me this was another stratagem<sup>12</sup> by which to escape. He told me I could go nowhere but that he could get me; and that, in the event of my running away, he should spare no pains in his efforts to catch me. He exhorted<sup>13</sup> me to content myself, and be obedient. He told me, if I would be happy, I must lay out no plans for the future. He said, if I behaved myself properly, he would take care of me. Indeed, he advised me to complete thoughtlessness of the future, and taught me to depend solely upon him for happiness. He seemed to see fully the pressing necessity of setting aside my intellectual nature, in order to contentment in slavery. But in spite of him, and even in spite of myself, I continued to think, and to think about the injustice of my enslavement, and the means of escape.

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12. **Stratagem** (*noun*): a trick or plan for deceiving an enemy or for achieving a goal

13. **Exhorted** (*verb*): to give warning

About two months after this, I applied to Master Hugh for the privilege of hiring my time. He was not acquainted with the fact that I had applied to Master Thomas, and had been refused. He too, at first, seemed disposed<sup>14</sup> to refuse; but, after some reflection, he granted me the privilege, and proposed the following terms: I was to be allowed all my time, make all contracts with those for whom I worked, and find my own employment; and, in return for this liberty, I was to pay him three dollars at the end of each week; find myself in calking tools, and in board and clothing. My board was two dollars and a half per week. This, with the wear and tear of clothing and calking tools, made my regular expenses about six dollars per week. This amount I was compelled to make up, or relinquish the privilege of hiring my time. Rain or shine, work or no work, at the end of each week the money must be forthcoming, or I must give up my privilege. This arrangement, it will be perceived, was decidedly in my master's favor. It relieved him of all need of looking after me. His money was sure. He received all the benefits of slaveholding without its evils; while I endured all the evils of a slave, and suffered all the care and anxiety of a freeman. I found it a hard bargain. But, hard as it was, I thought it better than the old mode of getting along. It was a step towards freedom to be allowed to bear the responsibilities of a freeman, and I was determined to hold on upon it. I bent myself to the work of making money. I was ready to work at night as well as day, and by the most untiring perseverance and industry, I made enough to meet my expenses, and lay up a little money every week. I went on thus from May till August. Master Hugh then refused to allow me to hire my time longer. The ground for his refusal was a failure on my part, one Saturday night, to pay him for my week's time. This failure was occasioned by my attending a camp meeting<sup>15</sup> about ten miles from Baltimore. During the week, I had entered into an engagement with a number of young friends to start from Baltimore to the camp ground early Saturday evening; and being detained by my employer, I was unable to get down to Master Hugh's without disappointing the company. I knew that Master Hugh was in no special need of the money that night. I therefore decided to go to camp meeting, and upon my return pay him the three dollars. I staid<sup>16</sup> at the camp meeting one day longer than I intended when I left. But as soon as I returned, I called upon him to pay him what he considered his due. I found him very angry; he could scarce restrain his wrath. He said he had a great mind to give me a severe whipping. He wished to know how I dared go out of the city without asking his permission. I told him I hired my time and while I paid him the price which he asked for it, I did not know that I was bound to ask him when and where I should go. This reply troubled him; and, after reflecting a few moments, he turned to me, and said I should hire my time no longer; that the next thing he should know of, I would be running away. Upon the same plea, he told me to bring my tools and clothing home forthwith. I did so; but instead of seeking work, as I had been accustomed to do previously to hiring my time, I spent the whole week without the performance of a single stroke of work. I did this in retaliation. Saturday night, he called upon me as usual for my week's wages. I told him I had no wages; I had done no work that week. Here we were upon the point of coming to blows. He raved, and swore his determination to get hold of me. I did not allow myself a single word; but was resolved, if he laid the weight of his hand upon me, it should be blow for blow. He did not strike me, but told me that he would find me in constant employment in future. I thought the matter over during the next day, Sunday, and finally resolved upon the third day of September, as the day upon which I would make a second attempt to secure my freedom. I now had three weeks during which to prepare for my journey. Early on Monday morning, before Master Hugh had time to make any engagement for me, I went out and got employment of Mr. Butler, at his ship-yard near the drawbridge, upon what is called the City Block, thus making it unnecessary for him to seek employment for me. At the end of the week, I brought him between eight and nine dollars. He seemed very well pleased, and asked why I did not do the same the week before. He little knew what my plans were. My object in working steadily was to remove any suspicion he might entertain of my intent to run away; and in this I succeeded admirably. I suppose he thought I was never better satisfied with my condition than at the very time during which I was planning my escape. The second week passed, and again I carried him my full wages; and so well pleased was he, that he gave me twenty-five

cents, (quite a large sum for a slaveholder to give a slave,) and bade<sup>17</sup> me to make a good use of it. I told him I would.

- [5] Things went on without very smoothly indeed, but within there was trouble. It is impossible for me to describe my feelings as the time of my contemplated start drew near. I had a number of warmhearted friends in Baltimore, — friends that I loved almost as I did my life, — and the thought of being separated from them forever was painful beyond expression. It is my opinion that thousands would escape from slavery, who now remain, but for the strong cords of affection that bind them to their friends. The thought of leaving my friends was decidedly the most painful thought with which I had to contend. The love of them was my tender point, and shook my decision more than all things else. Besides the pain of separation, the dread and apprehension of a failure exceeded what I had experienced at my first attempt. The appalling defeat I then sustained returned to torment me. I felt assured that, if I failed in this attempt, my case would be a hopeless one—it would seal my fate as a slave forever. I could not hope to get off with any thing less than the severest punishment, and being placed beyond the means of escape. It required no very vivid imagination to depict the most frightful scenes through which I should have to pass, in case I failed. The wretchedness of slavery, and the blessedness of freedom, were perpetually before me. It was life and death with me. But I remained firm, and, according to my resolution, on the third day of September, 1838, I left my chains, and succeeded in reaching New York without the slightest interruption of any kind. How I did so,—what means I adopted,—what direction I travelled, and by what mode of conveyance,—I must leave unexplained, for the reasons before mentioned.

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14. **Disposed** (*verb*): having a specific attitude toward something; likely to do something

15. "Camp meetings" were religious meetings held in tents or out in the open, usually lasting several days.

16. An archaic form of "stayed"

17. **Bade** (*verb*): (past tense of bid) to express or tell

I have been frequently asked how I felt when I found myself in a free State. I have never been able to answer the question with any satisfaction to myself. It was a moment of the highest excitement I ever experienced. I suppose I felt as one may imagine the unarmed mariner to feel when he is rescued by a friendly man-of-war<sup>18</sup> from the pursuit of a pirate. In writing to a dear friend, immediately after my arrival at New York, I said I felt like one who had escaped a den of hungry lions. This state of mind, however, very soon subsided; and I was again seized with a feeling of great insecurity and loneliness. I was yet liable to be taken back, and subjected to all the tortures of slavery. This in itself was enough to damp the ardor<sup>19</sup> of my enthusiasm. But the loneliness overcame me. There I was in the midst of thousands, and yet a perfect stranger; without home and without friends, in the midst of thousands of my own brethren—children of a common Father, and yet I dared not to unfold to any one of them my sad condition. I was afraid to speak to any one for fear of speaking to the wrong one, and thereby falling into the hands of money-loving kidnappers, whose business it was to lie in wait for the panting fugitive, as the ferocious beasts of the forest lie in wait for their prey. The motto which I adopted when I started from slavery was this—"Trust no man!" I saw in every white man an enemy, and in almost every colored man cause for distrust. It was a most painful situation; and, to understand it, one must needs experience it, or imagine himself in similar circumstances. Let him be a fugitive slave in a strange land—a land given up to be the hunting-ground for slaveholders—whose inhabitants are legalized kidnappers—where he is every moment subjected to the terrible liability of being seized upon by his fellowmen, as the hideous crocodile seizes upon his prey!—I say, let him place himself in my situation—without home or friends—without money or credit—wanting shelter, and no one to give it—wanting bread, and no money to buy it,—and at the same time let him feel that he is pursued by merciless men-hunters, and in total darkness as to what to do, where to go, or where to stay,—perfectly helpless both as to the means of defense and means of escape,—in the midst of plenty, yet suffering the terrible gnawings of hunger,—in the midst of houses, yet having no home,—among fellow-men, yet feeling as if in the midst of wild beasts, whose greediness to swallow up the trembling and half-famished fugitive is only equalled by that with which the monsters of the deep swallow up the helpless fish upon which they subsist,—I say, let him be placed in this most trying situation,—the situation in which I was placed,—then, and not till then, will he fully appreciate the hardships of, and know how to sympathize with, the toil-worn and whip-scarred fugitive slave.

Thank Heaven, I remained but a short time in this distressed situation. I was relieved from it by the humane hand of *Mr. David Ruggles*, whose vigilance, kindness, and perseverance, I shall never forget. I am glad of an opportunity to express, as far as words can, the love and gratitude I bear him. Mr. Ruggles is now afflicted with blindness, and is himself in need of the same kind offices which he was once so forward in the performance of toward others. I had been in New York but a few days, when Mr. Ruggles sought me out, and very kindly took me to his boarding-house at the corner of Church and Lespenard Streets. Mr. Ruggles was then very deeply engaged in the memorable *Darg* case,<sup>20</sup> as well as attending to a number of other fugitive slaves, devising ways and means for their successful escape; and, though watched and hemmed in on almost every side, he seemed to be more than a match for his enemies.

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18. **Man of war** (*noun*): a British war ship

19. **Ardor** (*noun*): with great passion

20. The "Darg Case of 1938" involved a Virginian slaveholder, John P. Darg, who brought one of his slaves to New York with him. David Ruggles involved himself and was severely punished and imprisoned as a result.

Very soon after I went to Mr. Ruggles, he wished to know of me where I wanted to go; as he deemed it unsafe for me to remain in New York. I told him I was a calker, and should like to go where I could get work. I thought of going to Canada; but he decided against it, and in favor of my going to New Bedford, thinking I should be able to get work there at my trade. At this time, Anna,\* my intended wife, came on; for I wrote to her immediately after my arrival at New York, (notwithstanding my homeless, houseless, and helpless condition,) informing her of my successful flight, and wishing her to come on forthwith<sup>21</sup>. In a few days after her arrival, Mr. Ruggles called in the Rev. J. W. C. Pennington, who, in the presence of Mr. Ruggles, Mrs. Michaels, and two or three others, performed the marriage ceremony, and gave us a certificate, of which the following is an exact copy:—

*“This may certify, that I joined together in holy matrimony Frederick Johnson\*\* and Anna Murray, as man and wife, in the presence of Mr. David Ruggles and Mrs. Michaels.”*

*JAMES W. C. PENNINGTON*

*“New York, Sept. 15, 1838”*

*\*She was free.*

*\*\*I had changed my name from Frederick Bailey to that of Johnson.*

Upon receiving this certificate, and a five-dollar bill from Mr. Ruggles, I shouldered one part of our baggage, and Anna took up the other, and we set out forthwith to take passage on board of the steamboat John W. Richmond for Newport, on our way to New Bedford. Mr. Ruggles gave me a letter to a Mr. Shaw in Newport, and told me, in case my money did not serve me to New Bedford, to stop in Newport and obtain further assistance; but upon our arrival at Newport, we were so anxious to get to a place of safety, that, notwithstanding<sup>22</sup> we lacked the necessary money to pay our fare, we decided to take seats in the stage, and promise to pay when we got to New Bedford. We were encouraged to do this by two excellent gentlemen, residents of New Bedford, whose names I afterward ascertained<sup>23</sup> to be Joseph Ricketson and William C. Taber. They seemed at once to understand our circumstances, and gave us such assurance of their friendliness as put us fully at ease in their presence.

- [10] It was good indeed to meet with such friends, at such a time. Upon reaching New Bedford, we were directed to the house of Mr. Nathan Johnson, by whom we were kindly received, and hospitably provided for. Both Mr. and Mrs. Johnson took a deep and lively interest in our welfare. They proved themselves quite worthy of the name of abolitionists.<sup>24</sup> When the stage-driver found us unable to pay our fare, he held on upon our baggage as security for the debt. I had but to mention the fact to Mr. Johnson, and he forthwith advanced the money.

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21. **Forthwith** (*adjective*): immediately

22. **Notwithstanding** (*conjunction*): in spite of the fact that

23. **Ascertained** (*verb*): to learn with certainty

24. **Abolitionists** (*noun*): persons who supported the ending of slavery within the United States, especially that of African-Americans; advocates and supporters of the anti-slavery movement

We now began to feel a degree of safety, and to prepare ourselves for the duties and responsibilities of a life of freedom. On the morning after our arrival at New Bedford, while at the breakfast-table, the question arose as to what name I should be called by. The name given me by my mother was, "Frederick Augustus Washington Bailey." I, however, had dispensed with the two middle names long before I left Maryland so that I was generally known by the name of "Frederick Bailey." I started from Baltimore bearing the name of "Stanley." When I got to New York, I again changed my name to "Frederick Johnson," and thought that would be the last change. But when I got to New Bedford, I found it necessary again to change my name. The reason of this necessity was, that there were so many Johnsons in New Bedford, it was already quite difficult to distinguish between them. I gave Mr. Johnson the privilege of choosing me a name, but told him he must not take from me the name of "Frederick." I must hold on to that, to preserve a sense of my identity. Mr. Johnson had just been reading the "Lady of the Lake," and at once suggested that my name be "Douglass." From that time until now I have been called "Frederick Douglass;" and as I am more widely known by that name than by either of the others, I shall continue to use it as my own.

I was quite disappointed at the general appearance of things in New Bedford. The impression which I had received respecting the character and condition of the people of the north, I found to be singularly erroneous. I had very strangely supposed, while in slavery, that few of the comforts, and scarcely any of the luxuries, of life were enjoyed at the north, compared with what were enjoyed by the slaveholders of the south. I probably came to this conclusion from the fact that northern people owned no slaves. I supposed that they were about upon a level with the non-slaveholding population of the south. I knew *they* were exceedingly poor, and I had been accustomed to regard their poverty as the necessary consequence of their being non-slaveholders. I had somehow imbibed the opinion that, in the absence of slaves, there could be no wealth, and very little refinement. And upon coming to the north, I expected to meet with a rough, hard-handed, and uncultivated population, living in the most Spartan-like simplicity, knowing nothing of the ease, luxury, pomp, and grandeur of southern slaveholders. Such being my conjectures,<sup>25</sup> any one acquainted with the appearance of New Bedford may very readily infer how palpably I must have seen my mistake.

In the afternoon of the day when I reached New Bedford, I visited the wharves,<sup>26</sup> to take a view of the shipping. Here I found myself surrounded with the strongest proofs of wealth. Lying at the wharves, and riding in the stream, I saw many ships of the finest model, in the best order, and of the largest size. Upon the right and left, I was walled in by granite warehouses of the widest dimensions, stowed to their utmost capacity with the necessaries and comforts of life. Added to this, almost every body seemed to be at work, but noiselessly so, compared with what I had been accustomed to in Baltimore. There were no loud songs heard from those engaged in loading and unloading ships. I heard no deep oaths or horrid curses on the laborer. I saw no whipping of men; but all seemed to go smoothly on. Every man appeared to understand his work, and went at it with a sober, yet cheerful earnestness, which betokened<sup>27</sup> the deep interest which he felt in what he was doing, as well as a sense of his own dignity as a man. To me this looked exceedingly strange. From the wharves I strolled around and over the town, gazing with wonder and admiration at the splendid churches, beautiful dwellings, and finely-cultivated gardens; evincing<sup>28</sup> an amount of wealth, comfort, taste, and refinement, such as I had never seen in any part of slaveholding Maryland.

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25. **Conjectures** (*noun*): an opinion without sufficient proof; a guess

26. **Wharves** (*noun*): (plural for wharf) a flat structure that is built along the shore of a river, ocean, etc., so that ships can load and unload cargo or passengers

27. **Betokened** (*verb*): to give evidence of; show

28. **Evincing** (*verb*): to show clearly

Every thing looked clean, new, and beautiful. I saw few or no dilapidated houses, with poverty-stricken inmates; no half-naked children and barefooted women, such as I had been accustomed to see in Hillsborough, Easton, St. Michael's, and Baltimore. The people looked more able, stronger, healthier, and happier, than those of Maryland. I was for once made glad by a view of extreme wealth, without being saddened by seeing extreme poverty. But the most astonishing as well as the most interesting thing to me was the condition of the colored people, a great many of whom, like myself, had escaped thither<sup>29</sup> as a refuge from the hunters of men. I found many, who had not been seven years out of their chains, living in finer houses, and evidently enjoying more of the comforts of life, than the average of slaveholders in Maryland. I will venture to assert, that my friend Mr. Nathan Johnson (of whom I can say with a grateful heart, "I was hungry, and he gave me meat; I was thirsty, and he gave me drink; I was a stranger, and he took me in") lived in a neater house; dined at a better table; took, paid for, and read, more newspapers; better understood the moral, religious, and political character of the nation,—than nine tenths of the slaveholders in Talbot county Maryland. Yet Mr. Johnson was a working man. His hands were hardened by toil, and not his alone, but those also of Mrs. Johnson. I found the colored people much more spirited than I had supposed they would be. I found among them a determination to protect each other from the blood-thirsty kidnapper, at all hazards. Soon after my arrival, I was told of a circumstance which illustrated their spirit. A colored man and a fugitive slave were on unfriendly terms. The former was heard to threaten the latter with informing his master of his whereabouts. Straightway a meeting was called among the colored people, under the stereotyped notice, "Business of importance!" The betrayer was invited to attend. The people came at the appointed hour, and organized the meeting by appointing a very religious old gentleman as president, who, I believe, made a prayer, after which he addressed the meeting as follows: "*Friends, we have got him here, and I would recommend that you young men just take him outside the door, and kill him!*" With this, a number of them bolted at him; but they were intercepted by some more timid than themselves, and the betrayer escaped their vengeance, and has not been seen in New Bedford since. I believe there have been no more such threats, and should there be hereafter, I doubt not that death would be the consequence.

- [15] I found employment, the third day after my arrival, in stowing a sloop with a load of oil. It was new, dirty, and hard work for me; but I went at it with a glad heart and a willing hand. I was now my own master. It was a happy moment, the rapture of which can be understood only by those who have been slaves. It was the first work, the reward of which was to be entirely my own. There was no Master Hugh standing ready, the moment I earned the money, to rob me of it. I worked that day with a pleasure I had never before experienced. I was at work for myself and newly-married wife. It was to me the starting-point of a new existence. When I got through with that job, I went in pursuit of a job of calking; but such was the strength of prejudice against color, among the white calkers, that they refused to work with me, and of course I could get no employment. (*I am told that colored persons can now get employment at calking in New Bedford—a result of anti-slavery effort.*)

Finding my trade of no immediate benefit, I threw off my calking habiliments<sup>30</sup>, and prepared myself to do any kind of work I could get to do. Mr. Johnson kindly let me have his wood-horse and saw, and I very soon found myself a plenty of work. There was no work too hard—none too dirty. I was ready to saw wood, shovel coal, carry wood, sweep the chimney, or roll oil casks,—all of which I did for nearly three years in New Bedford, before I became known to the anti-slavery world.

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29. **Thither** (*adverb*): to that place; there

30. **Habiliments** (*noun*): items characteristic of a specific occupation or activity

In about four months after I went to New Bedford, there came a young man to me, and inquired if I did not wish to take the "Liberator."<sup>31</sup> I told him I did; but, just having made my escape from slavery, I remarked that I was unable to pay for it then. I, however, finally became a subscriber to it. The paper came, and I read it from week to week with such feelings as it would be quite idle for me to attempt to describe. The paper became my meat and my drink. My soul was set all on fire. Its sympathy for my brethren in bonds—its scathing denunciations of slaveholders—its faithful exposures of slavery—and its powerful attacks upon the upholders of the institution—sent a thrill of joy through my soul, such as I had never felt before!

I had not long been a reader of the "Liberator," before I got a pretty correct idea of the principles, measures and spirit of the anti-slavery reform. I took right hold of the cause. I could do but little; but what I could, I did with a joyful heart, and never felt happier than when in an anti-slavery meeting. I seldom had much to say at the meetings, because what I wanted to say was said so much better by others. But, while attending an anti-slavery convention at Nantucket, on the 11th of August, 1841, I felt strongly moved to speak, and was at the same time much urged to do so by Mr. William C. Coffin, a gentleman who had heard me speak in the colored people's meeting at New Bedford. It was a severe cross, and I took it up reluctantly. The truth was, I felt myself a slave, and the idea of speaking to white people weighed me down. I spoke but a few moments, when I felt a degree of freedom, and said what I desired with considerable ease. From that time until now, I have been engaged in pleading the cause of my brethren—with what success, and with what devotion, I leave those acquainted with my labors to decide.

*The Narrative of the Life of Frederick Douglass: Excerpt from Chapter 11 by Frederick Douglass is in the public domain.*

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31. "The Liberator" (1831-1865) was an anti-slavery newspaper founded by William Lloyd Garrison.

## Text-Dependent Questions

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

1. PART A: As it is used in paragraph 1, the phrase “closing the slightest avenue” means:
  - A. to close or block off a street
  - B. putting an end to slavery once and for all
  - C. to prevent slaves from using existing routes of escape
  - D. to make slave-owners more aware of the efforts to free slaves

2. PART B: Explain the answer to Part A, citing evidence from the text as support.

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3. Explain Frederick Douglass’ feeling regarding the “Underground Railroad.” Are his feelings positive or negative? Cite details from the text to support your response.

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4. Summarize Douglass' feelings upon arriving in New York in paragraph 6. How does Douglass use figurative language in this paragraph to convey his emotions?

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5. Which of the following represents a central idea of the narrative?
- A. To truly be free, one must free himself both physically and mentally from the restraints of slavery.
  - B. The Underground Railroad was the best option for slaves to become free.
  - C. Slaves must change their names to hide their identity.
  - D. When escaping persecution, one must refrain from trusting others.

6. PART A: What is ironic about Douglass finally being a free man?
- A. Douglass makes many friends, even though he left his friends when he escaped.
  - B. Douglass encounters men who hunt fugitive slaves, making it difficult for him to enjoy his freedom.
  - C. Douglass must continue working as a caulker just as he did as a slave.
  - D. Upon entering into freedom, Douglass does not feel he is a free man.

7. PART B: Explain your answer to Part A. Support your response with details from the text.

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8. PART A: Which of the following best describes the significance of Douglass' introduction to "The Liberator"?
- A. It introduced him to the plight of slaves in the south.
  - B. It introduced him to the anti-slavery movement in the north.
  - C. It provided him with knowledge of the anti-slavery movement, as well as a purpose and voice within the movement.
  - D. He wrote for the paper, so he was able to practice his reading and writing skills.
9. PART B: Which of the following quotes best supports your answer to Part A?
- A. "The paper came, and I read it from week to week with such feelings as it would be quite idle for me to attempt to describe." (Paragraph 17)
  - B. "I had not long been a reader of the "Liberator," before I got a pretty correct idea of the principles, measures and spirit of the anti-slavery reform. I took right hold of the cause." (Paragraph 18)
  - C. "Its sympathy for my brethren in bonds—its scathing denunciations of slaveholders—its faithful exposures of slavery—and its powerful attacks upon the upholders of the institution—sent a thrill of joy through my soul, such as I had never felt before!" (Paragraph 17)
  - D. "The paper became my meat and my drink. My soul was set all on fire" (Paragraph 17)
10. How does the author use figurative language within the text? How does the figurative language further develop the central idea within the narrative? Provide details from the text to support your response.

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11. Explain the role education played in Douglass life and his journey to ultimate freedom. How does this contribute to the central idea? Provide details from the text to support your response.

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## Discussion Questions

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

1. Think about the institution of slavery. Why do you think slave owners forbade slaves from learning to read and write? Explain your answer.
2. What does it mean to be free?
3. In order to escape slavery, Frederick Douglass had to leave everything and everyone he knew. What other challenges did Frederick Douglass face after he escaped?
4. What is Frederick Douglass' legacy? How will he be remembered? Explain your answer.



Name: \_\_\_\_\_ Class: \_\_\_\_\_

# President Roosevelt's First Fireside Chat

## *The Banking Crisis*

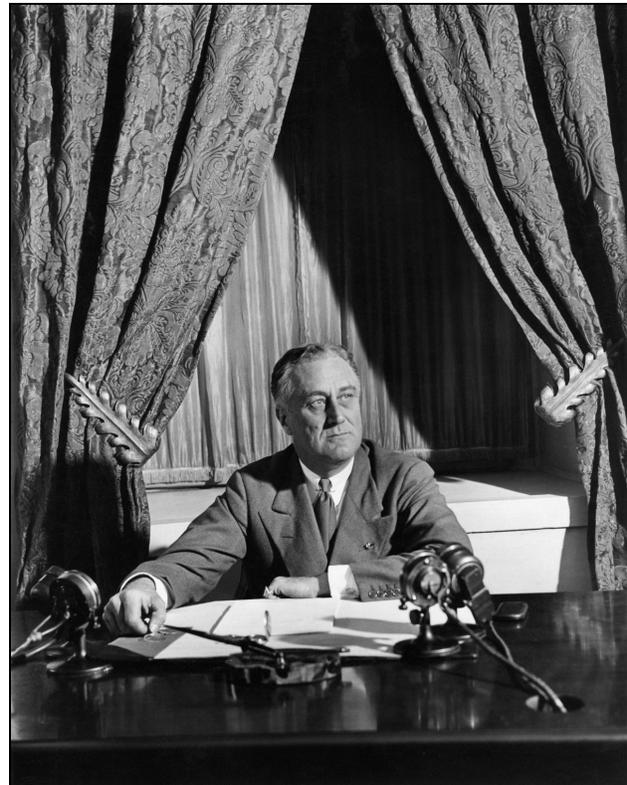
By President Franklin D. Roosevelt  
1933

*On March 12, 1933, President Franklin D. Roosevelt addressed the American people for the first time over a radiobroadcast. President Roosevelt uses this platform to explain the causes and results of the banking crisis that followed the stock market crash during the Great Depression. As you read, take notes of what President Roosevelt's purpose is throughout his address and what he is asking American citizens to do following the reopening of the banks.*

[1] My friends:

I want to talk for a few minutes with the people of the United States about banking — to talk with the comparatively few who understand the mechanics of banking, but more particularly with the overwhelming majority of you who use banks for the making of deposits and the drawing of checks.

I want to tell you what has been done in the last few days, and why it was done, and what the next steps are going to be. I recognize that the many proclamations from State capitols and from Washington, the legislation, the Treasury regulations, and so forth, couched for the most part in banking and legal terms, ought to be explained for the benefit of the average citizen. I owe this, in particular, because of the fortitude<sup>1</sup> and the good temper with which everybody has accepted the inconvenience and hardships of the banking holiday.<sup>2</sup> And I know that when you understand what we in Washington have been about, I shall continue to have your cooperation as fully as I have had your sympathy and your help during the past week.



*"President Franklin D. Roosevelt Broadcasting his First Fireside Chat Regarding the Banking Crisis, from the White House, Washington, D.C." by National Archives and Records Administration is in the public domain.*

1. **Fortitude** (*noun*): courage in pain of adversity
2. On March 6, 1933, President Roosevelt ordered the suspension of all banking transactions in an attempt to stabilize the banking system.

First of all, let me state the simple fact that when you deposit money in a bank, the bank does not put the money into a safe deposit vault. It invests your money in many different forms of credit — in bonds, in commercial paper, in mortgages and in many other kinds of loans. In other words, the bank puts your money to work to keep the wheels of industry and of agriculture turning around. A comparatively small part of the money that you put into the bank is kept in currency — an amount which in normal times is wholly sufficient to cover the cash needs of the average citizen. In other words, the total amount of all the currency in the country is only a comparatively small proportion of the total deposits in all the banks of the country.

- [5] What, then, happened during the last few days of February and the first few days of March? Because of undermined confidence on the part of the public, there was a general rush by a large portion of our population to turn bank deposits into currency or gold — a rush so great that the soundest banks couldn't get enough currency to meet the demand. The reason for this was that on the spur of the moment it was, of course, impossible to sell perfectly sound assets of a bank and convert them into cash, except at panic prices far below their real value. By the afternoon of March third, a week ago last Friday, scarcely a bank in the country was open to do business. Proclamations closing them, in whole or in part, had been issued by the Governors in almost all the states. It was then that I issued the proclamation providing for the national bank holiday, and this was the first step in the Government's reconstruction of our financial and economic fabric.

The second step, last Thursday, was the legislation promptly and patriotically passed by the Congress confirming my proclamation and broadening my powers so that it became possible in view of the requirement of time to extend the holiday and lift the ban of that holiday gradually in the days to come. This law also gave authority to develop a program of rehabilitation of our banking facilities. And I want to tell our citizens in every part of the Nation that the national Congress — Republicans and Democrats alike — showed by this action a devotion to public welfare and a realization of the emergency and the necessity for speed that it is difficult to match in all our history.

The third stage has been the series of regulations permitting the banks to continue their functions to take care of the distribution of food and household necessities and the payment of payrolls.

This bank holiday, while resulting in many cases in great inconvenience, is affording us the opportunity to supply the currency necessary to meet the situation. Remember that no sound bank is a dollar worse off than it was when it closed its doors last week. Neither is any bank which may turn out not to be in a position for immediate opening. The new law allows the twelve Federal Reserve Banks<sup>3</sup> to issue additional currency on good assets and thus the banks that reopen will be able to meet every legitimate call. The new currency is being sent out by the Bureau of Engraving and Printing<sup>4</sup> in large volume to every part of the country. It is sound currency because it is backed by actual, good assets.

Another question you will ask is this: Why are all the banks not to be reopened at the same time? The answer is simple and I know you will understand it: Your Government does not intend that the history of the past few years shall be repeated. We do not want and will not have another epidemic of bank failures.

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3. Federal Reserve Banks were established in 1913 by the U.S. Congress. A Federal Reserve Bank is a regional bank and part of the Federal Reserve System (the central banking system of the United States).

4. The Bureau of Engraving and Printing is a government agency within the United States Department of Treasury, responsible for producing paper money.

[10] As a result, we start tomorrow, Monday, with the opening of banks in the twelve Federal Reserve Bank cities — those banks, which on first examination by the Treasury, have already been found to be all right. That will be followed on Tuesday by the resumption of all other functions by banks already found to be sound in cities where there are recognized clearing houses. That means about two hundred and fifty cities of the United States. In other words, we are moving as fast as the mechanics of the situation will allow us.

On Wednesday and succeeding days, banks in smaller places all through the country will resume business, subject, of course, to the Government's physical ability to complete its survey. It is necessary that the reopening of banks be extended over a period in order to permit the banks to make applications for the necessary loans, to obtain currency needed to meet their requirements, and to enable the Government to make common sense checkups.

Please let me make it clear to you that if your bank does not open the first day you are by no means justified in believing that it will not open. A bank that opens on one of the subsequent<sup>5</sup> days is in exactly the same status as the bank that opens tomorrow.

I know that many people are worrying about State banks that are not members of the Federal Reserve System. There is no occasion for that worry. These banks can and will receive assistance from member banks and from the Reconstruction Finance Corporation.<sup>6</sup> And, of course, they are under the immediate control of the State banking authorities. These State banks are following the same course as the National banks except that they get their licenses to resume business from the State authorities, and these authorities have been asked by the Secretary of the Treasury to permit their good banks to open up on the same schedule as the national banks. And so I am confident that the State Banking Departments will be as careful as the national Government in the policy relating to the opening of banks and will follow the same broad theory.

It is possible that when the banks resume a very few people who have not recovered from their fear may again begin withdrawals. Let me make it clear to you that the banks will take care of all needs, except, of course, the hysterical demands of hoarders, and it is my belief that hoarding during the past week has become an exceedingly unfashionable pastime in every part of our nation. It needs no prophet to tell you that when the people find that they can get their money — that they can get it when they want it for all legitimate purposes — the phantom of fear will soon be laid. People will again be glad to have their money where it will be safely taken care of and where they can use it conveniently at any time. I can assure you, my friends, that it is safer to keep your money in a reopened bank than it is to keep it under the mattress.

[15] The success of our whole national program depends, of course, on the cooperation of the public — on its intelligent support and its use of a reliable system.

Remember that the essential accomplishment of the new legislation is that it makes it possible for banks more readily to convert their assets into cash than was the case before. More liberal provision has been made for banks to borrow on these assets at the Reserve Banks and more liberal provision has also been made for issuing currency on the security of these good assets. This currency is not fiat currency. It is issued only on adequate security, and every good bank has an abundance of such security.

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5. **Subsequent** (*adjective*): coming after something in time; following

6. A corporation in the United States that provided financial support to state and local governments, including loans to banks.

One more point before I close. There will be, of course, some banks unable to reopen without being reorganized. The new law allows the Government to assist in making these reorganizations quickly and effectively and even allows the Government to subscribe to at least a part of any new capital that may be required.

I hope you can see, my friends, from this essential recital of what your Government is doing that there is nothing complex, nothing radical in the process.

We have had a bad banking situation. Some of our bankers had shown themselves either incompetent or dishonest in their handling of the people's funds. They had used the money entrusted to them in speculations and unwise loans. This was, of course, not true in the vast majority of our banks, but it was true in enough of them to shock the people of the United States, for a time, into a sense of insecurity and to put them into a frame of mind where they did not differentiate, but seemed to assume that the acts of a comparative few had tainted them all. And so it became the Government's job to straighten out this situation and do it as quickly as possible. And that job is being performed.

[20] I do not promise you that every bank will be reopened or that individual losses will not be suffered, but there will be no losses that possibly could be avoided; and there would have been more and greater losses had we continued to drift. I can even promise you salvation for some, at least, of the sorely pressed banks. We shall be engaged not merely in reopening sound banks but in the creation of more sound banks through reorganization.

It has been wonderful to me to catch the note of confidence from all over the country. I can never be sufficiently grateful to the people for the loyal support that they have given me in their acceptance of the judgment that has dictated our course, even though all our processes may not have seemed clear to them.

After all, there is an element in the readjustment of our financial system more important than currency, more important than gold, and that is the confidence of the people themselves. Confidence and courage are the essentials of success in carrying out our plan. You people must have faith; you must not be stampeded by rumors or guesses. Let us unite in banishing fear. We have provided the machinery to restore our financial system, and it is up to you to support and make it work.

It is your problem, my friends, your problem no less than it is mine.

Together we cannot fail.

*"President Roosevelt's First Fireside Chat: The Banking Crisis" by President Franklin D. Roosevelt (1933) is in the public domain.*

## Text-Dependent Questions

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

1. PART A: What does President Roosevelt hope to achieve with his address to the public?
  - A. He wants to contrast his economic policies with the failed policies of previous American presidents.
  - B. He wants the public to learn from their mistakes and be more responsible with their money in the future.
  - C. He wants to ensure that the public doesn't cause another crisis by withdrawing too much money when the banks reopen.
  - D. He wants the public to allow the banks to continue to invest their money so that America's economy remains the same.
  
2. PART B: Which section from the text best supports the answer to Part A?
  - A. "First of all, let me state the simple fact that when you deposit money in a bank, the bank does not put the money into a safe deposit vault. It invests your money in many different forms of credit — in bonds, in commercial paper, in mortgages and in many other kinds of loans." (Paragraph 4)
  - B. "Because of undermined confidence on the part of the public, there was a general rush by a large portion of our population to turn bank deposits into currency or gold — a rush so great that the soundest banks couldn't get enough currency to meet the demand." (Paragraph 5)
  - C. "I hope you can see, my friends, from this essential recital of what your Government is doing that there is nothing complex, nothing radical in the process." (Paragraph 18)
  - D. "Confidence and courage are the essentials of success in carrying out our plan. You people must have faith; you must not be stampeded by rumors or guesses." (Paragraph 22)
  
3. PART A: What is the meaning of "couched" as it is used in paragraph 3?
  - A. speak a specific way
  - B. act dismissively
  - C. discuss thoroughly
  - D. speak ambiguously
  
4. PART B: Which detail from the text best supports the answer to Part A?
  - A. "to talk with the comparatively few who understand the mechanics of banking," (Paragraph 2)
  - B. "for the most part in banking and legal terms, ought to be explained for the benefit of the average citizen." (Paragraph 3)
  - C. "I owe this, in particular, because of the fortitude and the good temper with which everybody has accepted the inconvenience and hardships of the banking holiday." (Paragraph 3)
  - D. "let me state the simple fact that when you deposit money in a bank, the bank does not put the money into a safe deposit vault." (Paragraph 4)

5. PART A: How does paragraph 5 contribute to the development of ideas in the text?
- A. It criticizes citizens for not knowing how banks work.
  - B. It blames citizens for the bank failures.
  - C. It reassures citizens that the bank failures are a temporary setback.
  - D. It explains to the average citizen why the banks failed.
6. PART B: Which quote from the text best supports the answer to Part A?
- A. "In other words, the total amount of all the currency in the country is only a comparatively small proportion of the total deposits in all the banks of the country." (Paragraph 4)
  - B. "Because of undermined confidence on the part of the public, there was a general rush by a large portion of our population to turn bank deposits into currency or gold — a rush so great that the soundest banks couldn't get enough currency to meet the demand." (Paragraph 5)
  - C. "It was then that I issued the proclamation providing for the national bank holiday, and this was the first step in the Government's reconstruction of our financial and economic fabric." (Paragraph 5)
  - D. "the legislation promptly and patriotically passed by the Congress confirming my proclamation and broadening my powers so that it became possible in view of the requirement of time to extend the holiday and lift the ban of that holiday gradually in the days to come." (Paragraph 6)
7. Describe the central idea of President Roosevelt's speech using supporting evidence from the text.

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# To Build A Fire

By Jack London on 02.10.20

Word Count 7,125

Level MAX



At the man's heels trotted a dog, a big native husky, the proper wolf-dog, grey-coated and without any visible or temperamental difference from its brother, the wild wolf. Photo: Jose Carlos Ichiro/Unsplash

Day had broken cold and grey, exceedingly cold and grey, when the man turned aside from the main Yukon trail and climbed the high earthbank, where a dim and little-travelled trail led eastward through the fat spruce timberland. It was a steep bank, and he paused for breath at the top, excusing the act to himself by looking at his watch. It was nine o'clock. There was no sun nor hint of sun, though there was not a cloud in the sky. It was a clear day, and yet there seemed an intangible pall over the face of things, a subtle gloom that made the day dark, and that was due to the absence of sun. This fact did not worry the man. He was used to the lack of sun. It had been days since he had seen the sun, and he knew that a few more days must pass before that cheerful orb, due south, would just peep above the skyline and dip immediately from view.

The man flung a look back along the way he had come. The Yukon lay a mile wide and hidden under three feet of ice. On top of this ice were as many feet of snow. It was all pure white, rolling in gentle undulations where the ice-jams of the freeze-up had formed. North and south, as far as his eye could see, it was unbroken white, save for a dark hairline that curved and twisted from around the spruce-covered island to the south, and that curved and twisted away into the north, where it

disappeared behind another spruce-covered island. This dark hairline was the trail—the main trail—that led south five hundred miles to the Chilcoot Pass, Dyea, and saltwater; and that led north seventy miles to Dawson, and still on to the north a thousand miles to Nulato, and finally to St. Michael on the Bering Sea, a thousand miles and half a thousand more.

But all this—the mysterious, far-reaching hairline trail, the absence of sun from the sky, the tremendous cold, and the strangeness and weirdness of it all—made no impression on the man. It was not because he was long used to it. He was a newcomer in the land, a chechaquo, and this was his first winter. The trouble with him was that he was without imagination. He was quick and alert in the things of life, but only in the things, and not in the significances. Fifty degrees below zero meant eighty-odd degrees of frost. Such fact impressed him as being cold and uncomfortable, and that was all. It did not lead him to meditate upon his frailty as a creature of temperature, and upon man's frailty in general, able only to live within certain narrow limits of heat and cold; and from there on it did not lead him to the conjectural field of immortality and man's place in the universe. Fifty degrees below zero stood for a bite of frost that hurt and that must be guarded against by the use of mittens, ear-flaps, warm moccasins, and thick socks. Fifty degrees below zero was to him just precisely fifty degrees below zero. That there should be anything more to it than that was a thought that never entered his head.

As he turned to go on, he spat speculatively. There was a sharp, explosive crackle that startled him. He spat again. And again, in the air, before it could fall to the snow, the spittle crackled. He knew that at fifty below spittle crackled on the snow, but this spittle had crackled in the air. Undoubtedly it was colder than fifty below—how much colder he did not know. But the temperature did not matter. He was bound for the old claim on the left fork of Henderson Creek, where the boys were already. They had come over across the divide from the Indian Creek country, while he had come the roundabout way to take a look at the possibilities of getting out logs in the spring from the islands in the Yukon. He would be into camp by six o'clock; a bit after dark, it was true, but the boys would be there, a fire would be going, and a hot supper would be ready. As for lunch, he pressed his hand against the protruding bundle under his jacket. It was also under his shirt, wrapped up in a handkerchief and lying against the naked skin. It was the only way to keep the biscuits from freezing. He smiled agreeably to himself as he thought of those biscuits, each cut open and sopped in bacon grease, and each enclosing a generous slice of fried bacon.

**He was surprised, however, at the cold.**

He plunged in among the big spruce trees. The trail was faint. A foot of snow had fallen since the last sled had passed over, and he was glad he was without a sled, traveling light. In fact, he carried nothing but the lunch wrapped in the handkerchief. He was surprised, however, at the cold. It certainly was cold, he concluded, as he rubbed his numbed nose and cheek-bones with his mittened hand. He was a warm-whiskered man, but the hair on his face did not protect the high cheek-bones and the eager nose that thrust itself aggressively into the frosty air.

At the man's heels trotted a dog, a big native husky, the proper wolf-dog, grey-coated and without any visible or temperamental difference from its brother, the wild wolf. The animal was depressed by the tremendous cold. It knew that it was no time for traveling. Its instinct told it a truer tale than was told to the man by the man's judgment. In reality, it was not merely colder than fifty below zero; it was colder than sixty below, than seventy below. It was seventy-five below zero. Since the freezing-point is thirty-two above zero, it meant that one hundred and seven degrees of

frost obtained. The dog did not know anything about thermometers. Possibly in its brain there was no sharp consciousness of a condition of very cold such as was in the man's brain. But the brute had its instinct. It experienced a vague but menacing apprehension that subdued it and made it slink along at the man's heels, and that made it question eagerly every unwonted movement of the man as if expecting him to go into camp or to seek shelter somewhere and build a fire. The dog had learned fire, and it wanted fire, or else to burrow under the snow and cuddle its warmth away from the air.

The frozen moisture of its breathing had settled on its fur in a fine powder of frost, and especially were its jowls, muzzle, and eyelashes whitened by its crystallized breath. The man's red beard and mustache were likewise frosted, but more solidly, the deposit taking the form of ice and increasing with every warm, moist breath he exhaled. Also, the man was chewing tobacco, and the muzzle of ice held his lips so rigidly that he was unable to clear his chin when he expelled the juice. The result was that a crystal beard of the color and solidity of amber was increasing its length on his chin. If he fell down it would shatter itself, like glass, into brittle fragments. But he did not mind the appendage. It was the penalty all tobacco-chewers paid in that country, and he had been out before in two cold snaps. They had not been so cold as this, he knew, but by the spirit thermometer at Sixty Mile he knew they had been registered at fifty below and at fifty-five.

He held on through the level stretch of woods for several miles, crossed a wide flat of dark tussocks, and dropped down a bank to the frozen bed of a small stream. This was Henderson Creek, and he knew he was ten miles from the forks. He looked at his watch. It was ten o'clock. He was making four miles an hour, and he calculated that he would arrive at the forks at half-past twelve. He decided to celebrate that event by eating his lunch there.

The dog dropped in again at his heels, with a tail drooping discouragement, as the man swung along the creek-bed. The furrow of the old sled-trail was plainly visible, but a dozen inches of snow covered the marks of the last runners. In a month no man had come up or down that silent creek. The man held steadily on. He was not much given to thinking, and just then particularly he had nothing to think about save that he would eat lunch at the forks and that at six o'clock he would be in camp with the boys. There was nobody to talk to and, had there been, speech would have been impossible because of the ice-muzzle on his mouth. So he continued monotonously to chew tobacco and to increase the length of his amber beard.

Once in a while, the thought reiterated itself that it was very cold and that he had never experienced such cold. As he walked along he rubbed his cheek-bones and nose with the back of his mittened hand. He did this automatically, now and again changing hands. But rub as he would, the instant he stopped his cheek-bones went numb, and the following instant the end of his nose went numb. He was sure to frost his cheeks; he knew that, and experienced a pang of regret that he had not devised a nose-strap of the sort Bud wore in cold snaps. Such a strap passed across the cheeks, as well, and saved them. But it didn't matter much, after all. What were frosted cheeks? A bit painful, that was all; they were never serious.

Empty as the man's mind was of thoughts, he was keenly observant, and he noticed the changes in the creek, the curves and bends and timber-jams, and always he sharply noted where he placed his feet. Once, coming around a bend, he shied abruptly, like a startled horse, curved away from the place where he had been walking, and retreated several paces back along the trail. The creek he knew was frozen clear to the bottom—no creek could contain water in that arctic winter—but he

knew also that there were springs that bubbled out from the hillsides and ran along under the snow and on top of the ice of the creek. He knew that the coldest snaps never froze these springs, and he knew likewise their danger. They were traps. They hid pools of water under the snow that might be three inches deep, or three feet. Sometimes a skin of ice half an inch thick covered them, and in turn, was covered by the snow. Sometimes there were alternate layers of water and ice-skin, so that when one broke through he kept on breaking through for a while, sometimes wetting himself to the waist.

That was why he had shied in such panic. He had felt the give under his feet and heard the crackle of a snow-hidden ice-skin. And to get his feet wet in such a temperature meant trouble and danger. At the very least it meant delay, for he would be forced to stop and build a fire, and under its protection to bare his feet while he dried his socks and moccasins. He stood and studied the creek-bed and its banks, and decided that the flow of water came from the right. He reflected awhile, rubbing his nose and cheeks, then skirted to the left, stepping gingerly and testing the footing for each step. Once clear of the danger, he took a fresh chew of tobacco and swung along at his four-mile gait.

In the course of the next two hours, he came upon several similar traps. Usually, the snow above the hidden pools had a sunken, candied appearance that advertised the danger. Once again, however, he had a close call; and once, suspecting danger, he compelled the dog to go on in front. The dog did not want to go. It hung back until the man shoved it forward, and then it went quickly across the white, unbroken surface. Suddenly it broke through, floundered to one side, and got away to firmer footing. It had wet its forefeet and legs, and almost immediately the water that clung to it turned to ice. It made quick efforts to lick the ice off its legs, then dropped down in the snow and began to bite out the ice that had formed between the toes. This was a matter of instinct. To permit the ice to remain would mean sore feet. It did not know this. It merely obeyed the mysterious prompting that arose from the deep crypts of its being. But the man knew, having achieved a judgment on the subject, and he removed the mitten from his right hand and helped tear out the ice-particles. He did not expose his fingers more than a minute, and was astonished at the swift numbness that smote them. It certainly was cold. He pulled on the mitten hastily and beat the hand savagely across his chest.

### **He was pleased at the speed he had made.**

At twelve o'clock the day was at its brightest. Yet the sun was too far south on its winter journey to clear the horizon. The bulge of the earth intervened between it and Henderson Creek, where the man walked under a clear sky at noon and cast no shadow. At half-past twelve, to the minute, he arrived at the forks of the creek. He was pleased at the speed he had made. If he kept it up, he would certainly be with the boys by six. He unbuttoned his jacket and shirt and drew forth his lunch. The action consumed no more than a quarter of a minute, yet in that brief moment the numbness laid hold of the exposed fingers. He did not put the mitten on, but, instead, struck the fingers a dozen sharp smashes against his leg. Then he sat down on a snow-covered log to eat. The sting that followed upon the striking of his fingers against his leg ceased so quickly that he was startled, he had had no chance to take a bite of biscuit. He struck the fingers repeatedly and returned them to the mitten, baring the other hand for the purpose of eating. He tried to take a mouthful, but the ice-muzzle prevented. He had forgotten to build a fire and thaw out. He chuckled at his foolishness, and as he chuckled he noted the numbness creeping into the exposed fingers. Also, he noted that the stinging which had first come to his toes when he sat down was

already passing away. He wondered whether the toes were warm or numbed. He moved them inside the moccasins and decided that they were numbed.

He pulled the mitten on hurriedly and stood up. He was a bit frightened. He stamped up and down until the stinging returned into the feet. It certainly was cold, was his thought. That man from Sulphur Creek had spoken the truth when telling how cold it sometimes got in the country. And he had laughed at him at the time! That showed one must not be too sure of things. There was no mistake about it, it was cold. He strode up and down, stamping his feet and threshing his arms, until reassured by the returning warmth. Then he got out matches and proceeded to make a fire. From the undergrowth, where high water of the previous spring had lodged a supply of seasoned twigs, he got his firewood. Working carefully from a small beginning, he soon had a roaring fire, over which he thawed the ice from his face and in the protection of which he ate his biscuits. For the moment the cold of space was outwitted. The dog took satisfaction in the fire, stretching out close enough for warmth and far enough away to escape being singed.

When the man had finished, he filled his pipe and took his comfortable time over a smoke. Then he pulled on his mittens, settled the ear-flaps of his cap firmly about his ears, and took the creek trail up the left fork. The dog was disappointed and yearned back toward the fire. This man did not know cold. Possibly all the generations of his ancestry had been ignorant of cold, of real cold, of cold one hundred and seven degrees below freezing-point. But the dog knew; all its ancestry knew, and it had inherited the knowledge. And it knew that it was not good to walk abroad in such fearful cold. It was the time to lie snug in a hole in the snow and wait for a curtain of cloud to be drawn across the face of outer space whence this cold came. On the other hand, there was keen intimacy between the dog and the man. The one was the toil-slave of the other, and the only caresses it had ever received were the caresses of the whiplash and of harsh and menacing throat-sounds that threatened the whiplash. So the dog made no effort to communicate its apprehension to the man. It was not concerned in the welfare of the man; it was for its own sake that it yearned back toward the fire. But the man whistled, and spoke to it with the sound of whiplashes, and the dog swung in at the man's heels and followed after.

The man took a chew of tobacco and proceeded to start a new amber beard. Also, his moist breath quickly powdered with white his mustache, eyebrows, and lashes. There did not seem to be so many springs on the left fork of the Henderson, and for half an hour the man saw no signs of any. And then it happened. At a place where there were no signs, where the soft, unbroken snow seemed to advertise solidity beneath, the man broke through. It was not deep. He wetted himself half-way to the knees before he floundered out to the firm crust.

He was angry, and cursed his luck aloud. He had hoped to get into camp with the boys at six o'clock, and this would delay him an hour, for he would have to build a fire and dry out his foot-gear. This was imperative at that low temperature—he knew that much; and he turned aside to the bank, which he climbed. On top, tangled in the underbrush about the trunks of several small spruce trees, was a high-water deposit of dry firewood—sticks and twigs principally, but also larger portions of seasoned branches and fine, dry, last-year's grasses. He threw down several large pieces on top of the snow. This served for a foundation and prevented the young flame from drowning itself in the snow it otherwise would melt. The flame he got by touching a match to a small shred of birch-bark that he took from his pocket. This burned even more readily than paper. Placing it on the foundation, he fed the young flame with wisps of dry grass and with the tiniest dry twigs.

He worked slowly and carefully, keenly aware of his danger. Gradually, as the flame grew stronger, he increased the size of the twigs with which he fed it. He squatted in the snow, pulling the twigs out from their entanglement in the brush and feeding directly to the flame. He knew there must be no failure. When it is seventy-five below zero, a man must not fail in his first attempt to build a fire—that is, if his feet are wet. If his feet are dry, and he fails, he can run along the trail for half a mile and restore his circulation. But the circulation of wet and freezing feet cannot be restored by running when it is seventy-five below. No matter how fast he runs, the wet feet will freeze the harder.

All this the man knew. The old-timer on Sulphur Creek had told him about it the previous fall, and now he was appreciating the advice. Already all sensation had gone out of his feet. To build the fire he had been forced to remove his mittens, and the fingers had quickly gone numb. His pace of four miles an hour had kept his heart pumping blood to the surface of his body and to all the extremities. But the instant he stopped, the action of the pump eased down. The cold of space smote the unprotected tip of the planet, and he, being on that unprotected tip, received the full force of the blow. The blood of his body recoiled before it. The blood was alive, like the dog, and like the dog it wanted to hide away and cover itself up from the fearful cold. So long as he walked four miles an hour, he pumped that blood, willy-nilly, to the surface; but now it ebbed away and sank down into the recesses of his body. The extremities were the first to feel its absence. His wet feet froze the faster, and his exposed fingers numbed the faster, though they had not yet begun to freeze. Nose and cheeks were already freezing, while the skin of all his body chilled as it lost its blood.

But he was safe. Toes and nose and cheeks would be only touched by the frost, for the fire was beginning to burn with strength. He was feeding it with twigs the size of his finger. In another minute he would be able to feed it with branches the size of his wrist, and then he could remove his wet foot-gear, and, while it dried, he could keep his naked feet warm by the fire, rubbing them at first, of course, with snow. The fire was a success. He was safe. He remembered the advice of the old-timer on Sulphur Creek, and smiled. The old-timer had been very serious in laying down the law that no man must travel alone in the Klondike after fifty below. Well, here he was; he had had the accident; he was alone; and he had saved himself. Those old-timers were rather womanish, some of them, he thought. All a man had to do was to keep his head, and he was all right. Any man who was a man could travel alone. But it was surprising, the rapidity with which his cheeks and nose were freezing. And he had not thought his fingers could go lifeless in so short a time. Lifeless they were, for he could scarcely make them move together to grip a twig, and they seemed remote from his body and from him. When he touched a twig, he had to look and see whether or not he had hold of it. The wires were pretty well down between him and his finger-ends.

All of which counted for little. There was the fire, snapping and crackling and promising life with every dancing flame. He started to untie his moccasins. They were coated with ice; the thick German socks were like sheaths of iron half-way to the knees; and the moccasin strings were like rods of steel all twisted and knotted as by some conflagration. For a moment he tugged with his numbed fingers, then, realizing the folly of it, he drew his sheath-knife.

**He should not have built the fire under the spruce tree.**

But before he could cut the strings, it happened. It was his own fault or, rather, his mistake. He should not have built the fire under the spruce tree. He should have built it in the open. But it had

been easier to pull the twigs from the brush and drop them directly on the fire. Now the tree under which he had done this carried a weight of snow on its boughs. No wind had blown for weeks, and each bough was fully freighted. Each time he had pulled a twig he had communicated a slight agitation to the tree—an imperceptible agitation, so far as he was concerned, but an agitation sufficient to bring about the disaster. High up in the tree one bough capsized its load of snow. This fell on the boughs beneath, capsizing them. This process continued, spreading out and involving the whole tree. It grew like an avalanche, and it descended without warning upon the man and the fire, and the fire was blotted out! Where it had burned was a mantle of fresh and disordered snow.

The man was shocked. It was as though he had just heard his own sentence of death. For a moment he sat and stared at the spot where the fire had been. Then he grew very calm. Perhaps the old-timer on Sulphur Creek was right. If he had only had a trail-mate he would have been in no danger now. The trail-mate could have built the fire. Well, it was up to him to build the fire over again, and this second time there must be no failure. Even if he succeeded, he would most likely lose some toes. His feet must be badly frozen by now, and there would be some time before the second fire was ready.

Such were his thoughts, but he did not sit and think them. He was busy all the time they were passing through his mind, he made a new foundation for a fire, this time in the open; where no treacherous tree could blot it out. Next, he gathered dry grasses and tiny twigs from the high-water flotsam. He could not bring his fingers together to pull them out, but he was able to gather them by the handful. In this way, he got many rotten twigs and bits of green moss that were undesirable, but it was the best he could do. He worked methodically, even collecting an armful of the larger branches to be used later when the fire gathered strength. And all the while the dog sat and watched him, a certain yearning wistfulness in its eyes, for it looked upon him as the fire-provider, and the fire was slow in coming.

When all was ready, the man reached in his pocket for a second piece of birch-bark. He knew the bark was there, and, though he could not feel it with his fingers, he could hear its crisp rustling as he fumbled for it. Try as he would, he could not clutch hold of it. And all the time, in his consciousness, was the knowledge that each instant his feet were freezing. This thought tended to put him in a panic, but he fought against it and kept calm. He pulled on his mittens with his teeth, and threshed his arms back and forth, beating his hands with all his might against his sides. He did this sitting down, and he stood up to do it; and all the while the dog sat in the snow, its wolf-brush of a tail curled around warmly over its forefeet, its sharp wolf-ears pricked forward intently as it watched the man. And the man as he beat and threshed with his arms and hands, felt a great surge of envy as he regarded the creature that was warm and secure in its natural covering.

After a time he was aware of the first far-away signals of sensation in his beaten fingers. The faint tingling grew stronger till it evolved into a stinging ache that was excruciating, but which the man hailed with satisfaction. He stripped the mitten from his right hand and fetched forth the birch-bark. The exposed fingers were quickly going numb again. Next he brought out his bunch of sulphur matches. But the tremendous cold had already driven the life out of his fingers. In his effort to separate one match from the others, the whole bunch fell in the snow. He tried to pick it out of the snow, but failed. The dead fingers could neither touch nor clutch. He was very careful. He drove the thought of his freezing feet; and nose, and cheeks, out of his mind, devoting his whole soul to the matches. He watched, using the sense of vision in place of that of touch, and when he saw his fingers on each side the bunch, he closed them—that is, he willed to close them,

for the wires were drawn, and the fingers did not obey. He pulled the mitten on the right hand, and beat it fiercely against his knee. Then, with both mittened hands, he scooped the bunch of matches, along with much snow, into his lap. Yet he was no better off.

After some manipulation, he managed to get the bunch between the heels of his mittened hands. In this fashion, he carried it to his mouth. The ice crackled and snapped when by a violent effort he opened his mouth. He drew the lower jaw in, curled the upper lip out of the way, and scraped the bunch with his upper teeth in order to separate a match. He succeeded in getting one, which he dropped on his lap. He was no better off. He could not pick it up. Then he devised a way. He picked it up in his teeth and scratched it on his leg. Twenty times he scratched before he succeeded in lighting it. As it flamed he held it with his teeth to the birch-bark. But the burning brimstone went up his nostrils and into his lungs, causing him to cough spasmodically. The match fell into the snow and went out.

The old-timer on Sulphur Creek was right, he thought in the moment of controlled despair that ensued: after fifty below, a man should travel with a partner. He beat his hands but failed in exciting any sensation. Suddenly he bared both hands, removing the mittens with his teeth. He caught the whole bunch between the heels of his hands. His arm muscles not being frozen enabled him to press the hand-heels tightly against the matches. Then he scratched the bunch along his leg. It flared into flame, seventy sulphur matches at once! There was no wind to blow them out. He kept his head to one side to escape the strangling fumes, and held the blazing bunch to the birch-bark. As he so held it, he became aware of sensation in his hand. His flesh was burning. He could smell it. Deep down below the surface he could feel it. The sensation developed into pain that grew acute. And still he endured it, holding the flame of the matches clumsily to the bark that would not light readily because his own burning hands were in the way, absorbing most of the flame.

At last, when he could endure no more, he jerked his hands apart. The blazing matches fell sizzling into the snow, but the birch-bark was alight. He began laying dry grasses and the tiniest twigs on the flame. He could not pick and choose, for he had to lift the fuel between the heels of his hands. Small pieces of rotten wood and green moss clung to the twigs, and he bit them off as well as he could with his teeth. He cherished the flame carefully and awkwardly. It meant life, and it must not perish. The withdrawal of blood from the surface of his body now made him begin to shiver, and he grew more awkward. A large piece of green moss fell squarely on the little fire. He tried to poke it out with his fingers, but his shivering frame made him poke too far, and he disrupted the nucleus of the little fire, the burning grasses and tiny twigs separating and scattering. He tried to poke them together again, but in spite of the tenseness of the effort, his shivering got away with him, and the twigs were hopelessly scattered. Each twig gushed a puff of smoke and went out. The fire-provider had failed. As he looked apathetically about him, his eyes chanced on the dog, sitting across the ruins of the fire from him, in the snow, making restless, hunching movements, slightly lifting one forefoot and then the other, shifting its weight back and forth on them with wistful eagerness.

The sight of the dog put a wild idea into his head. He remembered the tale of the man, caught in a blizzard, who killed a steer and crawled inside the carcass, and so was saved. He would kill the dog and bury his hands in the warm body until the numbness went out of them. Then he could build another fire. He spoke to the dog, calling it to him; but in his voice was a strange note of fear that frightened the animal, who had never known the man to speak in such a way before. Something was the matter, and its suspicious nature sensed danger. It knew not what danger but somewhere,

somehow, in its brain arose an apprehension of the man. It flattened its ears down at the sound of the man's voice, and its restless, hunching movements and the liftings and shiftings of its forefeet became more pronounced, but it would not come to the man. He got on his hands and knees and crawled toward the dog. This unusual posture again excited suspicion, and the animal sidled mincingly away.

The man sat up in the snow for a moment and struggled for calmness. Then he pulled on his mittens, by means of his teeth, and got upon his feet. He glanced down at first in order to assure himself that he was really standing up, for the absence of sensation in his feet left him unrelated to the earth. His erect position in itself started to drive the webs of suspicion from the dog's mind; and when he spoke peremptorily, with the sound of whip-lashes in his voice, the dog rendered its customary allegiance and came to him. As it came within reaching distance, the man lost his control. His arms flashed out to the dog, and he experienced genuine surprise when he discovered that his hands could not clutch, that there was neither bend nor feeling in the fingers. He had forgotten for the moment that they were frozen and that they were freezing more and more. All this happened quickly, and before the animal could get away, he encircled its body with his arms. He sat down in the snow, and in this fashion held the dog, while it snarled and whined and struggled.

But it was all he could do, hold its body encircled in his arms and sit there. He realized that he could not kill the dog. There was no way to do it. With his helpless hands he could neither draw nor hold his sheath-knife nor throttle the animal. He released it, and it plunged wildly away, with tail between its legs, and still snarling. It halted forty feet away and surveyed him curiously, with ears sharply pricked forward. The man looked down at his hands in order to locate them, and found them hanging on the ends of his arms. It struck him as curious that one should have to use his eyes in order to find out where his hands were. He began thrashing his arms back and forth, beating the mittened hands against his sides. He did this for five minutes, violently, and his heart pumped enough blood up to the surface to put a stop to his shivering. But no sensation was aroused in the hands. He had an impression that they hung like weights on the ends of his arms, but when he tried to run the impression down, he could not find it.

A certain fear of death, dull and oppressive, came to him. This fear quickly became poignant as he realized that it was no longer a mere matter of freezing his fingers and toes, or of losing his hands and feet, but that it was a matter of life and death with the chances against him. This threw him into a panic, and he turned and ran up the creek-bed along the old, dim trail. The dog joined in behind and kept up with him. He ran blindly, without intention, in fear such as he had never known in his life. Slowly, as he plowed and floundered through the snow, he began to see things again—the banks of the creek, the old timber-jams, the leafless aspens, and the sky. The running made him feel better. He did not shiver. Maybe, if he ran on, his feet would thaw out; and, anyway, if he ran far enough, he would reach camp and the boys. Without doubt, he would lose some fingers and toes and some of his face; but the boys would take care of him, and save the rest of him when he got there. And at the same time, there was another thought in his mind that said he would never get to the camp and the boys; that it was too many miles away, that the freezing had too great a start on him, and that he would soon be stiff and dead. This thought he kept in the background and refused to consider. Sometimes it pushed itself forward and demanded to be heard, but he thrust it back and strove to think of other things.

It struck him as curious that he could run at all on feet so frozen that he could not feel them when they struck the earth and took the weight of his body. He seemed to himself to skim along above the surface and to have no connection with the earth. Somewhere he had once seen a winged Mercury, and he wondered if Mercury felt as he felt when skimming over the earth.

His theory of running until he reached camp and the boys had one flaw in it: he lacked the endurance. Several times he stumbled, and finally he tottered, crumpled up, and fell. When he tried to rise, he failed. He must sit and rest, he decided, and next time he would merely walk and keep on going. As he sat and regained his breath, he noted that he was feeling quite warm and comfortable. He was not shivering, and it even seemed that a warm glow had come to his chest and trunk. And yet, when he touched his nose or cheeks, there was no sensation. Running would not thaw them out. Nor would it thaw out his hands and feet. Then the thought came to him that the frozen portions of his body must be extending. He tried to keep this thought down, to forget it, to think of something else; he was aware of the panicky feeling that it caused, and he was afraid of the panic. But the thought asserted itself, and persisted, until it produced a vision of his body totally frozen. This was too much, and he made another wild run along the trail. Once he slowed down to a walk, but the thought of the freezing extending itself made him run again.

### **He was losing in his battle with the frost.**

And all the time the dog ran with him, at his heels. When he fell down a second time, it curled its tail over its forefeet and sat in front of him facing him curiously eager and intent. The warmth and security of the animal angered him, and he cursed it till it flattened down its ears appeasingly. This time the shivering came more quickly upon the man. He was losing in his battle with the frost. It was creeping into his body from all sides. The thought of it drove him on, but he ran no more than a hundred feet, when he staggered and pitched headlong. It was his last panic. When he had recovered his breath and control, he sat up and entertained in his mind the conception of meeting death with dignity. However, the conception did not come to him in such terms. His idea of it was that he had been making a fool of himself, running around like a chicken with its head cut off—such was the simile that occurred to him. Well, he was bound to freeze anyway, and he might as well take it decently. With this new-found peace of mind came the first glimmerings of drowsiness. A good idea, he thought, to sleep off to death. It was like taking an anæsthetic. Freezing was not so bad as people thought. There were lots worse ways to die.

He pictured the boys finding his body the next day. Suddenly he found himself with them, coming along the trail and looking for himself. And, still with them, he came around a turn in the trail and found himself lying in the snow. He did not belong with himself any more, for even then he was out of himself, standing with the boys and looking at himself in the snow. It certainly was cold, was his thought. When he got back to the States he could tell the folks what real cold was. He drifted on from this to a vision of the old-timer on Sulphur Creek. He could see him quite clearly, warm and comfortable, and smoking a pipe.

"You were right, old hoss; you were right," the man mumbled to the old-timer of Sulphur Creek.

Then the man drowsed off into what seemed to him the most comfortable and satisfying sleep he had ever known. The dog sat facing him and waiting. The brief day drew to a close in a long, slow twilight. There were no signs of a fire to be made, and, besides, never in the dog's experience had it known a man to sit like that in the snow and make no fire. As the twilight drew on, its eager

yearning for the fire mastered it, and with a great lifting and shifting of forefeet, it whined softly, then flattened its ears down in anticipation of being chidden by the man. But the man remained silent. Later, the dog whined loudly. And still later it crept close to the man and caught the scent of death. This made the animal bristle and back away. A little longer it delayed, howling under the stars that leaped and danced and shone brightly in the cold sky. Then it turned and trotted up the trail in the direction of the camp it knew, where were the other food-providers and fire-providers.

## Quiz

- 1 How does the setting of the story affect the development of the theme?
- (A) The quiet surroundings reveal a theme of quiet contemplation about life.
  - (B) The cold environment contrasts with the theme of love for one's companions.
  - (C) The desolate surroundings emphasize the theme of man against nature.
  - (D) The snowy environment suggests a theme of rebirth from the bleakness of winter.
- 2 Which statement would be MOST important to include in an objective summary of the story?
- (A) The man's dog sits far enough from the fire to avoid being singed.
  - (B) The man carries only a biscuit filled with bacon that he will eat for lunch.
  - (C) The man dreams of seeing the boys after he finishes his journey.
  - (D) Snow falling from the tree above him extinguishes the man's fire.
- 3 The dog mostly stays behind the man throughout the story.  
What does this MOST LIKELY reveal about him?
- (A) He is worried the man will attempt to kill him.
  - (B) He is reliant on the man for safety and warmth.
  - (C) He hopes the man will drop food along the way.
  - (D) He understands the man is in danger of freezing.
- 4 Which answer choice BEST explains how the man falling through the ice affects the development of the plot?
- (A) It introduces a life or death situation he must try to overcome.
  - (B) It emphasizes that the man should listen to the advice of the old-timer.
  - (C) It shows that the dog was right to avoid walking on the ice.
  - (D) It suggests that the man's matches will be too wet to start a fire.

## 2 degrees, flies planes, author, works at NASA. His age? 17

By Collin Binkley, Associated Press on 11.11.15

Word Count **721**

Level **MAX**



This August 2015 photo provided by Shu Chien shows her son, Moshe Kai Cavalin, at their home in San Gabriel, California. Shu Chien via AP

**BOSTON** — Moshe Kai Cavalin has two college degrees, but he's too young to vote. He flies airplanes, but he's too young to drive a car alone.

Life is filled with contrasts for Cavalin, a 17-year-old from San Gabriel, California, who has dashed by major milestones as his age seems to lag behind. He graduated from community college at age 11. Four years later, he had a bachelor's degree in math from the University of California, Los Angeles.

This year, he started online classes to get a master's degree in cybersecurity through the Boston area's Brandeis University. He decided to postpone that pursuit for a couple of terms, though, while he helps NASA develop surveillance technology for airplanes and drones.

Between all that, he has racked up an exhausting list of extracurricular feats. He just published his second book, drawing on his experience being bullied and stories he's heard from others. He plans

to have his airplane pilot's license by the year's end. At his family's home near Los Angeles, he has a trove of trophies from martial arts tournaments.

Still, Cavalin insists that he's more ordinary than people think. He credits his parents for years of focused instruction balanced by the freedom to pick his after-school activities. His eclectic interests stem from his cultural heritage, he said, with a mother from Taiwan and a father from Brazil.

"My case isn't that special. It's just a combination of parenting and motivation and inspiration," he says after a recent shift at NASA's Armstrong Flight Research Center in Edwards, California. "I tend to not compare myself that often to other people. I just try to do the best I can."

His parents say he was always a quick study. At 4 months, he pointed to a jet in the sky and said the Chinese word for airplane, his first word. Cavalin hit the limits of his home schooling after studying trigonometry at age 7. Then his mom started driving him to community college.

"I think most people just think he's a genius. They believe it just comes naturally," said Daniel Judge, a professor of mathematics who taught Cavalin for two years at East Los Angeles College. "He actually worked harder than, I think, any other student I've ever had."

But his rapid rise hasn't been without twists. Early in college, he dreamed of being an astrophysicist. When he started taking advanced physics classes, though, his interest waned. His fascination in cryptography led him toward computer science.

That has been a better fit, Cavalin said. He was surprised when NASA called to offer work after rejecting him in the past because of his age. Ricardo Arteaga, his boss and mentor at NASA, says Cavalin was perfect for a project that combines math, computers and aircraft technology.

"I needed an intern who knew software and knew mathematical algorithms," Arteaga says. "And I also needed a pilot who could fly it on a Cessna."

In the office, Cavalin is a quiet worker with a subtle sense of humor, Arteaga says. They laugh about the stuff scientists laugh about. His daily work at NASA has included running simulations of airplanes and drones that are headed for collision, and then finding ways to route them to safety.

"He's really sharp in mathematics," Arteaga says. "What we're trying to bring out more is his intuitive skills."

In conversation, Cavalin speaks with the even cadence and diction of someone who chooses his words with care. He's unflappable, at least until he discusses his distaste for being called a certain word: "One word I don't take too kindly is genius," he said. "Genius is just kind of taking it too far."

After he finishes his master's from Brandeis, Cavalin hopes to get a master's in business at the Massachusetts Institute of Technology. Later, he wants to start his own cybersecurity company.

For now, though, he's counting down the days until his 18th birthday, when he'll be able to get a full driver's license under California law. Living away from home to work at NASA, he relies on his landlord for rides to the grocery store, or he takes a taxi. His older colleagues drive him to work every day.

As for the other teenage stuff, Cavalin says he'll wait until he gets his doctorate to find a girlfriend. He's only half-joking.

## Quiz

- 1 According to the article, each of the following was important for Moshe's success EXCEPT:
- (A) parental support
  - (B) trying new things
  - (C) being highly motivated
  - (D) staying focused on one field
- 2 Fill in the blank in the sentence below.  
The author of the article portrays Moshe as .....
- (A) smart yet unfocused.
  - (B) brilliant yet humble.
  - (C) young and energetic.
  - (D) bold and overconfident.
- 3 Fill in the blank in the sentence below.  
By including the final two paragraphs of the article, the author .....
- (A) analyzes Moshe's professional accomplishments.
  - (B) implies that Moshe did not enjoy living with his parents.
  - (C) investigates how Moshe's work has affected his love life.
  - (D) distinguishes between Moshe's professional and personal life.
- 4 How do the first two paragraphs engage readers in the article?
- (A) by explaining why Moshe is so unusual
  - (B) by explaining when Moshe graduated from college
  - (C) by explaining when Moshe will be old enough to vote
  - (D) by explaining why Moshe is so good at math

# Japanese-American leagues help girls get the jump on prep basketball

By Samantha Masunaga, Los Angeles Times on 11.24.15

Word Count 1,122

Level MAX



Mark Keppel High School's Lauren Saiki drives to the basket during a game against Redondo Union in Long Beach, California, March 21, 2015. Cheryl A. Guerrero/Los Angeles Times/TNS

LOS ANGELES — Standing just 5-foot-3, Lauren Saiki was sometimes the smallest player on the basketball court. But her signature thread-the-needle passes and heady ball-handling propelled the point guard and her teams from Alhambra's Mark Keppel High School to four consecutive playoff appearances, capped by last season's run to the Division II state championship game, a first for the school.

Saiki, 18, has earned a basketball scholarship to West Virginia.

For all this, she can credit the fundamentals she learned while playing for more than a decade in a Japanese-American basketball league.

"That helped build my foundation," Saiki said. "... I really fell in love with basketball."

Also known as Asian leagues or JA leagues, these organizations — which take up many weekend hours for participants — have been the starting point for many successful high school and now

even college careers, particularly for young women.

Keppel is a consistent contender, even though the average height of its players is usually 5-foot-4 or -5. All but one of the girls on Keppel's team last season played in a Japanese-American basketball league. Three of Saiki's teammates have known her since they were 5, growing up on the same team, Tigers Elite.

Rough estimates put the total of youth and adult players in such leagues in California in the several thousands. There are other Japanese-American leagues — bowling, baseball, volleyball — but none are as popular as basketball.

Teams come from a variety of organizations — service clubs, Buddhist temples, community centers — and have so many young participants that a few Japanese-American churches in Los Angeles chose to cancel Sunday school.

Southern California's Japanese-American community is smaller than its Chinese, Vietnamese or Korean counterparts. Although cities such as Gardena and Torrance have more Japanese-American residents than most, there is no sprawling hub for Japanese-Americans similar to the huge swath of the San Gabriel Valley populated by Chinese-Americans, or Westminster and Garden Grove for Vietnamese-Americans.

“Right now, it seems like basketball is the only thing that holds the community together, like the third and fourth generations,” said George Imamura, past president of the South Bay F.O.R. Junior Sports Association, the largest Japanese-American basketball organization in Southern California. “That's why I think it's so important that if that's all we have right now, to keep it going.”

The legacy of these teams motivates families like the Sugiyamas to make the 30-mile drive from their home in Torrance to Alhambra for basketball. On a Sunday morning earlier this spring, Claire Sugiyama was in the Alhambra High gym bleachers with about a dozen parents and grandparents to watch her daughter Sarah play with the Tigerettes Pulelehua sixth-grade team.

Sarah comes from a long line of Tigers: Her grandfather was a founder of the Tigers Youth Club, and her father, who coaches the team, also played basketball with the organization.

“He just felt she needed to play with Tigers,” Claire Sugiyama said. “She was born with stripes.”

The Japanese American Optimist (JAO) Club girls' league began about 50 years ago to give children of Japanese-American descent the opportunity to play basketball at a time when they were not allowed to play elsewhere, said Leland Lau, league commissioner. When he became commissioner about 20 years ago, there were about 50 girls' teams. Today, there are nearly 130.

“It's a factory of point guards,” he said.

The leagues' success in getting girls onto high school teams has even attracted non-Asian players, Lau said. The high intermarriage rate in the Japanese-American community is also a factor in the leagues' increasing diversity.

Competition can be fierce, said Kiki Yang, 18, a four-year starter at Pasadena Poly High and three-time winner of the Prep League's most-valuable-player award.

Yang, who will play at Claremont McKenna College next season, learned to play basketball with the Pasadena Bruins when she was in second grade.

“It gave me more confidence,” she said. “It exposes you to the sport and allows you to make friends from different schools.”

The strength of these friendships convinced Kylie Fujioka to transfer to Keppel for her senior year. “There were a lot of closer schools, but the entire varsity team, I’ve known them since elementary school through Asian league,” said Fujioka, who will play for California State University, Monterey Bay in the fall. “Even though I had never played with them before, I had spent my entire life playing against them.”

Kayla Sato, 17, credits the skills she learned on her F.O.R. basketball team with helping her make varsity at West Torrance High School.

“This community is like a family,” said Sato, who will play next year at Westmont College in Santa Barbara, Calif. “Through one connection, there were so many doors.”

Sato’s West Torrance team won a California Interscholastic Federation Southern Section title this year, as did North and South Torrance highs, all of which have rosters filled with JAO players. Early training in the leagues often teaches players to be quick and nimble ball-handlers and accurate outside shooters.

Saiki’s Keppel teammate, Kelli Kamida, set a Southern Section record last season with 16 three-pointers in one game.

Girls who want more competition often will join club teams to improve their skills before high school. Although basketball is a sport that places a premium on height, the lack of it has not been an impediment for Japanese-American girls, Lau said.

Many of the JAO league’s best-known alumni are shorter point guards such as Jamie Hagiya, a former USC point guard who is 5-foot-3, or Natalie Nakase, who played for UCLA and stands just under 5-foot-2. Nakase became the first female head coach in Japan’s top professional men’s basketball league, and now serves as the Clippers’ assistant video coordinator.

Confidence is key, said Monica Hang, an alum of the leagues who played in college and is now coach of the Los Angeles Valley College women’s basketball team.

“Being 5-foot-2 in JAO doesn’t mean you’re a guard,” she said. “Sometimes you have to play the forward or center position so it makes you into a complete basketball player. It taught me how to be 5-foot-2 and play as if I was 6-foot-2.”

That confidence will be important for Saiki as she heads to West Virginia.

“I’m nervous because it’s big-time basketball, but I’m pretty excited because it’s a great experience,” she said. “I’m going to meet a lot of different people and have different experiences than what I’ve had growing up on the West Coast.”

But before she moves 2,500 miles away, she’ll have to graduate and say goodbye to her teammates.

“It’s going to be a bittersweet moment, of course,” Saiki said. “Growing up with them ... it’s going to be a lot different. I’ll probably stay in touch with them a lot.”

## Quiz

- 1 Read the first four paragraphs of the article. How does Saiki's experience help develop a key idea of the article?
- (A) Her experience in the Japanese-American league provides an example of how sports in general can influence kids' lives.
  - (B) Her experience in the Japanese-American league shows how the sport builds camaraderie within the Japanese-American community.
  - (C) Her experience in the Japanese-American league illustrates how being involved with the league can contribute to later achievements in basketball.
  - (D) Her experience in the Japanese-American league demonstrates how participation in the sport leads to bonding among different groups of people.
- 2 Which sentence best summarizes the significance of the basketball league in the Japanese-American community?
- (A) The league, originally a response to segregation, is now primarily responsible for creating professional opportunities for Japanese-American athletes.
  - (B) The league, originally a response to segregation, has become a source of bonding, tradition and opportunity for Japanese-Americans.
  - (C) The Japanese-American basketball league currently provides Japanese-Americans with the best opportunity to then advance in other leagues.
  - (D) The Japanese-American basketball league continues to evolve to meet the unique needs of the current generation of young athletes.
- 3 The article is PRIMARILY organized around:
- (A) the ways that the Japanese-American league has shaped perceptions of Japanese-Americans
  - (B) a series of historical vignettes about the evolution of the Japanese-American league
  - (C) the various personal experiences of people who are involved with the Japanese-American league
  - (D) an analysis of similarities and differences between the Japanese-American league and the broader American context
- 4 Read the final four paragraphs of the article. Which statement BEST evaluates the conclusion of the article with relevant justification?
- (A) The conclusion is engaging because it connects back to the beginning of the article and evokes Saiki's future.
  - (B) The conclusion is anti-climatic because it ends on a note of sadness rather than emphasizing the more positive aspects of basketball.
  - (C) The conclusion is satisfying because it resolves all the major questions about Saiki's future in basketball.
  - (D) The conclusion is distracting because it reveals that Saiki is leaving her home community and moving 2,500 miles away.

## Fishing lures a hit for small-town teen entrepreneurs

By Michael Pearce, The Wichita Eagle on 07.31.17

Word Count **1,026**

Level **MAX**



Five styles of plastic lures (left) and two kinds of jigs (right) are currently sold by Gabe Backhus and his teen-owned Double B Baits, in Herington, Kansas. The company also sells t-shirts, hats and hoodies. Photo: Michael Pearce/Wichita Eagle/TNS

HERINGTON, Kansas — Three 16-year-olds from this Kansas town just beat about 90 percent of the competition at a national high school business class convention in California.

The business model they designed for their fishing-lure company was up against those of many older students, some from private schools in major U.S. cities, at the Future Business Leaders of America conference in Anaheim, California.

Now, the teens are back in Kansas with the goal of growing the company by improving the product, packaging, promotions and sales in retail stores and online.

Even beyond the next school year, Gabe Backhus, McKenzie Shippy and Emilie Roe are talking about ways this business experience will help them through college and into adult careers.

The business, Double B Baits, is living up to its company slogan of "Kickin' Bass & Takin' Names," according to the teacher who is helping them.

"This is really very impressive, what they're accomplishing," said Lisa Beye, a business teacher at Herington High School. "These kids are gaining so much great experience from this project."

Backhus began fishing with his dad when he was 2. By the time he was 10 he was entering youth bass tournaments around central Kansas. It wasn't long until he started thinking about making his own fishing lures.

"I just wanted to be fishing something better than what everybody else had," said Backhus, a tall, lanky kid who loses his shyness when the talk turns to bass fishing and bass lures. "My mom gave me a lure-making kit for Christmas one year and I started making plastics. Things just grew from there."

Rather than copying what was already being made, Backhus looked for ways to make his lures more attractive to fish.

His plastic lures, which include imitation crawdads and wormlike senkos, look and smell like something a bass would want to eat.

"I'd heard when a bass bites, that tasting some scent will get them to hold onto it longer," Backhus said, "so I found some scents online and mix it into the baits. I also soak the baits in scent before I put them into a package."

In a workshop at his rural Herington home, Backhus has continued to experiment. He tests his creations at a 26-acre lake that's literally in his backyard.

The desire to sell some of his creations was a natural progression of his ideas, Backhus said. He knew who to turn to for help.

Last school year he enrolled in Project Management, a business class taught by Beye. Backhus and Beye sought other students who could add talents to a company they named Double B Baits.

Shippy signed on as marketing manager; Roe joined the team to help with accounting.

"I've just given them suggestions and ideas," Beye said. "They've been the ones who've taken ideas and really run with them. They've worked hard."

Beye said the project got a boost when Chris Barnes, owner of a local grocery store, offered advice on pricing and marketing.

"The timing was really great, because he was wanting to start selling some fishing equipment, since no place in town was at that time," said Beye. "He was one of the first businesses to stock the Double B Baits." Tammie Roe, Emilie's mother and an accountant, lent her expertise to the business plan used to pilot the business.

One of the company's biggest home runs came with the idea of marketing T-shirts and hoodies with the business logo and "Kickin' Bass & Takin' Names" slogan.

"I told them they have to get that one approved by the principal. I wasn't going to do it," Beye said. "They did, and I think every kid in school has at least a shirt. It was amazing to see how many kids stood in line to buy those things. This summer they started selling hats with just the logo, but it seems like I'm seeing them all over town."

Much of the school year the students worked to improve the business plan they used to place third in the Kansas Future Business Leaders of America competition. In California, they made it to the round of 14 finalists out of 112 schools. They weren't called for the final 10.

Now students and teacher are working to increase demand for the lure line, which includes swim and football jigs, and plastic senkos, craws, finesse worms, mud bugs and flukes. Backhus has some improvements in mind, and hopes more anglers take advantage of the custom-made side of the business.

"If they have a particular color they like and can't find, I'd be glad to work with them and produce what they're looking for," said Backhus. "I'm pretty sure we can make about anything."

Lures average about \$6 a package, and all profit goes to Backhus. Shippy and Roe will be rewarded with scholarship money when they graduate in two years.

Shippy said she's fine with that arrangement and feels she is getting paid for her efforts in other ways.

"Getting to talk to so many people in so many places has really made me branch out. Just the whole experience of going to California and presenting our business plan to so many people was really good for me," Shippy said. "I know everything I'm learning is going to help me in the future."

She said that could include applying to colleges and for scholarships and a possible career in sports marketing.

Backhus hopes to keep the company going, and growing, through his college career. His current ambition is to head to Kansas State, become a member of the school's national championship bass fishing team and major in fish or wildlife management.

Beye has confidence he'll succeed.

"Even a year ago I don't think he could have done what he did at the national competition, to get up and talk with people like that," she said. "Of course there's a lot he doesn't know, but if he stays with this there will probably be opportunity after opportunity. [In California] we had so many people come up and talk to the kids, and encourage them. I think there are plenty of people who will support young entrepreneurs out there."

## Quiz

1 Read the paragraphs from the article.

*Beye said the project got a boost when Chris Barnes, owner of a local grocery store, offered advice on pricing and marketing.*

*"The timing was really great, because he was wanting to start selling some fishing equipment, since no place in town was at that time," said Beye. "He was one of the first businesses to stock the Double B Baits." Tammie Roe, Emilie's mother and an accountant, lent her expertise to the business plan used to pilot the business.*

What conclusion can be drawn from these paragraphs?

- (A) Beye worked hard to seek out adults in the community who would work with the young business.
- (B) It is unlikely the business would have made it if Barnes had been unwilling to help with pricing.
- (C) The business became successful because Barnes and Roe began running it themselves for the kids.
- (D) Gabe Backhus' business was able to grow thanks to a combination of luck and experienced support.

2 Which statement would Lisa Beye MOST LIKELY agree with? Which selection from the article BEST supports your answer?

1. *The students deserve all the credit for working to make Double B Baits a success.*
2. *Double B Baits will definitely continue to be successful after the students graduate.*

- (A) option 1; "This is really very impressive, what they're accomplishing," said Lisa Beye, a business teacher at Herington High School.
- (B) option 1; "I've just given them suggestions and ideas," Beye said. "They've been the ones who've taken ideas and really run with them. They've worked hard."
- (C) option 2; "It was amazing to see how many kids stood in line to buy those things. This summer they started selling hats with just the logo, but it seems like I'm seeing them all over town."
- (D) option 2; "Of course there's a lot he doesn't know, but if he stays with this there will probably be opportunity after opportunity."

3 HOW did Backhus' lure business grow over time?

- (A) At first, Backhus was not successful at selling his lures to many fishermen. Then, he took a class at school and learned to make better lures. Finally, his teacher and friends helped him join Future Business Leaders of America.
- (B) At first, Backhus sold lures made by himself and his father online. Then, he got the idea to begin selling lures and shirts to his classmates. Finally, a teacher offered to introduce him to other students who were interested in lures.
- (C) At first, Backhus was making lures out of plastic from a kit his mother gave him. Then, he got the idea to add color and scent to attract bass. Finally, other fishermen saw that he was successful in bass-fishing tournaments.
- (D) At first, Backhus simply wanted to make better baits for himself. Then, he enrolled in a business class at school and found help. Finally, hard work led to more sales and a place in the Future Business Leaders of America competition.

4 Which of the following ideas did the author develop LEAST in the article about the teen entrepreneurs?

- (A) how well they performed at a national competition
- (B) how well they work together and communicate
- (C) how they believe the business will help their futures
- (D) how they plan to improve and increase demand

## A Pair of Silk Stockings

By Kate Chopin on 02.05.20

Word Count **1,975**

Level **MAX**



"It was a long time since Mrs. Sommers had been fitted with gloves." Photo: Chicago History Museum/Getty Images

*Editor's Note: American writer Kate Chopin wrote the short story "A Pair of Silk Stockings" in April 1896. The story was published in 1897. Chopin is known for writing stories about women who lived in the late 19th century and their roles in society. This story takes place over a single day. A young mother wanders through town with some unexpected extra money in hand. She spends the extra funds on herself, rather than on her family as she had originally planned.*

Little Mrs. Sommers one day found herself the unexpected possessor of \$15. It seemed to her a very large amount of money, and the way in which it stuffed and bulged her worn old portemonnaie gave her a feeling of importance such as she had not enjoyed for years.

The question of investment was one that occupied her greatly. For a day or two she walked about apparently in a dreamy state, but really absorbed in speculation and calculation. She did not wish to act hastily, to do anything she might afterward regret. But it was during the still hours of the night when she lay awake revolving plans in her mind that she seemed to see her way clearly toward a proper and judicious use of the money.

A dollar or two should be added to the price usually paid for Janie's shoes, which would insure their lasting an appreciable time longer than they usually did. She would buy so and so many yards of percale for new shirt waists for the boys and Janie and Mag. She had intended to make the old ones do by skillful patching. Mag should have another gown. She had seen some beautiful patterns, veritable bargains in the shop windows. And still there would be left enough for new stockings—two pairs apiece—and what darning that would save for a while! She would get caps for the boys and sailor-hats for the girls. The vision of her little brood looking fresh and dainty and new for once in their lives excited her and made her restless and wakeful with anticipation.

The neighbors sometimes talked of certain "better days" that little Mrs. Sommers had known before she had ever thought of being Mrs. Sommers. She herself indulged in no such morbid retrospection. She had no time — no second of time to devote to the past. The needs of the present absorbed her every faculty. A vision of the future like some dim, gaunt monster sometimes appalled her, but luckily tomorrow never comes.

Mrs. Sommers was one who knew the value of bargains; who could stand for hours making her way inch by inch toward the desired object that was selling below cost. She could elbow her way if need be; she had learned to clutch a piece of goods and hold it and stick to it with persistence and determination till her turn came to be served, no matter when it came.

But that day she was a little faint and tired. She had swallowed a light luncheon — no! when she came to think of it, between getting the children fed and the place righted, and preparing herself for the shopping bout, she had actually forgotten to eat any luncheon at all!

She sat herself upon a revolving stool before a counter that was comparatively deserted, trying to gather strength and courage to charge through an eager multitude that was besieging breastworks of shirting and figured lawn. An all-gone limp feeling had come over her and she rested her hand aimlessly upon the counter. She wore no gloves. By degrees she grew aware that her hand had encountered something very soothing, very pleasant to touch. She looked down to see that her hand lay upon a pile of silk stockings. A placard near by announced that they had been reduced in price from \$2.50 to \$1.98; and a young girl who stood behind the counter asked her if she wished to examine their line of silk hosiery. She smiled, just as if she had been asked to inspect a tiara of diamonds with the ultimate view of purchasing it. But she went on feeling the soft, sheeny luxurious things — with both hands now, holding them up to see them glisten, and to feel them glide serpent-like through her fingers.

Two hectic blotches came suddenly into her pale cheeks. She looked up at the girl.

"Do you think there are any eights-and-a-half among these?"

There were any number of eights-and-a-half. In fact, there were more of that size than any other. Here was a light-blue pair; there were some lavender; some all black; and various shades of tan and gray. Mrs. Sommers selected a black pair and looked at them very long and closely. She pretended to be examining their texture, which the clerk assured her was excellent.

"A dollar and ninety-eight cents," she mused aloud. "Well, I'll take this pair." She handed the girl a \$5 bill and waited for her change and for her parcel. What a very small parcel it was! It seemed lost in the depths of her shabby old shopping-bag.

Mrs. Sommers after that did not move in the direction of the bargain counter. She took the elevator, which carried her to an upper floor into the region of the ladies' waiting-rooms. Here, in a retired corner, she exchanged her cotton stockings for the new silk ones which she had just bought. She was not going through any acute mental process or reasoning with herself, nor was she striving to explain to her satisfaction the motive of her action. She was not thinking at all. She seemed for the time to be taking a rest from that laborious and fatiguing function and to have abandoned herself to some mechanical impulse that directed her actions and freed her of responsibility.

How good was the touch of the raw silk to her flesh! She felt like lying back in the cushioned chair and reveling for a while in the luxury of it. She did for a little while. Then she replaced her shoes, rolled the cotton stockings together and thrust them into her bag. After doing this she crossed straight over to the shoe department and took her seat to be fitted.

She was fastidious. The clerk could not make her out; he could not reconcile her shoes with her stockings, and she was not too easily pleased. She held back her skirts and turned her feet one way and her head another way as she glanced down at the polished, pointed-tipped boots. Her foot and ankle looked very pretty. She could not realize that they belonged to her and were a part of herself. She wanted an excellent and stylish fit, she told the young fellow who served her, and she did not mind the difference of a dollar or two more in the price so long as she got what she desired.

It was a long time since Mrs. Sommers had been fitted with gloves. On rare occasions when she had bought a pair they were always "bargains," so cheap that it would have been preposterous and unreasonable to have expected them to be fitted to the hand.

Now she rested her elbow on the cushion of the glove counter, and a pretty, pleasant young creature, delicate and deft of touch, drew a long-wristed "kid" over Mrs. Sommers's hand. She smoothed it down over the wrist and buttoned it neatly, and both lost themselves for a second or two in admiring contemplation of the little symmetrical gloved hand. But there were other places where money might be spent.

There were books and magazines piled up in the window of a stall a few paces down the street. Mrs. Sommers bought two high-priced magazines such as she had been accustomed to read in the days when she had been accustomed to other pleasant things. She carried them without wrapping. As well as she could she lifted her skirts at the crossings. Her stockings and boots and well fitting gloves had worked marvels in her bearing — had given her a feeling of assurance, a sense of belonging to the well-dressed multitude.

She was very hungry. Another time she would have stilled the cravings for food until reaching her own home, where she would have brewed herself a cup of tea and taken a snack of anything that was available. But the impulse that was guiding her would not suffer her to entertain any such thought. There was a restaurant at the corner. She had never entered its doors; from the outside she had sometimes caught glimpses of spotless damask and shining crystal, and soft-stepping waiters serving people of fashion.

When she entered her appearance created no surprise, no consternation, as she had half feared it might. She seated herself at a small table alone, and an attentive waiter at once approached to take her order. She did not want a profusion; she craved a nice and tasty bite — a half dozen blue-

points, a plump chop with cress, a something sweet — a creme-frappee, for instance; a glass of Rhine wine, and after all a small cup of black coffee.

While waiting to be served she removed her gloves very leisurely and laid them beside her. Then she picked up a magazine and glanced through it, cutting the pages with a blunt edge of her knife. It was all very agreeable. The damask was even more spotless than it had seemed through the window, and the crystal more sparkling. There were quiet ladies and gentlemen, who did not notice her, lunching at the small tables like her own. A soft, pleasing strain of music could be heard, and a gentle breeze, was blowing through the window. She tasted a bite, and she read a word or two, and she sipped the amber wine and wiggled her toes in the silk stockings. The price of it made no difference. She counted the money out to the waiter and left an extra coin on his tray, whereupon he bowed before her as before a princess of royal blood.

There was still money in her purse, and her next temptation presented itself in the shape of a matinee poster.

It was a little later when she entered the theatre, the play had begun and the house seemed to her to be packed. But there were vacant seats here and there, and into one of them she was ushered, between brilliantly dressed women who had gone there to kill time and eat candy and display their gaudy attire. There were many others who were there solely for the play and acting. It is safe to say there was no one present who bore quite the attitude which Mrs. Sommers did to her surroundings. She gathered in the whole — stage and players and people in one wide impression, and absorbed it and enjoyed it. She laughed at the comedy and wept — she and the gaudy woman next to her wept over the tragedy. And they talked a little together over it. And the gaudy woman wiped her eyes and sniffled on a tiny square of filmy, perfumed lace and passed little Mrs. Sommers her box of candy.

The play was over, the music ceased, the crowd filed out. It was like a dream ended. People scattered in all directions. Mrs. Sommers went to the corner and waited for the cable car.

A man with keen eyes, who sat opposite to her, seemed to like the study of her small, pale face. It puzzled him to decipher what he saw there. In truth, he saw nothing — unless he were wizard enough to detect a poignant wish, a powerful longing that the cable car would never stop anywhere, but go on and on with her forever.

## Quiz

- 1 Which decision leads to a shift in the development of the plot?
- (A) Mrs. Sommers changes into the silk stockings she purchased.
  - (B) Mrs. Sommers enters a theater to watch a matinee performance.
  - (C) Mrs. Sommers sits at a counter and notices a pile of silk stockings.
  - (D) Mrs. Sommers eats lunch by herself in a fancy restaurant.

- 2 How are Mrs. Sommers's motivations developed over the course of the story?
- (A) She transitions from being frugal to savoring a life of extravagant spending.
  - (B) She becomes ashamed of the money she spent on items she did not need.
  - (C) She starts to worry the people around her are unimpressed with her appearance.
  - (D) She begins to worry that the money she came into will be gone before she knows it.

- 3 Read the following sentence from the story.

*She smoothed it down over the wrist and buttoned it neatly, and both lost themselves for a second or two in admiring contemplation of the little symmetrical gloved hand.*

What is the BEST definition of the word “contemplation” as it is used above?

- (A) expectation
  - (B) reflection
  - (C) misgiving
  - (D) apprehension
- 4 Read the following words and phrases from the story.

*reveling for a while in the luxury of it*

*delicate and deft of touch*

*caught glimpses of spotless damask and shining crystal*

*eat candy and display their gaudy attire*

How do these words and phrases develop the tone of the story?

- (A) They establish an arrogant tone that is developed as Mrs. Sommers spends her money.
- (B) They create an envious tone as Mrs. Sommers compares herself to other women she encounters.
- (C) They build a luxurious tone that is developed as Mrs. Sommers experiences a lavish lifestyle.
- (D) They generate a nostalgic tone as Mrs. Sommers thinks back to a special day in her life.

# Can't keep your New Year's resolutions? Try being kind to yourself

By Kristin Neff, The Conversation on 01.01.20

Word Count **1,310**

Level **MAX**



Image 1. A student practices mindful breathing during the Mindful Studies class at Wilson High School in Portland, Oregon. Mindfulness is part of self-compassion, which can help to achieve goals and overcome failure. Photo: AP /Gosia Wozniacka/File.

Many of us will start out the New Year by making a list of resolutions – changes we want to make to be happier such as eating better, volunteering more often, being a more attentive spouse and so on. But, as we know, we will often fail. After a few failures we will typically give up and go back to our old habits.

Why is it so hard to stick to resolutions that require us to make effective or lasting changes?

I would argue the problem isn't that we try and we fail – the problem is how we treat ourselves when we fail. I study self-compassion, and my research and that of others show that how we relate to personal failure – with kindness or harsh self-judgment – is incredibly important for building resilience.

From early childhood, we are taught that we must succeed at all costs. What most of us aren't taught is how to fail successfully so we can change and grow.

One of the best ways to deal with failure is to have self-compassion.

### **What Exactly Is Self-Compassion?**

I define self-compassion as having three main components: self-kindness, common humanity and mindfulness. Self-kindness refers to the tendency to be caring, understanding and supportive toward ourselves when we fail or make mistakes rather than being harshly critical or judgmental.

Common humanity involves recognizing that all humans are imperfect, and connecting our own flawed condition to the shared human condition so we can have a greater perspective on our shortcomings.

Mindfulness involves being aware of the pain associated with failure in a clear and balanced manner so that we neither ignore nor obsess about our faults. The three together combine to create a self-compassionate frame of mind.



A large body of research shows that self-compassion results in greater emotional well-being. One of the most consistent findings in this research is that greater self-compassion is linked to less depression, anxiety and stress.

In addition to reducing such negative mind states, self-compassion appears to enhance positive mind states such as optimism, gratitude and curiosity. By meeting one's suffering with the warm embrace of self-compassion, positive feelings such as happiness are generated at the same time that negative emotions are alleviated.

Self-compassion has been found to be an important source of coping and resilience in the face of various life stressors such as divorce, chronic health conditions or military combat. It also reduces body dissatisfaction and even leads to healthier eating behavior (relevant to many New Year's resolutions!).

### **Misgivings About Self-Compassion**

If self-compassion is so good for us, why aren't we kinder to ourselves?

Perhaps the biggest block to self-compassion is the belief that it will undermine our motivation. In parenting circles, we no longer hold to the adage "spare the rod spoil the child." When it comes to our own selves, however, many of us think that sparing the rod of harsh self-criticism will turn us into lazy, self-indulgent ne'er-do-wells. This theme constantly comes up in the workshops I teach.

Of course, the dynamics that go into motivating our children and motivating ourselves are quite similar. Let's say your teenage son were to come home with a failing English grade. You have two ways to motivate him to try harder and do better next time.

You could admonish him and tell him how stupid he is and that you are ashamed of him. The other option is, knowing how upset he is, you could give him a hug and gently ask him how you could support him in doing better next time. This type of caring, encouraging response would help your son maintain his self-confidence and feel emotionally supported. The same goes for how we respond to ourselves when we fail.

## **How Does Self-Compassion Increase Motivation?**

A growing body of research indicates that self-compassion is linked to greater motivation. Self-compassion has been associated with increased personal initiative – the desire to reach one's full potential.

Self-compassionate people are also more likely to adopt "mastery goals," which focus on learning and mastering material to increase competence, and less likely to adopt "performance goals," which are primarily concerned with succeeding to make a favorable impression on others.

While self-compassionate people have performance standards that are as high as those who are harshly self-critical, they don't get as upset when they don't reach their goals. As a result, self-compassionate people have less performance anxiety and engage in fewer self-defeating behaviors such as procrastination.

Not only are self-compassionate people less likely to fear failure, but when they do fail they're more likely to pick themselves up and try again.

A series of experiments by psychologists Juliana Breines and Serena Chen from the University of California at Berkeley examined whether helping undergraduate students to be more self-compassionate would impact their motivation to change.

In one study, participants were asked to recall a recent action they felt guilty about – cheating on an exam, lying to a romantic partner, saying something harmful, etc. – something that still made them feel bad when they thought about it.

Next, they were randomly assigned to one of three conditions. In the self-compassion condition, participants were instructed to write to themselves for three minutes from the perspective of a compassionate and understanding friend.

The second condition had people write about all their positive qualities, and the third about a hobby they enjoyed. These two control conditions helped to differentiate self-compassion from positive self-talk and positive mood in general.

The researchers found that participants who were helped to be self-compassionate about their recent transgressions reported being more motivated to apologize for the harm done and more committed to not repeating the behavior than those in the control conditions.

### **Sustaining Motivation Through Kindness**

Another study in this same series of experiments explored whether self-compassion would directly translate into greater efforts to learn after failure. Students were given a difficult vocabulary test they all did poorly on.

One group of students was given an instruction to be self-compassionate about their failure. The instruction said: "If you had difficulty with the test you just took, you're not alone. It's common for students to have difficulty with tests like this. If you feel bad about how you did, try not to be too hard on yourself."

Another group was given a self-esteem boost, which said:

"If you had difficulty with the test you just took, try not to feel bad about yourself – you must be intelligent if you got into Berkeley!"

The third group of participants was given no additional instructions.

The students were next told that they would receive a second vocabulary test and were given a list of words and definitions they could study for as long as they wanted before taking it. Study time was used as a measure of improvement motivation.

The students who were told to be self-compassionate after failing the first test spent more time studying than those in the other two conditions. Study time was linked to how well participants actually performed on the test. These findings suggest that being kind to yourself when you fail or make mistakes gives you the emotional support needed to try your best, and to keep trying even when discouraged.

Kindness is the engine that drives us to keep trying even after we fall flat on our face. So this New Year, when you make and inevitably break your resolutions, instead of beating yourself up and then giving up, try being kind to yourself. In the long run, you'll be more likely to succeed.

*Kristin Neff is an associate professor of educational psychology at the University of Texas at Austin.*



## Quiz

- 1 Which idea did the author develop LEAST in this article about self-compassion?
- (A) the role of three main components in developing a compassionate mindset
  - (B) the relationship that exists between self-compassion and motivation
  - (C) the way compassion affects body dissatisfaction and eating behaviors
  - (D) the contrast between self-compassionate and self-critical individuals
- 2 Which answer choice accurately summarizes the results of different studies on self-compassion?
- (A) One study found that participants who practiced self-compassion after bad behavior were more likely to apologize or improve their behavior in the future. Another study found that those who practiced self-compassion after failing a difficult test were more likely to study hard, but no more likely to pass the next test.
  - (B) One study found that participants who were given a specific statement about self-compassion were more successful than those who were told to write to themselves as compassionate and understanding friend. Another study found that specific statements made no difference as long as self-compassion was emphasized.
  - (C) One study found that participants who wrote to themselves from the perspective of a compassionate friend were more motivated to apologize for bad behavior, while another found that those given instructions to be self-compassionate improved test scores. Both studies showed self-compassionate groups to be more likely to improve their behavior than control groups.
  - (D) One study found that participants who thought about a previous misdeed were more likely to write letters apologizing for their bad behavior, while another found that those given self-esteem boosting statements felt more self-compassion. Both studies showed self-compassionate groups to be more likely to improve their behavior than control groups.
- 3 The author uses a mostly calm and understanding tone throughout the article.
- In which selection does the author use a more disapproving tone to emphasize a point?
- (A) By meeting one's suffering with the warm embrace of self-compassion, positive feelings such as happiness are generated at the same time that negative emotions are alleviated.
  - (B) When it comes to our own selves, however, many of us think that sparing the rod of harsh self-criticism will turn us into lazy, self-indulgent ne'er-do-wells. This theme constantly comes up in the workshops I teach.
  - (C) This type of caring, encouraging response would help your son maintain his self-confidence and feel emotionally supported. The same goes for how we respond to ourselves when we fail.
  - (D) Another study in this same series of experiments explored whether self-compassion would directly translate into greater efforts to learn after failure.

*Self-compassionate people are also more likely to adopt "mastery goals," which focus on learning and mastering material to increase competence, and less likely to adopt "performance goals," which are primarily concerned with succeeding to make a favorable impression on others.*

How does this sentence contribute to the effectiveness of the author's argument overall?

- (A) It uses a statistic to demonstrate the danger of focusing on performance rather than mastery when taking tests.
- (B) It uses a specific study to establish the author's credibility on the relationship between self-compassion and mastery.
- (C) It uses a comparison to increase the reader's emotional motivation to adopt goals that will draw more compassion from others.
- (D) It uses a contrast to develop the logical conclusion that self-compassion increases personal initiative that leads to success.

# Happiness can be a prime predictor of whether we'll find success in life

By Mark Williamson, The Guardian, adapted by Newsela staff on 07.20.18

Word Count **1,193**

Level **MAX**



Image 1. Fans of the French soccer team Red Star celebrate a victory. Photo by Christophe Simon/AFP/Getty Images

Does happiness matter? People react to this question in surprisingly different ways. Some suggest that there are far more significant things to worry about; others see happiness as vitally important and something that every human being ultimately wants in life. To explore this conundrum, we need to start by looking at what happiness actually means.

Happiness relates to how we feel, but it is more than just a passing mood. We are emotional beings and experience a wide range of feelings on a daily basis. Negative emotions – such as fear and anger – help us to get away from danger or defend ourselves. And positive emotions – such as enjoyment and hope – help us to connect with others and build our capacity to cope when things go wrong.

Trying to live a happy life is not about denying negative emotions or pretending to feel joyful all the time. We all encounter adversity and it's completely natural for us to feel anger, sadness, frustration and other negative emotions as a result. To suggest otherwise would be to deny part of the human condition.

Happiness is about being able to make the most of the good times – but also to cope effectively with the inevitable bad times, in order to experience the best possible life overall. Or, in the words of the biochemist turned Buddhist monk Matthieu Ricard: "Happiness is a deep sense of flourishing, not a mere pleasurable feeling or fleeting emotion but an optimal state of being."

### **Happiness Influences Many Aspects Of Life**

One popular misconception about happiness is that happy people are somehow more likely to be lazy or ineffective. In fact research shows the opposite is true: happiness doesn't just feel good, it actually leads to a wide range of benefits for our performance, health, relationships and more.

For example, economists at Warwick University showed different groups of people either a positive film clip or a neutral film clip and then asked them to carry out standard workplace tasks under paid conditions. The people who were primed to feel happy were 11 percent more productive than their peers, even after controlling for age, IQ and other factors. Similarly, researchers at Wharton Business School found that companies with happy employees outperform the stock market year on year and a team at University College London has discovered that people who are happy as young adults go on to earn more than their peers later in life.



In health care, doctors who are happy have been found to make faster and more accurate diagnoses, even when this happiness was induced simply by giving them the small gift of a sugary sweet. In education, schools that focus on children's social and emotional well-being experience significant gains in academic attainment as well as improvements in pupil behavior. Happiness has also been linked to better decision-making and improved creativity.

So, rather than success being the key to happiness, research shows that happiness could in fact be the key to success.

### **Research Reveals Overall Benefits To Society**

But it doesn't just help us function better: happiness also brings substantial benefits for society as a whole. For example, a review of more than 160 studies found "clear and compelling evidence" that happier people have better overall health and live longer than their less happy peers. They are around half as likely to catch the cold virus and have a 50 percent lower risk of experiencing a cardiovascular event such as a heart attack or stroke.

Happier people are also less likely to engage in risky behavior – for example, they are more likely to wear seat belts and less likely to be involved in road accidents. Happier people are even more financially responsible, tending to save more and have more control over their expenditures.

But perhaps most importantly of all, people who are happier are more likely to make a positive contribution to society. In particular, they are more likely to vote, do voluntary work and participate in public activities. They also have a greater respect for law and order and offer more help to others.

There is even evidence that happiness is contagious, so that happier people help others around them to become happier, too. An extensive study in the British Medical Journal followed people over 20 years and found that their happiness affected others in their networks across "three degrees of separation." In other words, how happy we are has a measurable impact on the mood of our friend's friend's friend.

When it comes to the happiness of society as a whole, however, the sad truth is that in recent decades we have become substantially richer but no happier. The positive benefits of higher incomes have been undermined by rising inequality and falling levels of trust and social cohesion. We've also reached the point where mental illness is one of our greatest social challenges – causing more of the suffering in our society than either unemployment or poverty.

### **Governments Recognize Importance Of Happiness**

This is why increasing numbers of policymakers and leaders are now calling for measures of progress to be based on human well-being and happiness, not just economic factors such as growth in gross domestic product. In the United Kingdom, the government has introduced a program to measure national well-being, and influential figures – including former cabinet secretary Gus O'Donnell – are calling for well-being to become the overall measure of prosperity and the main guide to public policy.

This shift towards prioritizing happiness is important because this also reflects what the majority of people want. In a YouGov poll commissioned by Action for Happiness, a majority (87 percent) of U.K. adults said they would prefer a society with the "greatest overall happiness and well-being", rather than the "greatest overall wealth" (8 percent). The findings were consistent across all regions, age groups and social classes.

So happiness does matter – the scientific evidence is compelling. The pursuit of happiness is not some fluffy nice-to-have or middle-class luxury; it's about helping people to live better lives and creating a society that is more productive, healthy and cohesive. As Aristotle said: "Happiness is the meaning and the purpose of life, the whole aim and end of human existence."

### **There Are Limits To Happiness**

Of course, being happy is not some magical cure-all. Happy people still get sick and lose loved ones – and not all happy people are efficient, creative or generous. But, other things being equal, happiness brings substantial advantages.

Perhaps the most powerful insight of all comes not from the research, but from the responses I've heard from many hundreds of parents when asking them what they want above all for their children. Nearly all say something like: "I really just want them to be happy."

Happiness is the thing we want most for the people we love the most. That's why it matters so much.

## Quiz

1 Which matter is left uncertain in the article?

- (A) whether other governments will follow the U.K.'s lead and develop ways to measure well-being
- (B) whether people are able to use their happiness to mitigate difficult circumstances they encounter
- (C) whether happiness plays a significant role in workplace productivity and earning potential
- (D) whether happiness can improve the quality of life for an individual and for those around them

2 Read the following statement.

*The pursuit of a happy life is a universal desire.*

Which detail from the article BEST supports the statement above?

- (A) Happiness is about being able to make the most of the good times – but also to cope effectively with the inevitable bad times, in order to experience the best possible life overall.
- (B) But it doesn't just help us function better: happiness also brings substantial benefits for society as a whole. For example, a review of more than 160 studies found "clear and compelling evidence" that happier people have better overall health and live longer than their less happy peers.
- (C) An extensive study in the British Medical Journal followed people over 20 years and found that their happiness affected others in their networks across "three degrees of separation." In other words, how happy we are has a measurable impact on the mood of our friend's friend's friend.
- (D) In a YouGov poll commissioned by Action for Happiness, a majority (87 percent) of U.K. adults said they would prefer a society with the "greatest overall happiness and well-being", rather than the "greatest overall wealth" (8 percent). The findings were consistent across all regions, age groups and social classes.

3 What purpose is served by including data from scientific studies on happiness?

- (A) It highlights the need for more research on the benefits of happiness.
- (B) It reinforces the importance of promoting happiness in the workplace.
- (C) It emphasizes the idea that the effects of happiness are noticeable and measurable.
- (D) It encourages governments to highly value the well-being and happiness of their citizens.

4 Read the last two paragraphs of the article.

*Perhaps the most powerful insight of all comes not from the research, but from the responses I've heard from many hundreds of parents when asking them what they want above all for their children. Nearly all say something like: "I really just want them to be happy."*

*Happiness is the thing we want most for the people we love the most. That's why it matters so much.*

What is the MOST LIKELY reason the author concludes the article with these two paragraphs?

- (A) to provide a compelling rationale for seeking happiness for oneself and loved ones
- (B) to suggest that the research doesn't give sufficient information about happiness
- (C) to emphasize the necessity of parents ensuring that their children are happy
- (D) to highlight the importance of surveying people about their opinions on happiness



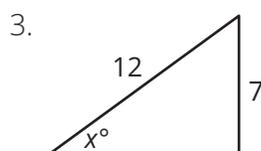
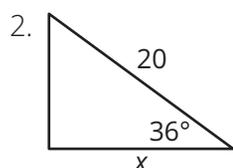
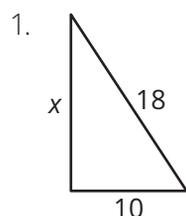
# Pre-Calculus

# The Deriving Force

Deriving the Triangle Area Formula, the Law of Sines, and the Law of Cosines

## Warm Up

Solve for  $x$  in each right triangle.



## 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.

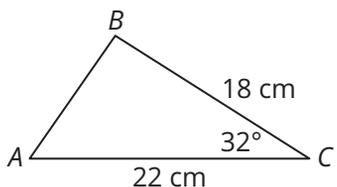
## Key Terms

- 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  $\triangle ABC$ ?

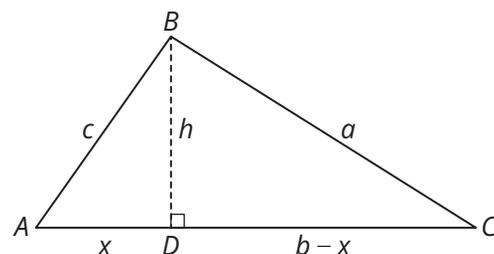


Solving for unknown measurements of sides or angles of a triangle becomes more involved if the given triangle is not a right triangle.

In this lesson, you will explore how trigonometric ratios are useful when determining the area of any triangle, solving for unknown side lengths of any triangle, and solving for unknown angle measures in any triangle.

### 1. Analyze $\triangle ABC$ .

a. Write the formula for the area of  $\triangle ABC$  in terms of  $b$  and  $h$ .



b. Write the ratio that represents  $\sin C$  and solve for the height,  $h$ .

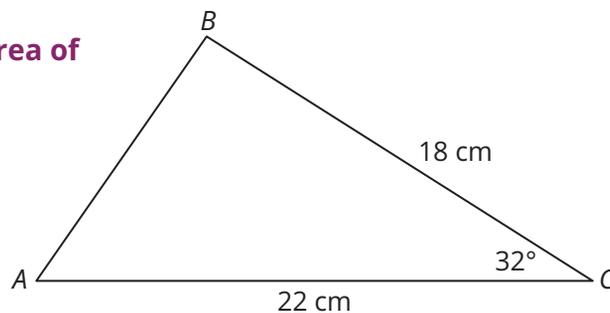
c. Rewrite the formula you wrote for the area of  $\triangle ABC$  in part (a) by substituting the expression for the value of  $h$  from part (b).

#### Remember:

The sine of an angle in a right triangle is the ratio of the length of the opposite side to the length of the hypotenuse.

The area formula  $A = \frac{1}{2}ab \cdot \sin C$  can be used to determine the area of any triangle if you know the lengths of two sides and the measure of the included angle.

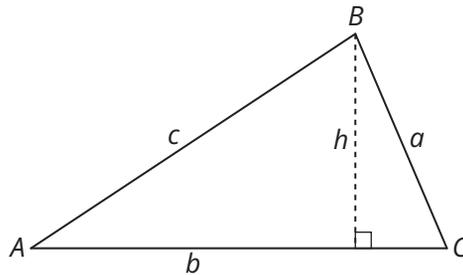
2. Use a trigonometric ratio to determine the area of the triangle.





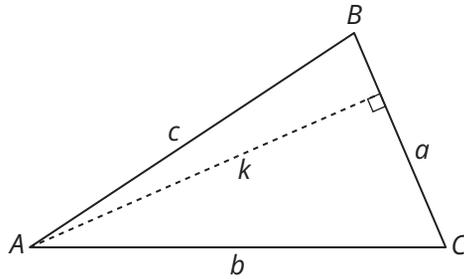
You have used the trigonometric ratios to solve for unknown side lengths and angle measures in right triangles. Let's explore relationships between side lengths and angle measures in any triangle.

**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,  $k$ .**

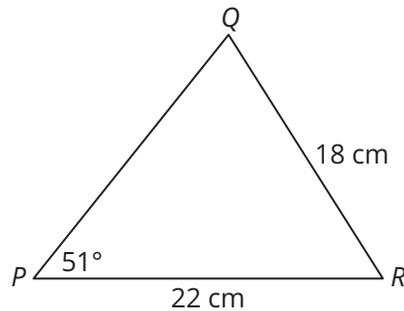
**c. What can you conclude about the relationship between  $c \cdot \sin B$  and  $b \cdot \sin C$ ?**

**d. Express  $c \cdot \sin B = b \cdot \sin C$  as a proportion by dividing both sides of the equation by  $bc$ .**

**3. Derive the *Law of Sines* by combining the proportions formed in Question 1, part (d) and Question 2, part (d).**

The **Law of Sines**, or  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$ , can be used to determine the unknown side lengths or the unknown angle measures in *any* triangle.

**4. Use the Law of Sines to determine the measure of  $\angle Q$ .**



**5. In  $\triangle ABC$ , side  $c$  measures 35 inches, side  $b$  measures 28 inches, and  $m\angle B = 40^\circ$ . Taggart calculated  $m\angle C$  as shown.**

$$\frac{\sin 40}{28} = \frac{\sin C}{35}$$

$$35 \cdot \sin 40 = 28 \cdot \sin C$$

$$22.5 \approx 28 \cdot \sin C$$

$$\sin C \approx 0.8 \text{ and } \sin^{-1} C \approx 53.1^\circ$$

Since  $180^\circ - 53.1^\circ = 126.9^\circ$ , the measure of angle  $C$  could be  $53.1^\circ$  or  $126.9^\circ$ .

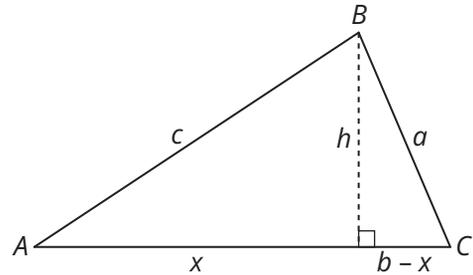
**Is Taggart correct? Use a drawing to justify your reasoning.**



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  $\triangle ABC$ .**

- a. Write a ratio that represents  $\sin A$ , and then solve for the height,  $h$ .**



- b. Write a ratio that represents  $\cos A$ , and then solve for  $x$ .**

- c. Solve for  $a^2$  using the Pythagorean Theorem.**

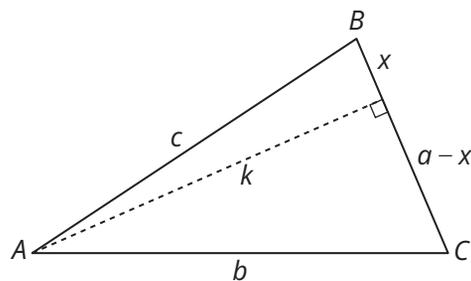
- d. Substitute the expressions for  $h$  and  $x$  into the equation in part (c).**

- e. Use algebraic properties to rewrite the equation you wrote in part (d).**

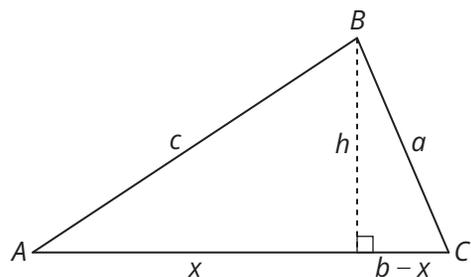
**Remember:**

The Pythagorean identity states that  $\sin^2 \theta + \cos^2 \theta = 1$ . The symbol  $\theta$  represents an angle measure.

2. Repeat the steps in Question 1 to solve for  $b^2$ .



3. Repeat the steps in Question 1 to solve for  $c^2$ .



The **Law of Cosines**, or

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cdot \cos C$$

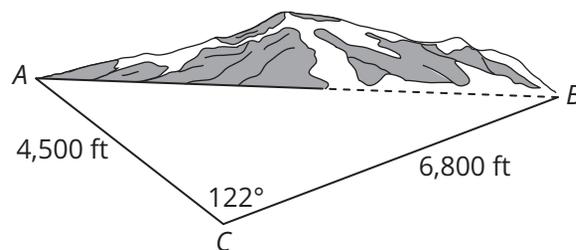
can be used to determine the unknown lengths of sides or the unknown measures of angles in *any* triangle.

4. Why is the Pythagorean Theorem considered to be a special case of the Law of Cosines?

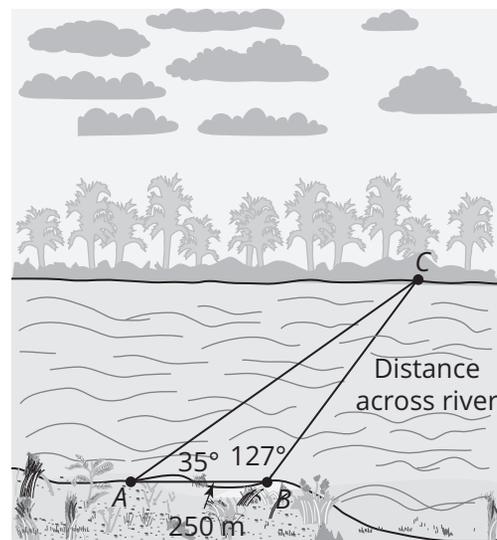


A surveyor was hired to determine the approximate length of a proposed tunnel, which will be necessary to complete a new highway. A mountain stretches from point  $A$  to point  $B$  as shown. The surveyor stands at point  $C$  and measures the distance from where she is standing to both points  $A$  and  $B$ , then measures the angle formed between these two distances.

1. Use the surveyor's measurements to determine the length of the proposed tunnel.

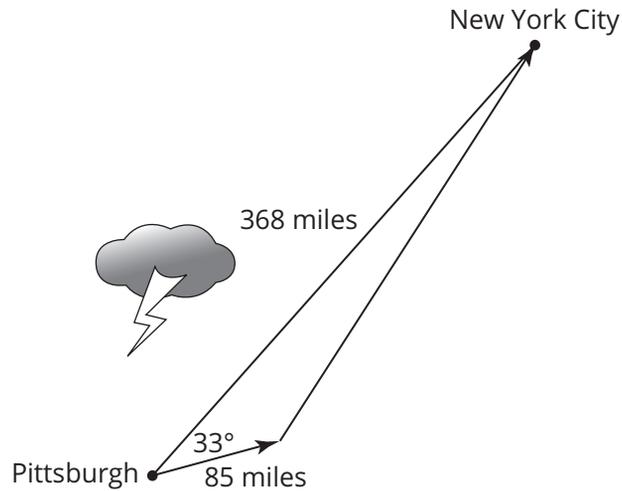


2. A nature lover decides to use geometry to determine whether she can swim across a river. She locates two points,  $A$  and  $B$ , along one side of the river and determines the distance between these points is 250 meters. She then spots a point  $C$  on the other side of the river and measures the angles formed using point  $C$  to point  $A$  and then point  $C$  to point  $B$ . She determines the measure of the angle whose vertex is located at point  $A$  to be  $35^\circ$  and the angle whose vertex is located at point  $B$  to be  $127^\circ$  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  $33^\circ$  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

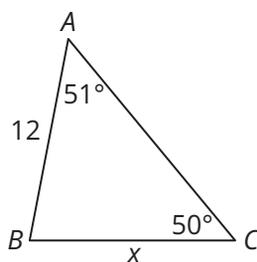
Each of the trigonometric laws you learned in this lesson is useful in determining unknown measures in any triangle, depending on which measures are known.

**1. When is the Law of Sines useful to determine unknown measures?**

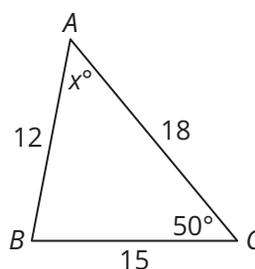
**2. When is the Law of Cosines useful to determine unknown measures?**

**3. For each triangle, state your strategy for solving for  $x$ —the Law of Sines or the Law of Cosines.**

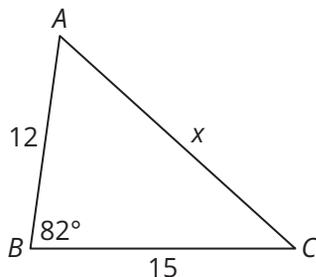
a.



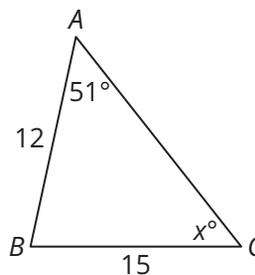
b.



c.



d.





# Assignment

## Write

Define each term in your own words.

1. Law of Sines
2. Law of Cosines

## Remember

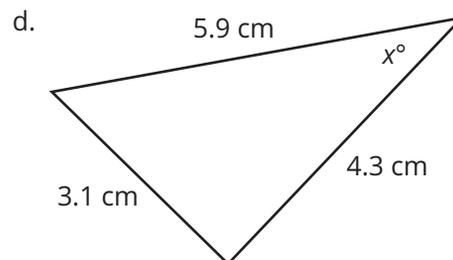
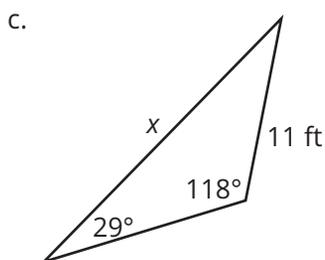
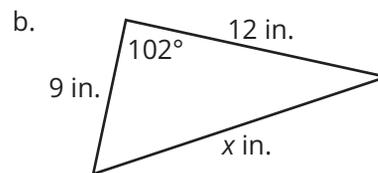
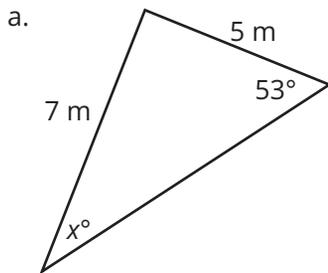
The area formula  $A = \frac{1}{2}ab \cdot \sin C$  can be used to determine the area of any triangle if you know the lengths of two sides and the measure of the included angle.

The Law of Sines can be used to determine the unknown side lengths or unknown angle measures in any triangle.

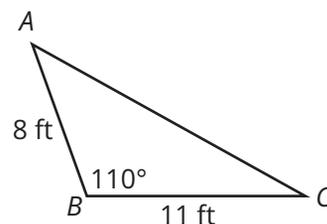
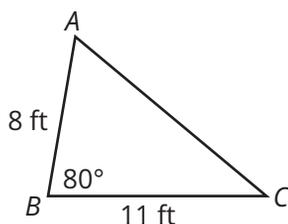
The Law of Cosines can be used to determine the unknown lengths of sides or the unknown measures of angles in any triangle.

## Practice

1. Solve for  $x$  in each triangle. Round each answer to the nearest tenth.



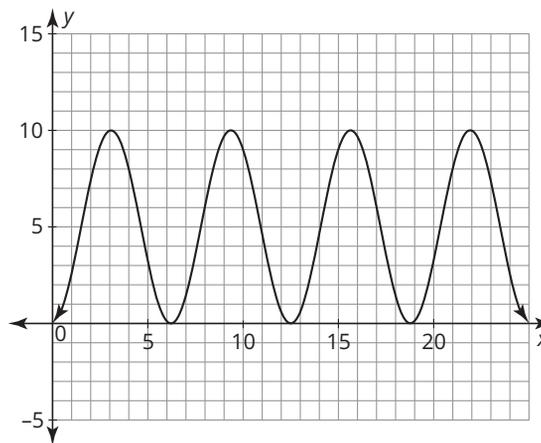
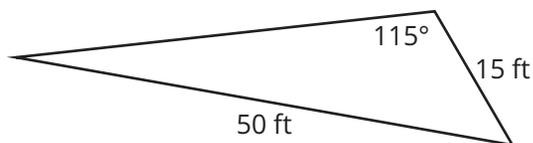
2. Emily and Joe are designing a fenced backyard play space for their children Max and Caroline. They start out by considering two designs for a triangular play space. They have made measurements in their yard and determined that either design would fit into the space that is available.



- Explain how Emily and Joe can use trigonometry to calculate the area and perimeter of the possible play spaces.
- Calculate the area of the play space for each design.
- Calculate the perimeter of the play space for each design.
- Which design do you think Emily and Joe should choose? Explain your reasoning.

## Stretch

- Consider the triangle shown.
  - Determine the area of the triangle. Round your answer to the nearest tenth.
  - Determine the perimeter of the triangle. Round your answer to the nearest tenth.
- Consider the graph shown.
  - Is the graph continuous or discrete?
  - Does the graph contain a maximum? If so, what is the maximum?
  - Does the graph contain a minimum? If so, what is the minimum?
  - Approximately where are the  $x$ -intercepts?
  - Where is the  $y$ -intercept?
  - Do you notice a pattern in the graph? Explain your reasoning.



## Review

1. Compute each geometric series.

a.  $\sum_{i=0}^{10} 2^i$

b.  $\sum_{i=0}^8 5^{i-1}$

# 2

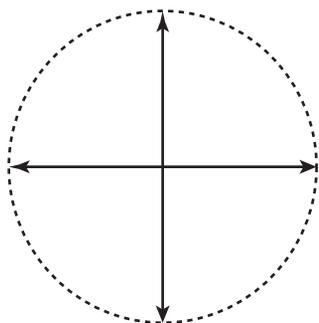
## A Sense of Déjà Vu

### Periodic Functions

#### Warm Up

Use a protractor and the axes to draw angles of the given measure in the circle.

1.  $45^\circ$
2.  $30^\circ$
3.  $180^\circ$
4.  $270^\circ$



#### Learning Goals

- Model a situation with a periodic function.
- Analyze the period and amplitude of a periodic function.
- Determine the period, amplitude, and midline of a periodic function.

#### Key Terms

- periodic function
- period
- standard position
- initial ray
- terminal ray
- amplitude
- midline

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You have learned about many different types of functions. What functions can be defined using points on the circle as the domain?

## A Wheel Good Time

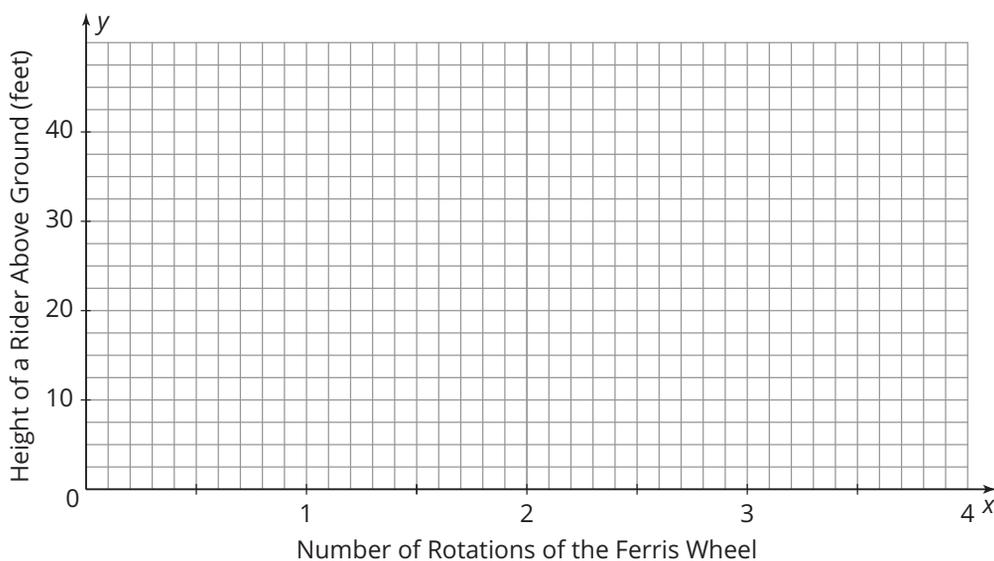
One of the most popular amusement park rides is the Ferris wheel. One Ferris wheel has a diameter of 50 feet. Riders board the cars at ground level, and the wheel moves counterclockwise. Each ride consists of four rotations, and you can assume that the Ferris wheel rotates at a constant rate.

1. **Create a sketch to model the height of a rider above ground with respect to the number of rotations of the Ferris wheel. Include 4 rotations.**

Think

about:

Imagine yourself on this Ferris wheel. When will you be on the ground, and when will you be 50 feet above the ground?



2. Complete the table to represent the height of a rider above ground as a function of the number of rotations of the Ferris wheel.

Rotations of the Ferris Wheel	Height of a Rider Above Ground (feet)
0	
$\frac{1}{8}$	
$\frac{1}{4}$	
$\frac{3}{8}$	
$\frac{1}{2}$	
$\frac{5}{8}$	
$\frac{3}{4}$	
$\frac{7}{8}$	
1	

Ask

yourself:

What adjustments can you make to your sketch of this situation after completing the table of values?

3. Describe the characteristics of your graph.

4. What do you notice about the shape of the graph for each rotation?



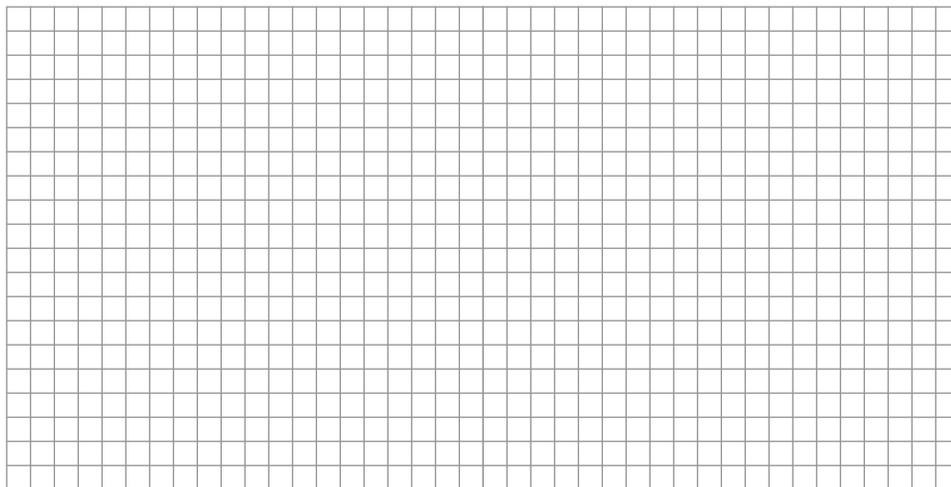


To model the height of a rider above ground on the Ferris wheel, you used a *periodic function*. A **periodic function** is a function whose values repeat over regular intervals. The **period** of a periodic function is the length of the smallest interval over which the function repeats.

**1. Describe the period of the function that models the height of a rider above ground on the Ferris wheel.**

At a different amusement park, a Ferris wheel was designed so that half of the wheel is actually below the ground. The diameter of this underground Ferris wheel is still 50 feet. The top of the ride reaches 25 feet above ground and the bottom of the ride reaches 25 feet below ground. Riders board the cars at ground level to the right, and the Ferris wheel moves counterclockwise.

**2. Create a sketch to model the height of a rider above ground with respect to the number of rotations of the underground Ferris wheel. Include 4 rotations.**



3. Complete the table to represent the height of a rider above ground as a function of the number of rotations of the underground Ferris wheel.

Rotations of the Ferris Wheel	Height of a Rider Above Ground (feet)
0	
$\frac{1}{8}$	
$\frac{1}{4}$	
$\frac{3}{8}$	
$\frac{1}{2}$	
$\frac{5}{8}$	
$\frac{3}{4}$	
$\frac{7}{8}$	
1	

4. Describe the characteristics of your graph.

5. Describe the period of the function that models the height of a rider above ground on the underground Ferris wheel.

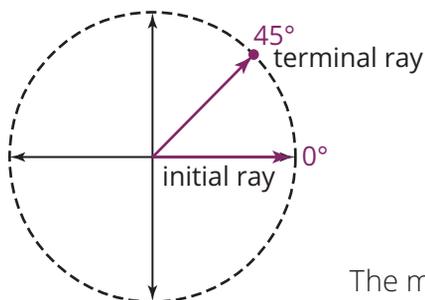




In the last two activities, you modeled the height of a rider above ground as a function of the number of rotations of two different Ferris wheels. You can also model the height of a rider as a function using angle measures.

An angle is in **standard position** when the vertex is at the origin and one ray of the angle is on the  $x$ -axis. The ray on the  $x$ -axis is the **initial ray**, and the other ray is the **terminal ray**.

1. Use the graph on the next page and complete the steps shown to build a periodic function to model the underground Ferris wheel scenario. The position of the car is the intersection of the terminal ray and the circle.

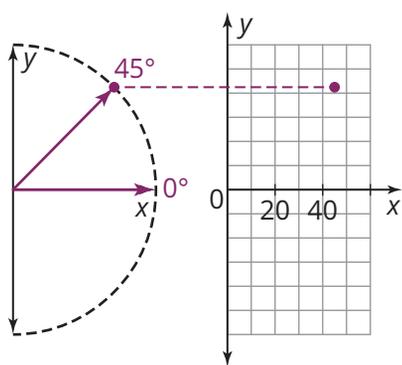


**Step 1: Analyze each axis label.**

**Step 2: Measure a  $45^\circ$  angle in standard position.**

**Mark and label a point on the Ferris wheel as shown.**

The measure of an angle in standard position is the amount of rotation from the initial ray to the terminal ray. When the rotation is counterclockwise, the angle measure is positive. When the rotation is clockwise, the angle measure is negative.



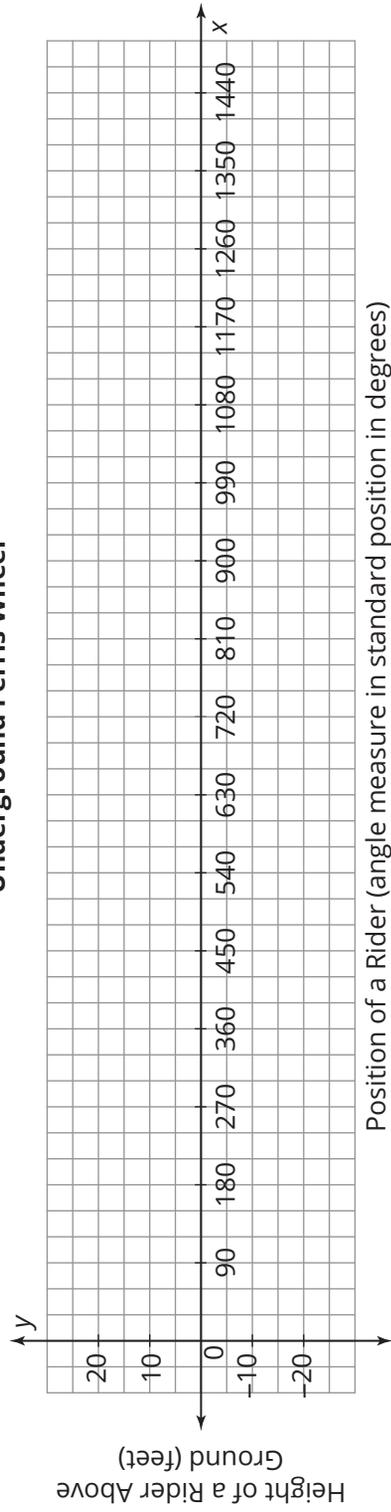
**Step 3: Use a straightedge to line up the point on the Ferris wheel with the appropriate location on the coordinate plane. Plot the point.**

**Step 4: Repeat Steps 2 and 3 for each angle measure:  $0^\circ$ ,  $30^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $180^\circ$ ,  $270^\circ$ ,  $360^\circ$ .**

**Step 5: Draw a smooth curve to connect the points of your graph.**

**Step 6: Continue the curve to represent angle measures greater than  $360^\circ$ .**

### Underground Ferris Wheel



2. Determine the period of the function you graphed. What does this value represent in terms of this problem situation?
  
3. Determine any maximum or minimum values of your graph. What does each value represent in terms of this problem situation?

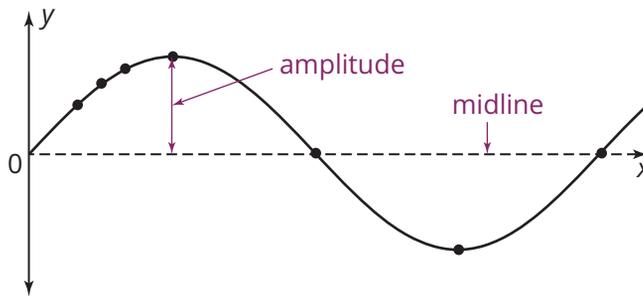


**Remember:**

You can describe angle measures greater than  $360^\circ$ .

4. At certain angle measures, a rider is at the highest or lowest point.
  - a. List 4 angle measures associated with a rider being at the highest point.
  
  - b. List 4 angle measures associated with a rider being at the lowest point.
  
5. Describe the symmetries you see in the graph of the function. Explain how these are related to the symmetries associated with the Ferris wheel.

The graphs of periodic functions have characteristics that are given special names, such as *amplitude* and *midline*.



The **amplitude** of a periodic function is one-half the absolute value of the difference between the maximum and minimum values of the function.

The **midline** of a periodic function is a reference line whose equation is the average of the minimum and maximum values of the function.

**6. Determine the amplitude of each function you graphed in this lesson. Show your work.**

**7. Identify the midline of each function you graphed in this lesson.**

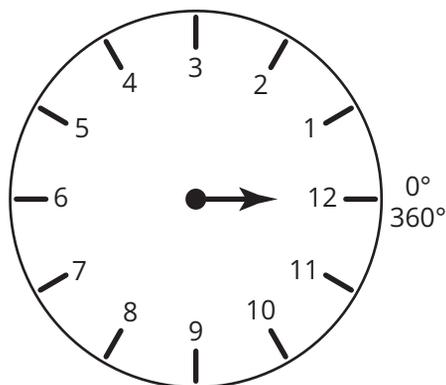


## TALK the TALK

### Rock. Around. The Clock Tonight.

Consider a typical day in the life of you. What do you do every day?  
At what time?

1. Plot at least 5 of your daily events and their hours on the altered clock shown.



2. Determine the degree measures of each of your events, using  $0^\circ$  to represent 12:00 midnight and  $360^\circ$  to represent 12:00 noon.



4. Compare your graphs with your classmates' graphs.

a. What do you notice?

b. How do you distinguish between AM and PM on your graph?

c. How can you tell from your graph whether an event happened at 8:00 or 10:00?

d. How can you tell from your graph when an event happens at the same time every day?

# Assignment

## Write

Write the term that best completes each statement.

1. The terminal ray of an angle in standard position is the ray with its endpoint at the origin that is not the \_\_\_\_\_.
2. The \_\_\_\_\_ of a periodic function is one half the absolute value of the difference between the maximum and minimum values of the function.
3. An angle is in \_\_\_\_\_ when the vertex is at the origin and one ray of the angle is on the  $x$ -axis.
4. A \_\_\_\_\_ is a function whose values repeat over regular intervals.
5. The \_\_\_\_\_ of a periodic function is a reference line whose equation is the average of the minimum and maximum values of the function.
6. The \_\_\_\_\_ of a periodic function is the length of the smallest interval over which the function repeats.
7. The measure of an angle in standard position is the amount of rotation from the initial ray to the \_\_\_\_\_.

## Remember

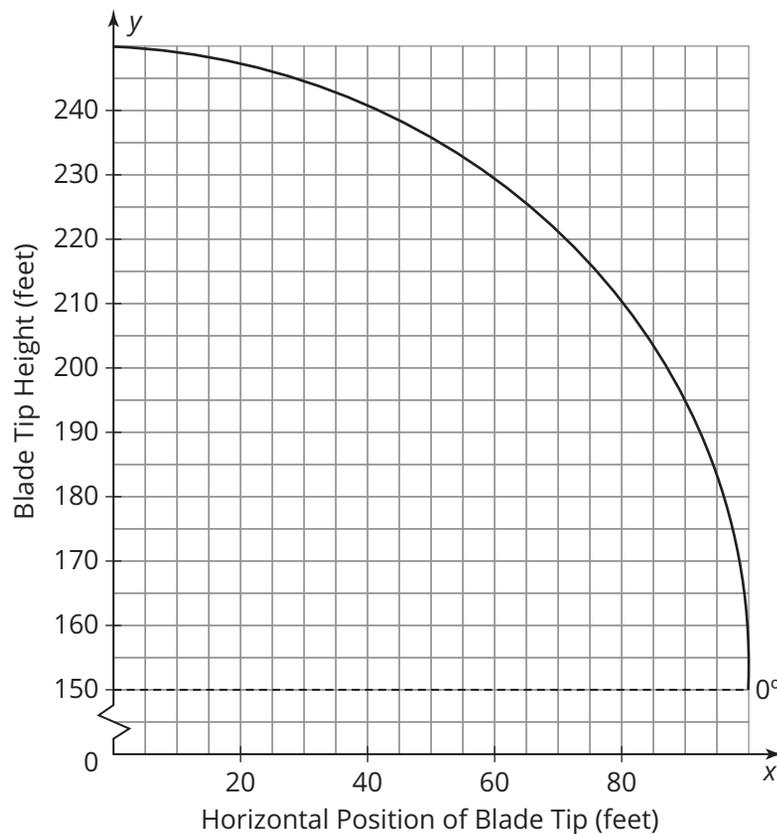
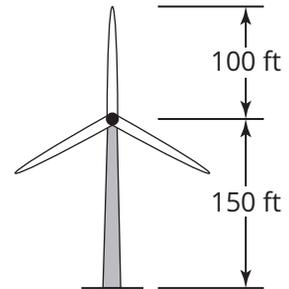
A periodic function is a function whose values repeat over regular intervals. The period of a periodic function is the length of the smallest interval over which the function repeats.

## Practice

1. Wind turbines harness the power of the wind to generate electricity.

One particular wind turbine consists of three 100-foot-long rotor blades that rotate around the top of a 150-foot vertical shaft.

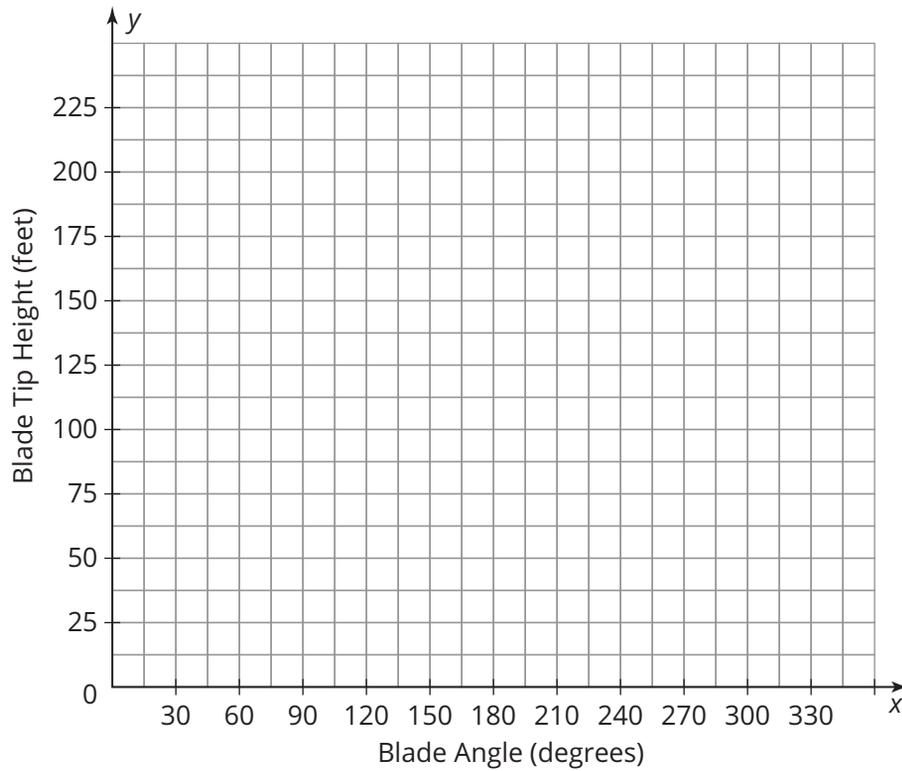
- a. Use a protractor, a straightedge, and the given graph to estimate the height of the blade tip when the blade is at angles of  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$  and  $90^\circ$ . The arc on the graph represents a portion of the blade tip's path. Assume the blade rotates counterclockwise and the blade is at an angle of  $0^\circ$  when the blade tip is directly to the right of the top of the vertical shaft. This position has been labeled as  $0^\circ$  on the graph.



- b. Complete the table using your knowledge of the symmetry of circles.

<b>Blade Angle</b>	$120^\circ$	$135^\circ$	$150^\circ$	$180^\circ$	$210^\circ$	$225^\circ$	$240^\circ$	$270^\circ$	$300^\circ$	$315^\circ$	$330^\circ$
<b>Tip Height (feet)</b>											

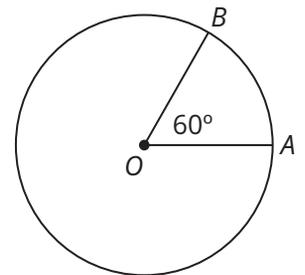
c. Graph the blade tip height as a function of the blade angle.



- d. Determine the equation of the midline for the periodic function you graphed in part (c). Sketch and label the midline as a dashed line on the graph in part (c).
- e. Determine the amplitude of the function you graphed in part (c). Explain your reasoning.
- f. Determine the period of the function you graphed in part (c). Explain your reasoning.
- g. Determine the height of the blade tip when the blade angle is  $570^\circ$ . Explain your reasoning.

## Stretch

- The circle with center  $O$  has a radius of 1 unit.
  - Determine the arc length  $AB$ .
  - Determine the ratio of the arc length to the radius of the circle.
  - The ratio of the arc length to the radius of the circle is the measure of the central angle in radians. Determine the measure of a central angle of  $135^\circ$  in radians.



## Review

1. The following rules are used to create a certain fractal, the Cantor set.

Stage 0: Begin with a line segment.

Stage 1: Divide the line segment into thirds and then erase the middle third.

Stages 2 and up: Repeat Stage 1 for the line segments in the figure.

- a. Complete Stage 2 of the fractal. Stage 0 and Stage 1 are given.

Stage 0 

Stage 1 

Stage 2

Stage	Total Length of Line Segments (in.)
0	
1	
2	
3	
4	
5	
$n$	

- b. Determine the total length of the line segments at each stage and complete the table. The length of the initial line segment in Stage 0 is 1 in.
- c. Identify the type of sequence represented by the total length of the line segments at Stage  $n$ .
- d. Write a function to represent the total length of the line segments as a function of the stage,  $n$ . Describe the type of function you used.
2. The following rules are used to create a certain fractal, the von Koch curve.

Stage 0: Begin with a line segment.

Stage 1: Replace the middle segment with an equilateral triangle, and remove the side of the triangle corresponding to the initial straight line.

Stages 2 and up: Repeat Stage 1 for the line segments in the figure.

- a. Complete Stage 2 of the fractal. Stage 0 and Stage 1 are given.

Stage 0 

Stage 1 

Stage	Number of Line Segments
0	
1	
2	
3	
4	
5	
$n$	

- b. Determine the number of line segments at each stage and complete the table.
- c. Identify the type of sequence represented by the number of line segments at Stage  $n$ .
- d. Write a function to represent the number of line segments as a function of the stage,  $n$ . Describe the type of function you used.
3. Identify the number of real zeros of each polynomial.
- a.  $2x^4 + x^3 + 3x^2 + 3x - 9 = 0$
- b.  $x^5 + 2x^4 + 11x^3 + 22x^2 + 24x + 48 = 0$

# 3

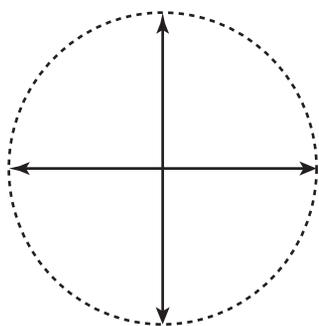
# The Knights of the Round Table

## Radian Measure

### Warm Up

Use a protractor and the axes to draw angles of the given measure in the circle.

1.  $50^\circ$
2.  $25^\circ$
3.  $135^\circ$
4.  $225^\circ$



### Learning Goals

- Determine the radian measure of angles.
- Convert between angle measures in degrees and angle measures in radians.
- Estimate the degree measure of central angle measures given in radians.
- Identify reference angles in radians

### Key Terms

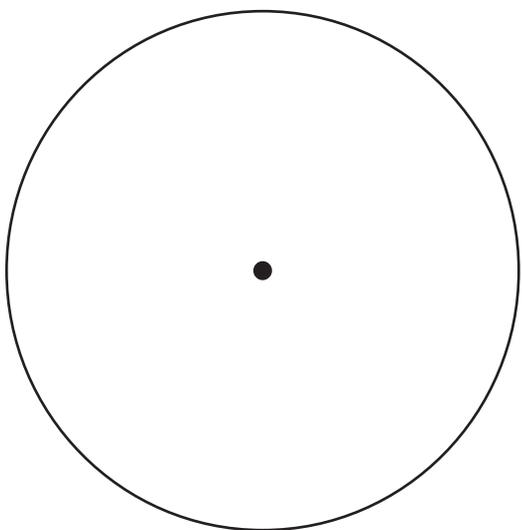
- theta ( $\theta$ )
- unit circle
- radians

You have measured angles in degrees and learned that movement along a circle can be modeled by a periodic function. Are there other units of measure that describe angles?

## King Arthur's Knights

You may have heard of the legend of King Arthur and his Knights of the Round Table. The round table was used to show that each person sitting at it was equal. In most depictions, the knights also appear to be spaced around the table so that they are an equal distance apart.

But different versions of the legend give different numbers of knights. In many versions, there are 12 knights, but some include 25 or even 150 knights of the round table!



- 1. On the circle given, show how 12 knights could be seated at the round table at an equal distance from each other.**
- 2. Express the location of each of the twelve knights in terms of the circumference of the circle,  $2\pi r$ . Write each value in lowest terms.**
- 3. Without drawing, describe the locations of the knights if there are 25 Knights of the Round Table spaced an equal distance from each other.**
- 4. What if there were 150 knights? What do you think the diameter of the table should be for that many knights to sit comfortably around the table? Justify your answer.**

Measuring Central Angles  
in Radians

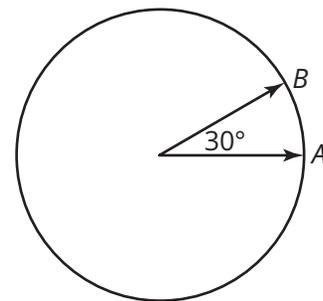
Recall that the measure of an arc of a circle is equal to the degree measure of the central angle that intercepts the arc.

$$m\widehat{AB} = 30^\circ$$

The length of the intercepted arc is given by the expression:

$$\text{arc length} = 2\pi r \cdot \frac{\text{measure of central angle}}{360^\circ}$$

You can identify the central angle measures of a circle in standard position using the symbol **theta**, written as  $\theta$ . For example, a central angle measure of  $30^\circ$  can be written as  $\theta = 30^\circ$ .



The central angles you will discuss in this lesson are all angles in standard position.

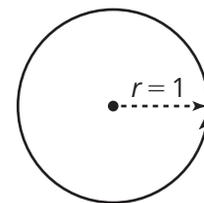
### 1. Given any circle with a radius of $r$ units:

- Write an expression in terms of  $r$  to describe the arc length for a central angle measure of  $\theta = 30^\circ$ .
- Write an expression in terms of  $r$  to describe the arc length for a central angle measure of  $\theta = 45^\circ$ .

A powerful way to measure central angles of a circle is to identify arc lengths of the circle in terms of the radius of a *unit circle*. A **unit circle** has a radius of 1 unit.

### 2. Consider the unit circle shown.

- Identify a central angle measure,  $\theta$ , that represents a complete rotation of the terminal ray around the unit circle.
- Identify the arc length of this central angle.
- Identify a central angle measure,  $\theta$ , and arc length that represent half of a rotation of the terminal ray around the unit circle.

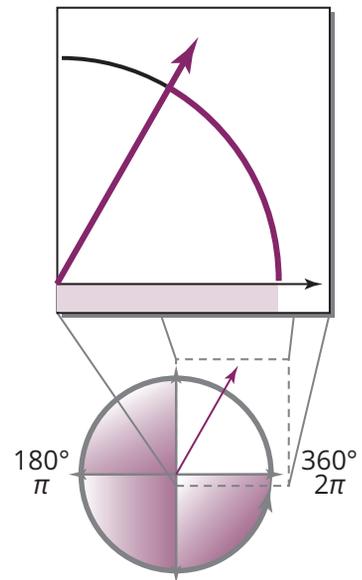
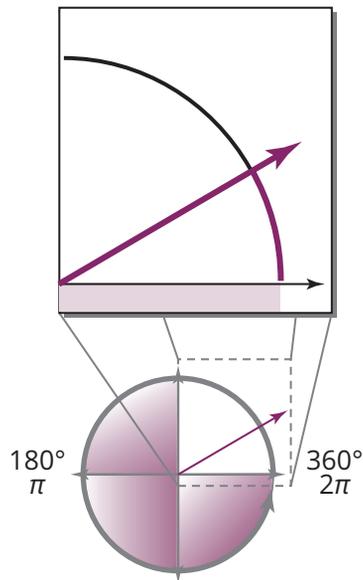
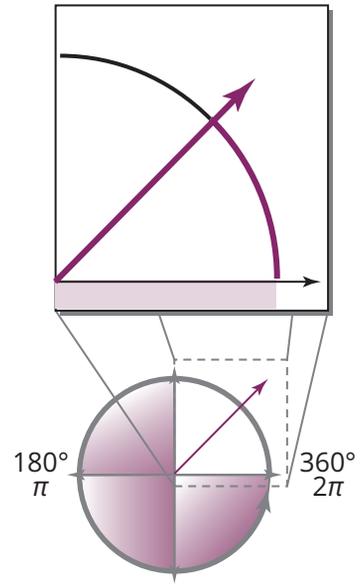
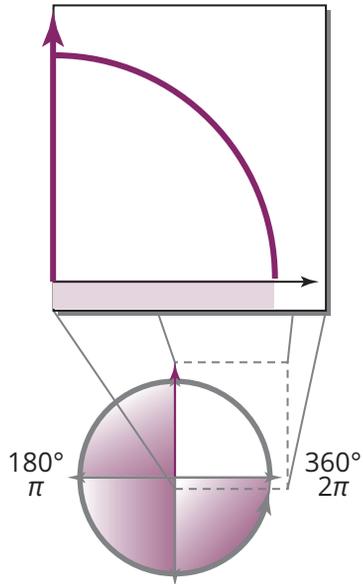


Ask

yourself:

What is the arc length when the radius is 1 unit?

3. Use a protractor to determine each central angle measure,  $\theta$ , in the unit circle. Then label the angle measures and their corresponding arc lengths in units. Explain how you determined your answers.

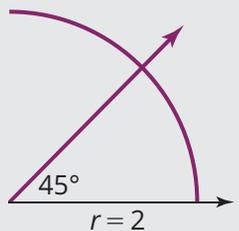


The unit that describes the measure of an angle theta,  $\theta$ , in terms of the arc length and radius of a unit circle is called a *radian*. The ratio of the intercepted arc length of a central angle to the length of the radius is the measure of the central angle in **radians**.

There are  $\frac{2\pi r}{r}$ , or  $2\pi$ , radians in  $360^\circ$  and  $\frac{\pi r}{r}$ , or  $\pi$ , radians in  $180^\circ$ .

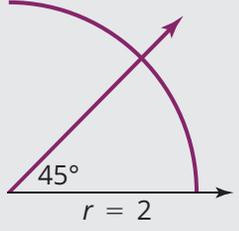
**4. Jaylen and Malik each determined the radian measure for a central angle measuring  $45^\circ$  in a circle with a radius of 2 units.**

Jaylen 



Arc length =  $2\pi(2) \cdot \frac{45^\circ}{360^\circ}$   
 $= 4\pi \cdot \frac{1}{8} = \frac{\pi}{2}$  units  
 The radian measure of this angle is  $\frac{\pi}{2} \div 2$ , or  $\frac{\pi}{4}$  radian.

Malik 



Arc length =  $2\pi(2) \cdot \frac{45^\circ}{360^\circ}$   
 $= 4\pi \cdot \frac{1}{8} = \frac{\pi}{2}$  units  
 The radian measure of this angle is  $\frac{\pi}{2}$  radians.

**Explain why Malik's reasoning is incorrect.**

**5. Use what you know about the symmetry of a circle to label each central angle measure in degrees and radians on the unit circle located at the end of the lesson. Explain how you determined the measures, and show your work.**

Use your protractor to verify your angle measures.



It is important to keep in mind that values such as  $\frac{\pi}{4}$  and  $\frac{7\pi}{6}$  are constants. Each of these irrational numbers can be rewritten as non-terminating, non-repeating decimals.

$$\frac{\pi}{4} \approx \frac{3.14}{4} \approx 0.785 \qquad \frac{7\pi}{6} \approx \frac{7(3.14)}{6} \approx 3.6633\dots$$

You can also write whole-number values for radians.

You can use the abbreviation “rad” when describing measures in radians.

**1. Estimate the degree measure of each central angle measure given in radians. Explain your reasoning.**

**a. 3 radians**

**b. 6 radians**

**c. 2 radians**

**d. 4 radians**

**e. 1 radian**

**f. 5 radians**

**2. What is the arc length of a central angle that has a measure of 1 radian on the unit circle? Explain your reasoning.**

The formulas you can use to convert the units to measure angles from radians to degrees and degrees to radians are shown.

**Radians to Degrees:**  $x \text{ radians} \cdot \frac{180^\circ}{\pi \text{ radians}}$

**Degrees to Radians:**  $x \text{ degrees} \cdot \frac{\pi \text{ radians}}{180^\circ}$

Notice that the ratios in the formulas are forms of 1.

**3. Use the formulas to convert each angle measure in Question 1 to degrees.**

**How close were your estimates?**

**4. Corinne made the statement regarding radian measures.**

**Corinne**



The complement of an angle measure  $\theta$  in radians is  $\left(\frac{\pi}{2} - \theta\right)$  radians.

**Explain why Corinne is correct. Write a similar statement using degrees.**

**5. What is the supplement of an angle measure  $\theta$  in radians? Explain your reasoning.**

**TALK the TALK** **Degrees Are Rad Too**

You can use degrees or radians as units of measure to describe angles.

**1. Convert each angle in degree measure to radian measure.**

a.  $500^\circ$

b.  $390^\circ$

c.  $150^\circ$

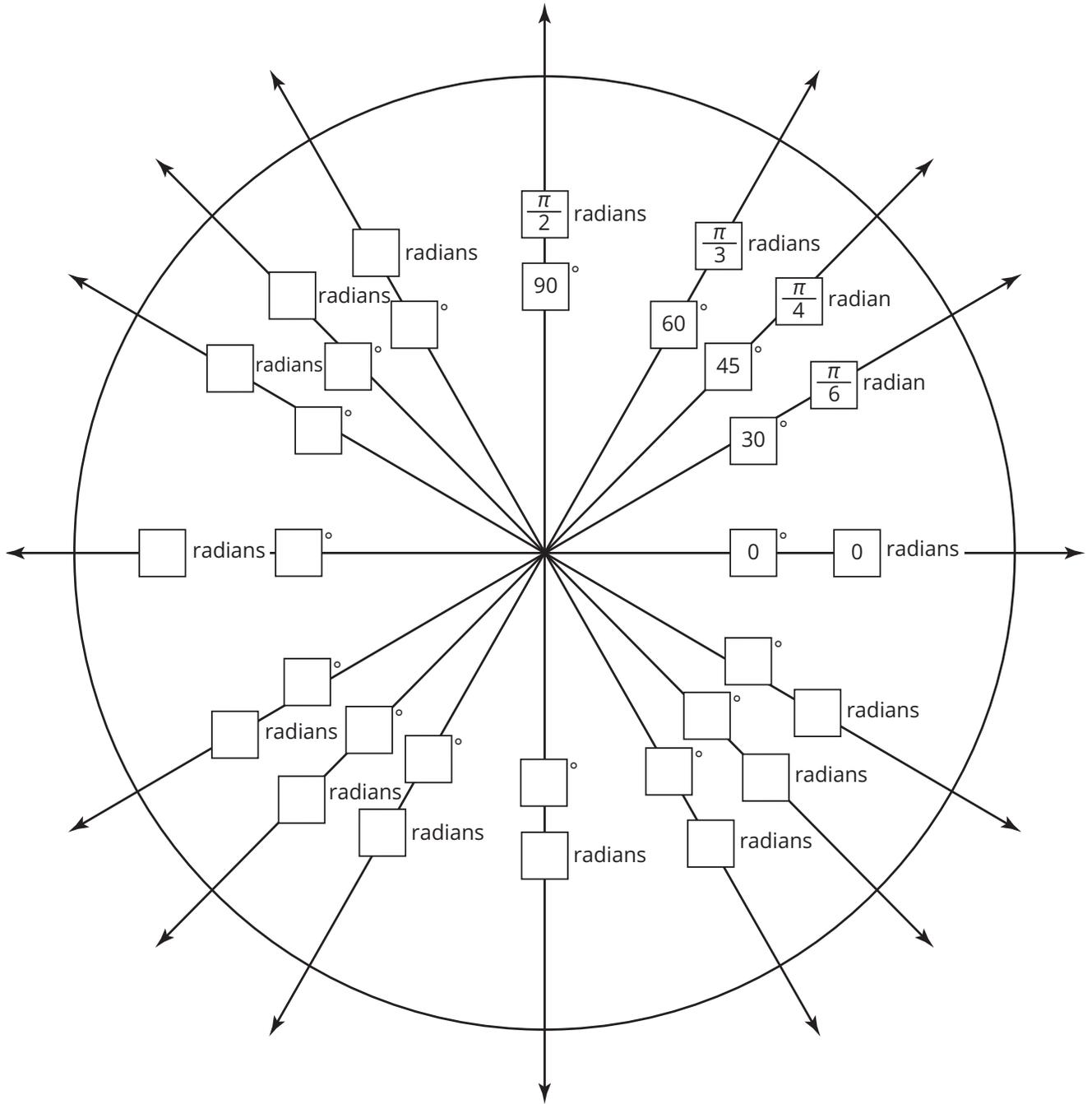
**2. Convert each angle in radian measure to degree measure.**

a.  $\frac{\pi}{10}$

b.  $\frac{7\pi}{6}$

c.  $\frac{14\pi}{15}$

## Central Angle Measures in Degrees and Radians





# Assignment

## Write

Complete each sentence.

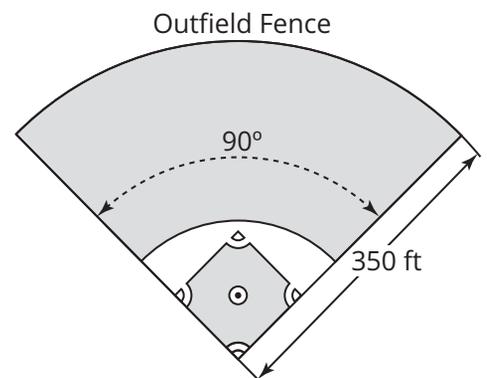
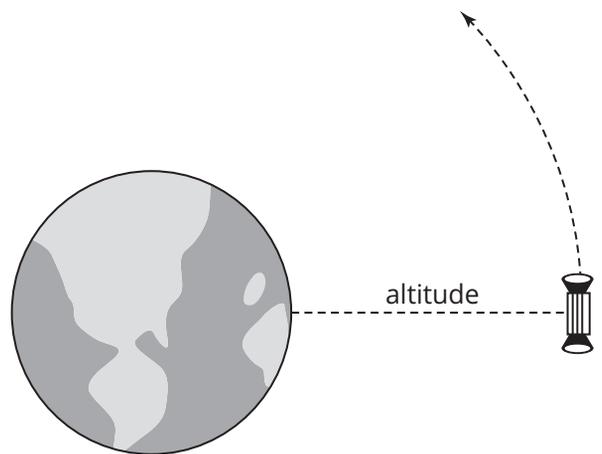
1. A unit circle has a radius of \_\_\_\_\_.
2. A symbol used to identify the central angle measure of a circle in standard position is \_\_\_\_\_.
3. There are  $2\pi$  \_\_\_\_\_ in  $360^\circ$ .

## Remember

The ratio of the intercepted arc length of a central angle to the radius is the measure of the central angle in radians. There are  $\pi$  radians in  $180^\circ$ .

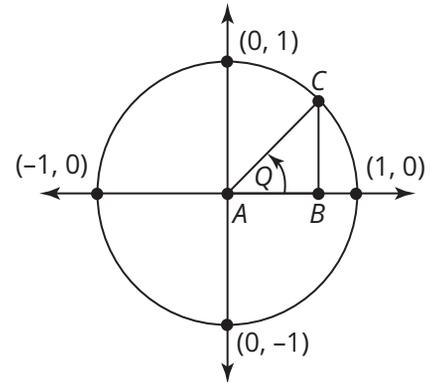
## Practice

1. A Global Positioning System (GPS) satellite completes 1 orbit of Earth every 12 hours. The satellite follows a circular path with its center at the center of Earth.
  - a. Determine the angle of rotation, in radians, that corresponds to 1 complete orbit of the satellite around Earth.
  - b. Determine the radius of the circular path the satellite follows during its orbit if Earth's radius is 3,959 miles and the altitude of the satellite is 12,645 miles.
  - c. Determine the angle of rotation, in radians, that corresponds to an 8-hour time period.
  - d. Determine the distance traveled by the satellite in an 8-hour time period.
  - e. The computer onboard the satellite had to be remotely shut down and rebooted in order to repair a software glitch. The satellite traveled a distance of 27,000 miles during that time. How long did it take to shut down and reboot the computer?
2. The outfield fence on a baseball field needs to be replaced. The fence is an arc with its center at home plate and a central angle of  $90^\circ$ . The distance from home plate to any point on the fence is 350 feet.
  - a. Determine the central angle of the outfield fence in radians.
  - b. Determine the length of the outfield fence that needs to be replaced.



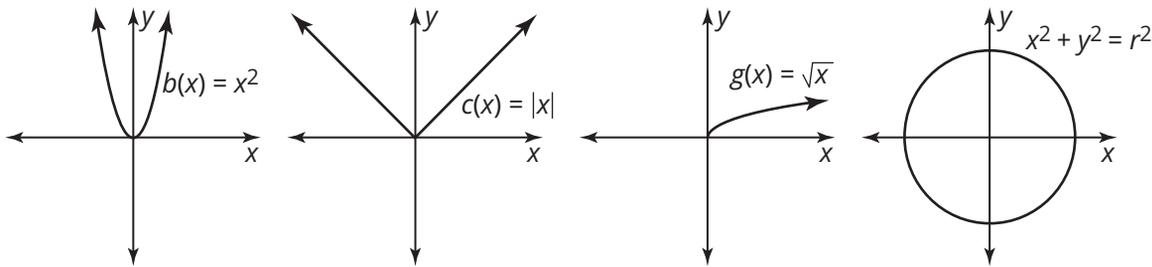
## Stretch

- An automobile tire has a diameter of 28 inches.
  - What angle does the wheel turn through if the car has moved 2 feet? Give the answer in both radians and degrees.
  - If the tire makes 10 turns in 1 second, how fast is the car going in miles per hour?
- A unit circle is shown. Determine the coordinates of points  $B$  and  $C$  on the triangle for the different measures of  $\theta$ .
  - $\theta = \frac{\pi}{6}$  radians
  - $\theta = \frac{\pi}{4}$  radians
  - $\theta = \frac{\pi}{3}$  radians



## Review

- Consider the relations shown.



Graph each relation to create a picture.

$$y = g(-x - 1) + 4, \quad -5 \leq x \leq -1$$

$$y = g(x - 1) + 4, \quad 1 \leq x \leq 5$$

$$y = -2c(x) + 6, \quad -3 \leq x \leq 3$$

$$x^2 + (y - 7)^2 = 1$$

- Identify the number of complex zeros for the polynomial equation.
  - $12x^5 - 20x^4 + 19x^3 - 6x^2 - 2x + 1 = 0$
  - $5x^4 + 3x^3 + 3x^2 + 3x - 2 = 0$

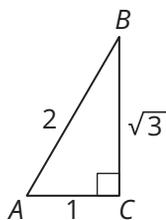
# What Goes Around

## The Sine and Cosine Functions

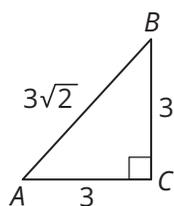
### Warm Up

Determine the sine ratio and cosine ratio of  $\angle A$  in each triangle.

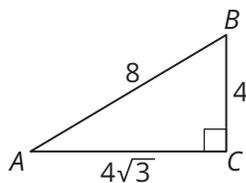
1.



2.



3.



### Learning Goals

- Define the sine and cosine functions.
- Calculate values for the sine and cosine of reference angles.
- Define the sine and cosine of an angle as a coordinate of a point on the unit circle.
- Graph and compare the sine and cosine functions.

### Key Terms

- sine function
- cosine function
- trigonometric function
- periodicity identity

You have previously explored the relationship of the side lengths in special right triangles, and you know how to determine the sine and cosine ratios of angles in a right triangle. How can these relationships on a unit circle be represented as functions on a coordinate plane?

## The Right Triangle Connection

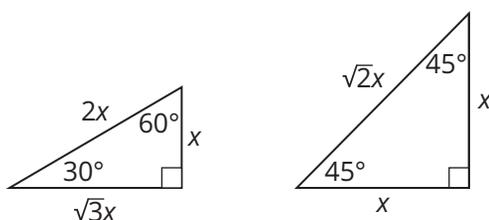
Recall that the sine ratio ( $\sin$ ), given a reference angle,  $\theta$ , is the ratio of the length of the opposite side to the length of the hypotenuse in a right triangle.

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

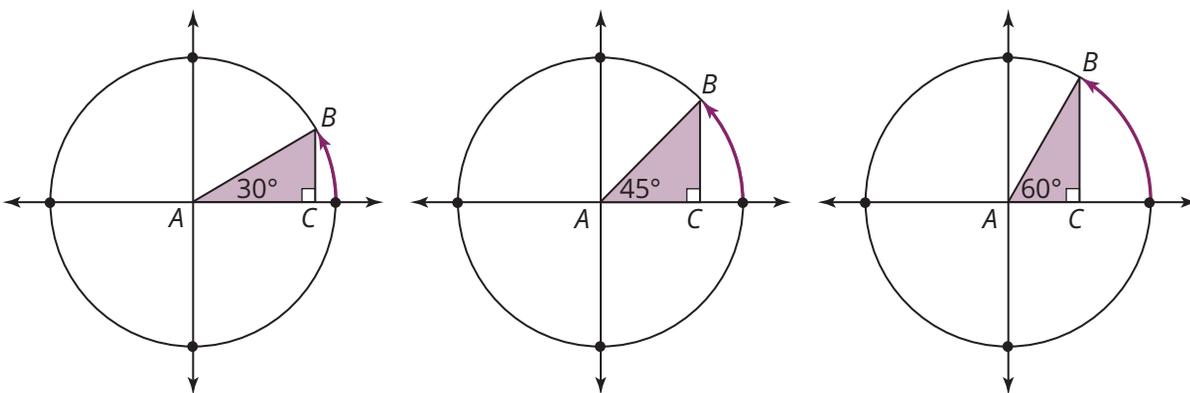
The cosine ratio ( $\cos$ ), given a reference angle,  $\theta$ , is the ratio of the length of the adjacent side to the length of the hypotenuse.

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

The side-length relationships for a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle and a  $45^\circ$ - $45^\circ$ - $90^\circ$  triangle are shown.



The diagram shows a right triangle  $ABC$  placed on a unit circle centered at the origin. The central angle measures  $\theta = 30^\circ$ ,  $\theta = 45^\circ$ , and  $\theta = 60^\circ$  are shown.



1. What is the length of the hypotenuse  $c$  in each circle? Label the measures on each triangle.

2. Label the side lengths of the triangles in each diagram in radical form.

3. The hypotenuse of each right triangle represents the terminal ray of a central angle that intersects the unit circle at point  $B$ .

a. Complete the table to record the sine and cosine of each angle measure,  $\theta$ , and the coordinates of the point where the terminal ray intersects the unit circle. Explain your reasoning.

$\theta$	$\cos \theta$	$\sin \theta$	Coordinates of Point $B$ , (Intersection of Terminal Ray and Unit Circle)
$30^\circ$			
$45^\circ$			
$60^\circ$			

b. Write the coordinates of the intersection of the terminal ray and the unit circle at  $0^\circ$ .

c. Write the coordinates of the intersection of the terminal ray and the unit circle at  $90^\circ$ .

4. Jorge conjectured that the coordinates of the point where the terminal ray of a central angle  $\theta$  intersects the unit circle can always be written as  $(\cos \theta, \sin \theta)$ . Do you think Jorge's conjecture is correct? Explain your reasoning.





In the unit circle, you will label the first quadrant now. Then you will be able to determine the coordinates of the points in the other quadrants in the next activity.

Use the unit circle located at the end of this lesson and your answers to the questions in the Getting Started to complete this activity.

**1. Determine the coordinates of the points in the first quadrant on the unit circle. Label the coordinates.**

**2. Use the unit circle to evaluate each measure.**

$$\sin\left(\frac{\pi}{6} \text{ radian}\right) = \underline{\hspace{2cm}}$$

$$\cos\left(\frac{\pi}{6} \text{ radian}\right) = \underline{\hspace{2cm}}$$

$$\sin\left(\frac{\pi}{4} \text{ radian}\right) = \underline{\hspace{2cm}}$$

$$\cos\left(\frac{\pi}{4} \text{ radian}\right) = \underline{\hspace{2cm}}$$

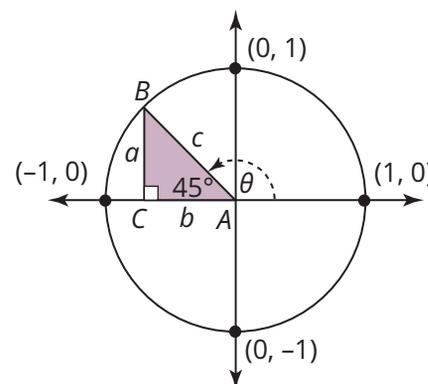
**3. For each angle measure in Question 2, evaluate the sine and cosine of the complement. Explain your reasoning.**

ACTIVITY  
**4.2**

# Unit Circle Coordinates Beyond Quadrant I



Now that you have identified values of sine and cosine in the first quadrant, how can you use that knowledge to identify values in other quadrants?



**1. The diagram shows a  $45^\circ$  central angle positioned in the second quadrant on the unit circle.**

**a. State the measure of  $\theta$  in degrees and in radians. Explain how you determined your answer.**

**b. Identify the coordinates of the point at which the terminal ray of the angle intercepts the circle. Explain how you determined your answer.**

**c. What do you notice about the coordinates of this point and the coordinates of the symmetrical point in the first quadrant?**

**2. Use what you know about symmetry to label the coordinates of the remaining points on the unit circle located at the end of the lesson.**

**3. Look back at Jorge's conjecture in the Getting Started. Is his conjecture correct? Explain your reasoning.**

## Remember:

When creating a triangle using a terminal ray, the right triangle drawn must always be bound to the x-axis.

## Think

about:

Does the cosine have a negative or a positive value? Does the sine have a negative or positive value?

4. Describe when the values of cosine and sine are positive and negative in the unit circle. Label this information on the unit circle at the end of the lesson.

5. Ray makes this conclusion.

Ray

Many different central angle measures have the same sine or cosine values.



Provide examples to support Ray's conclusion.

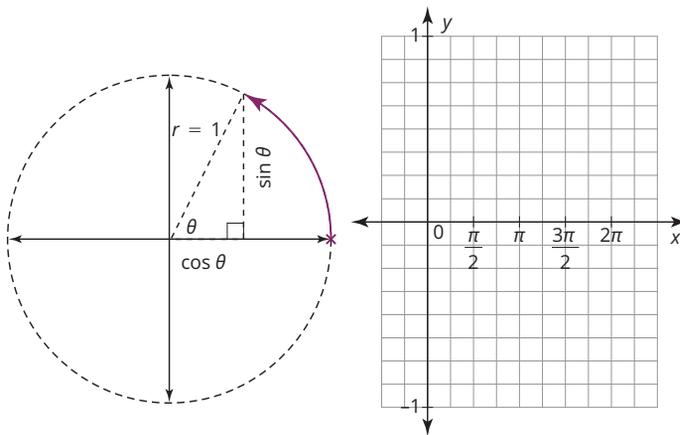


Let's consider how to represent the values from your unit circle as functions on a coordinate plane.

**1. Use your completed unit circle to graph the function  $y = \sin x$ .**

- a. As the terminal ray traverses the unit circle counterclockwise in standard position, plot the output value,  $\sin \theta$ , that corresponds to the input value,  $\theta$ , which is the radian measure of the central angle, from 0 to  $2\pi$  radians.**

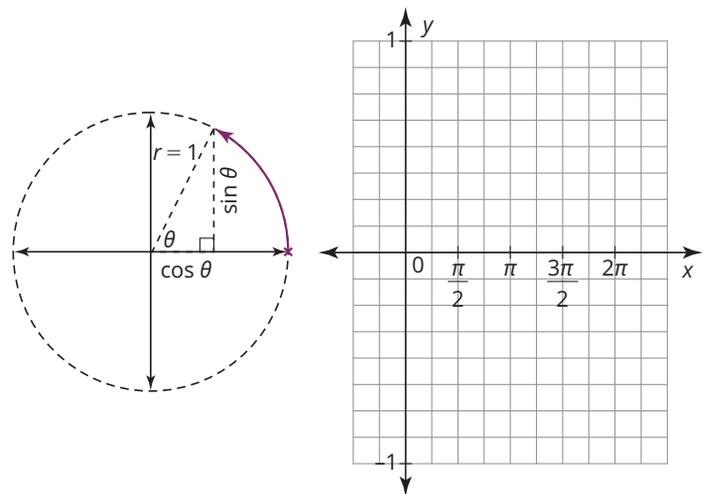
Plot the output values from left to right on the graph as you move counterclockwise around the unit circle.



- b. What coordinate values on the unit circle did you use to create the graph of  $y = \sin x$ ?**

**2. Use your completed unit circle to graph the function  $y = \cos x$ .**

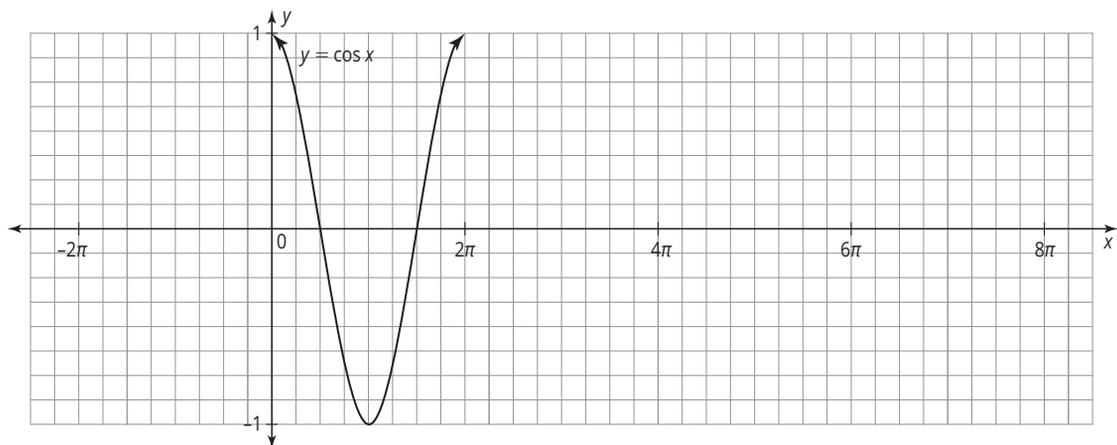
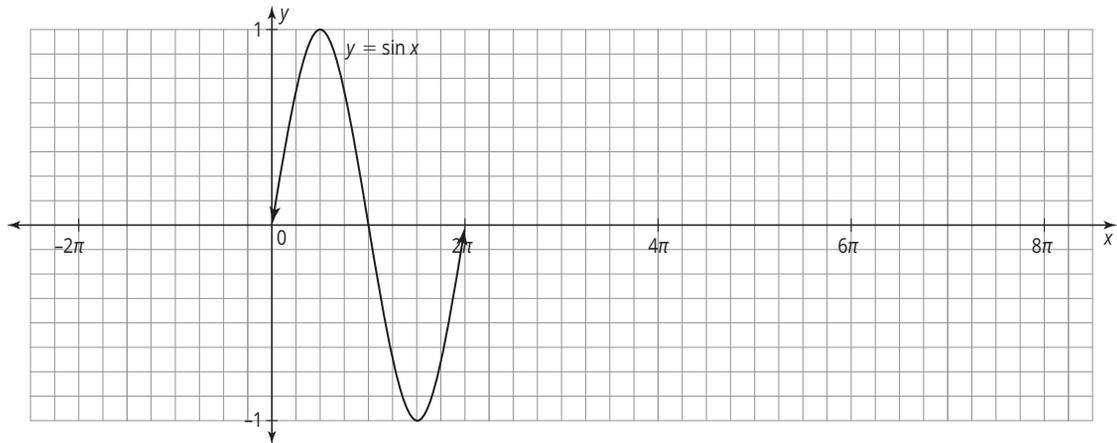
- a. As the terminal ray traverses the unit circle counterclockwise in standard position, plot the output value,  $\cos \theta$ , that corresponds to the input value,  $\theta$ , which is the radian measure of the central angle, from 0 to  $2\pi$  radians.**



- b. What coordinate values on the unit circle did you use to create the graph of  $y = \cos x$ ?**

You have graphed the *sine function* and *cosine function*. The **sine function** and **cosine function** are periodic **trigonometric functions**. Each of these trigonometric functions takes angle measures ( $\theta$  values) as inputs and outputs real number values, which correspond to coordinates of points on the unit circle.

**3. Consider the functions  $y = \sin x$  and  $y = \cos x$ .**



- a. Extend the graphs of the functions  $y = \sin x$  and  $y = \cos x$  over the domain  $0 \leq x \leq 8\pi$ .**

b. Determine the values of  $\sin x$  and  $\cos x$  at  $4\pi$ ,  $6\pi$ , and  $8\pi$  radians.

c. Describe how you can determine each value from part (b) on the unit circle for each function.

4. Now consider a domain of  $-2\pi \leq x \leq 8\pi$  for the functions  $y = \sin x$  and  $y = \cos x$ .

a. Extend the graphs of the functions  $y = \sin x$  and  $y = \cos x$  in Question 3 through  $x = -2\pi$ .

b. Determine each sine value.

$$\sin\left(-\frac{\pi}{2}\right) = \underline{\hspace{2cm}}$$

$$\sin(-\pi) = \underline{\hspace{2cm}}$$

$$\sin\left(-\frac{3\pi}{2}\right) = \underline{\hspace{2cm}}$$

$$\sin(-2\pi) = \underline{\hspace{2cm}}$$

c. Determine each cosine value.

$$\cos\left(-\frac{\pi}{2}\right) = \underline{\hspace{2cm}}$$

$$\cos(-\pi) = \underline{\hspace{2cm}}$$

$$\cos\left(-\frac{3\pi}{2}\right) = \underline{\hspace{2cm}}$$

$$\cos(-2\pi) = \underline{\hspace{2cm}}$$

Ask

yourself:

Can the sine and cosine functions output any real number, given any angle measure input?

5. Consider the values of  $\sin(x + 2\pi)$ . How do these values compare to the values of  $\sin x$ ?

6. Consider the values of  $\cos(x + 2\pi)$ . How do these values compare to the values of  $\cos x$ ?

The period of the sine function is  $2\pi$  radians, and the period of the cosine function is  $2\pi$  radians. Thus, you can write two *periodicity identities*:

- $\sin(x + 2\pi) = \sin x$
- $\cos(x + 2\pi) = \cos x$

Each of these is called a **periodicity identity** because they are each based on the period of the function,  $2\pi$ .

## TALK the TALK

### Comes Around

#### 1. Complete the table.

Angle Measure ( $\theta$ )		$\cos \theta$	$\sin \theta$	Angle Measure ( $\theta$ )		$\cos \theta$	$\sin \theta$
radians	degrees			radians	degrees		
0	$0^\circ$	1	0	$\frac{7\pi}{6}$	$210^\circ$		
$\frac{\pi}{6}$	$30^\circ$			$\frac{5\pi}{4}$	$225^\circ$		
$\frac{\pi}{4}$	$45^\circ$			$\frac{4\pi}{3}$	$240^\circ$		
$\frac{\pi}{3}$	$60^\circ$			$\frac{3\pi}{2}$	$270^\circ$		
$\frac{\pi}{2}$	$90^\circ$			$\frac{5\pi}{3}$	$300^\circ$		
$\frac{2\pi}{3}$	$120^\circ$			$\frac{7\pi}{4}$	$315^\circ$		
$\frac{3\pi}{4}$	$135^\circ$			$\frac{11\pi}{6}$	$330^\circ$		
$\frac{5\pi}{6}$	$150^\circ$			$2\pi$	$360^\circ$		
$\pi$	$180^\circ$						

#### 2. Compare and contrast the functions $y = \sin x$ and $y = \cos x$ . Describe the similarities and differences between the two functions.

3. Identify each of the characteristics for  $y = \sin x$  and  $y = \cos x$ .

	$y = \sin x$	$y = \cos x$
y-intercept(s)		
Domain		
Range		
Period		
Minimum Output Value		
Maximum Output Value		
Amplitude		
Midline		

4. Describe the intervals of increase and decrease for both the sine and cosine functions. Explain your reasoning.

5. Identify the  $x$ -intercepts for each function.

a.  $x$ -intercepts for  $y = \sin x$

b.  $x$ -intercepts for  $y = \cos x$

6. Use the language of transformations to explain how the sine and cosine functions are related.

Ask

yourself:

How can you write this relationship mathematically?

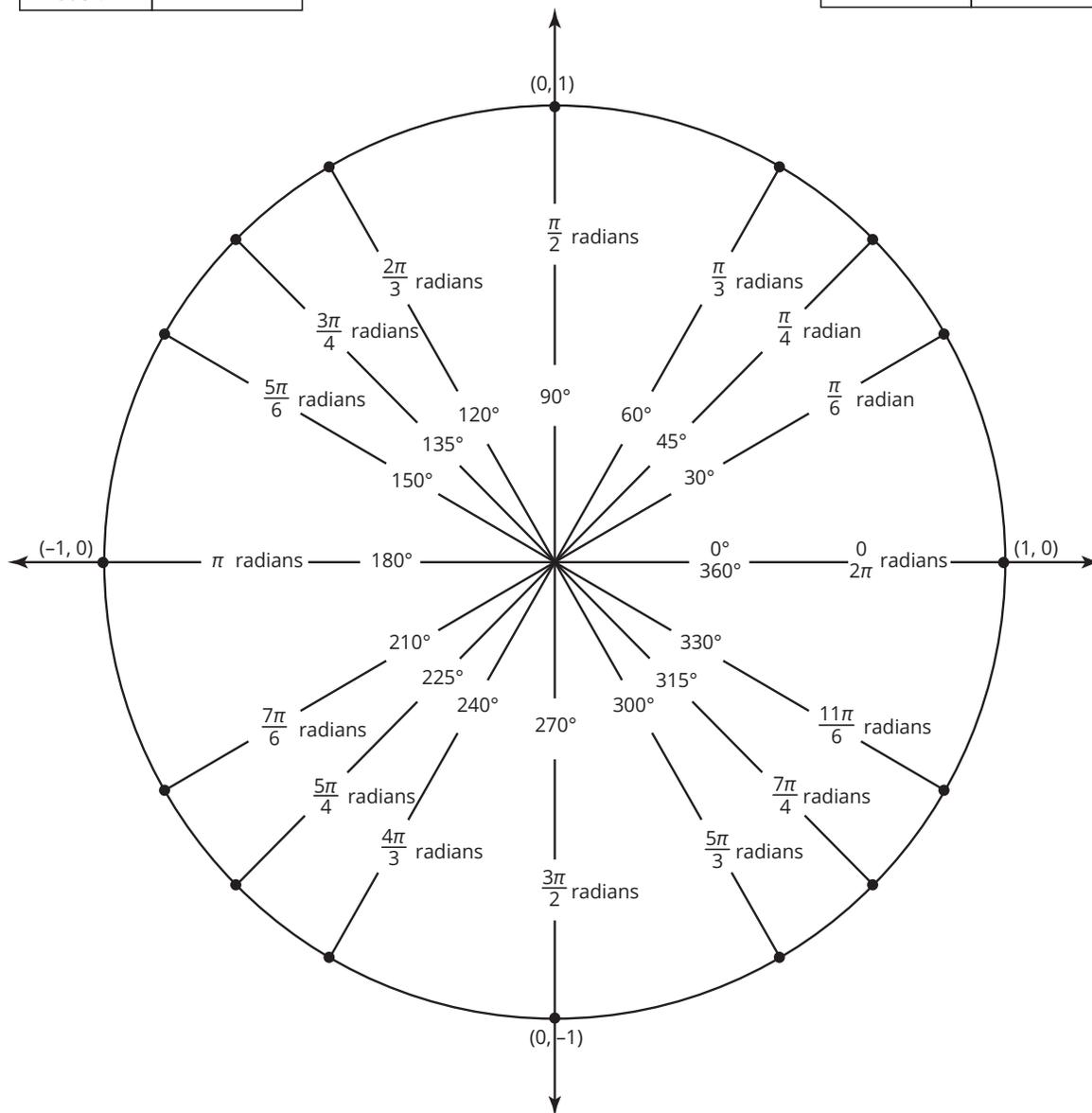
# Sine and Cosine on the Unit Circle

Quadrant II

$\sin \theta$	
$\cos \theta$	

Quadrant I

$\sin \theta$	
$\cos \theta$	



Quadrant III

$\sin \theta$	
$\cos \theta$	

Quadrant IV

$\sin \theta$	
$\cos \theta$	



# Assignment

## Write

Write a definition for each term in your own words.

1. sine function
2. cosine function
3. trigonometric function
4. periodicity identity

## Remember

The cosine of the central angle measure of a unit circle is the  $x$ -coordinate of the point where the terminal ray intersects the unit circle and the sine of the same central angle measure is the  $y$ -coordinate of the same point.

The sine function,  $y = \sin x$ , and cosine function,  $y = \cos x$ , are periodic trigonometric functions that take angle measures ( $\theta$  values) as inputs and outputs real number values, which correspond to coordinates of points on the unit circle. The period of each function is  $2\pi$  radians, therefore  $\sin(x + 2\pi) = \sin x$  and  $\cos(x + 2\pi) = \cos x$ .

## Practice

1. Determine  $\theta$  and  $\cos \theta$  when  $\sin \theta = \frac{\sqrt{3}}{2}$  and  $\cos \theta$  is negative. Restrict values for  $\theta$  such that  $0 \leq \theta \leq 2\pi$ .
2. Determine  $\theta$  and  $\sin \theta$  when  $\cos \theta = -\frac{\sqrt{2}}{2}$  and  $\sin \theta$  is negative. Restrict values for  $\theta$  such that  $0 \leq \theta \leq 2\pi$ .
3. Determine 3 values for  $\theta$  such that  $\sin \theta = -\frac{\sqrt{3}}{2}$ .
4. Determine 3 values for  $\theta$  such that  $\cos \theta = \frac{\sqrt{2}}{2}$ .
5. Determine 3 values for  $\theta$  such that  $\cos \theta = 0$ .
6. Determine the value of each ratio.
  - a.  $\sin\left(\frac{15\pi}{4}\right)$
  - b.  $\cos\left(\frac{17\pi}{6}\right)$
  - c.  $\sin\left(\frac{25\pi}{6}\right)$
  - d.  $\cos\left(\frac{19\pi}{4}\right)$

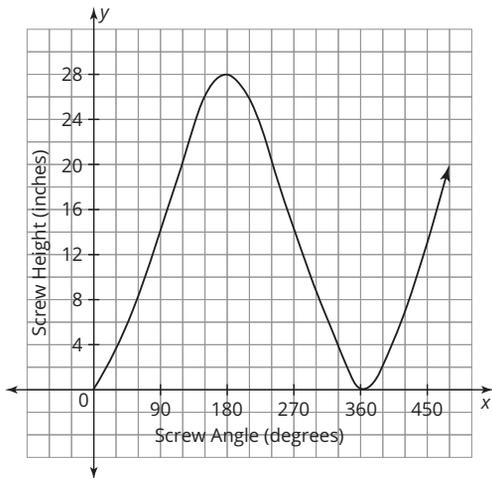
## Stretch

1. Determine  $\theta$  and  $\sin \theta$  when  $\cos\left(\frac{\theta}{2}\right) = -\frac{\sqrt{3}}{2}$ . Restrict values for  $\theta$  such that  $0 \leq \theta \leq 2\pi$ .
2. Complete the table of values for the functions shown.

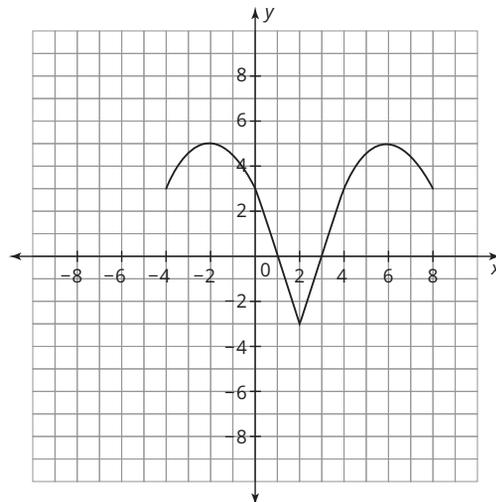
		Function			
		$\sin \theta$	$2\sin \theta$	$\sin \theta + 1$	$\sin(\theta + \pi)$
Angle Measure ( $\theta$ )	0				
	$\frac{\pi}{6}$				
	$\frac{\pi}{4}$				
	$\frac{\pi}{3}$				
	$\frac{\pi}{2}$				

## Review

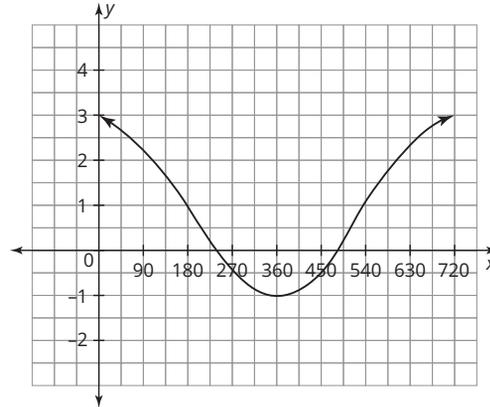
1. Ahmed is riding his bike. The tires on the bike have a diameter of 28 inches. He runs over a screw, but is able to keep riding the bike. Assume the tire rotates clockwise and the screw is at an angle of  $0^\circ$  when it is at ground level. The graph shows the height of the screw above the ground as a function of the angle of the screw.



- Determine the amplitude of the function.
  - Determine the period of the function.
  - Determine the height of the screw when the screw angle is  $630^\circ$ .
3. Write the equations of the two relations used to create this bird in terms of the function  $f(x) = x^2$ . Include any restrictions on the domains.



2. Consider the periodic function shown, with  $x$  in degrees.



- Determine the amplitude of the function.
- Determine the period of the function.
- Determine the value of the function when  $x = 900^\circ$ .

# 5

# The Sines They Are A-Changin'

## Transformations of Sine and Cosine Functions

### Warm Up

Determine the output for each function when  $x = \frac{\pi}{2}$ .

1.  $y = 2 \sin x$
2.  $y = \cos x - 3$
3.  $y = \sin(2x)$

### Learning Goals

- Transform the graphs of the sine and cosine functions.
- Determine the amplitude, frequency, and phase shift of transformed functions.
- Graph transformed sine and cosine functions using a description of the period, phase shift, and amplitude.

### Key Terms

- frequency
- phase shift

You have graphed the basic sine and cosine functions and reasoned that adding  $2\pi$  to the argument of each function translates the function onto itself. How do the  $A$ -,  $B$ -,  $C$ -, and  $D$ -values in the transformation function form,  $g(x) = Af(B(x - C)) + D$  affect the graphs of the basic sine and cosine functions?

## The Sines They Are A-Changin'

The table shows the characteristics of the graphs of the sine and cosine functions.

	$y = \sin x$	$y = \cos x$
<b>y-intercept</b>	(0, 0)	(0, 1)
<b>Domain</b>	$(-\infty, \infty)$	$(-\infty, \infty)$
<b>Range</b>	$[-1, 1]$	$[-1, 1]$
<b>Period</b>	$2\pi$	$2\pi$
<b>Minimum Output Value</b>	-1	-1
<b>Maximum Output Value</b>	1	1
<b>Amplitude</b>	1	1
<b>Midline</b>	$y = 0$	$y = 0$

Recall that transformations performed on any function  $f(x)$  to form a new function  $g(x)$  can be described by the transformation function form.

$$g(x) = Af(B(x - C)) + D$$

### Ask

In general, what effect does multiplying a function  $y = f(x)$  by a constant,  $A$ , have on the graph of the function?

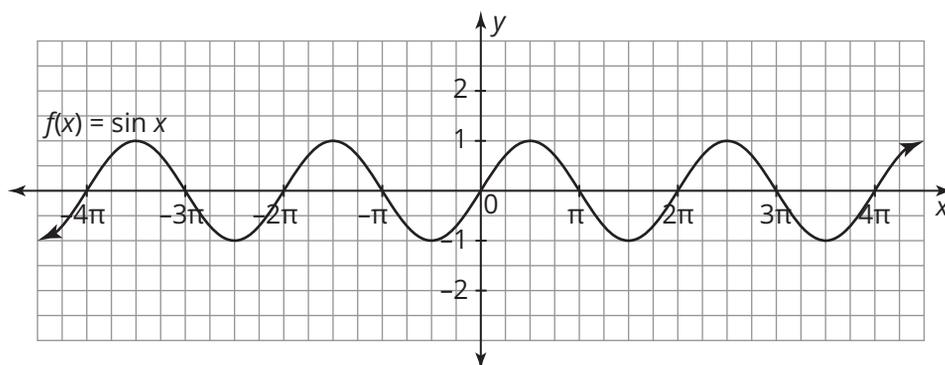
- Which characteristics of the transformed function  $y = A \sin x$  differ from those of the basic function  $y = \sin x$  if  $|A| > 0$ ? Which characteristics remain the same? Explain your predictions.

	$y = A \sin x$	
	Will Change	Won't Change
<b>y-intercept</b>		
<b>Domain</b>		
<b>Range</b>		
<b>Period</b>		
<b>Minimum Output Value</b>		
<b>Maximum Output Value</b>		
<b>Amplitude</b>		
<b>Midline</b>		



Let's investigate how the  $A$ -value affects the graph of  $y = \sin x$ .

1. A graph of the function  $f(x) = \sin x$  is shown. Sketch the graphs of the functions  $g(x) = 2 \sin x$  and  $h(x) = \frac{1}{2} \sin x$  on the same coordinate plane.



2. What similarities and differences do you notice about the three functions with respect to their periods, intercepts, and maximum and minimum values?

3. How do your graphs of the transformed functions compare with your predictions in the Getting Started?

Ask

yourself:

How is each value of the basic function affected by the transformation?



**Remember:**

The amplitude of a sine or cosine function is one-half the absolute value of the difference between the maximum and minimum values of the function.

4. Determine the maximum, minimum, and amplitude of each function you graphed.

a.  $g(x) = 2 \sin x$

b.  $h(x) = \frac{1}{2} \sin x$

5. Determine the maximum, minimum, and amplitude of each cosine function.

a.  $f(x) = \cos x$

b.  $g(x) = 3 \cos x$

c.  $h(x) = \frac{1}{4} \cos x$



Let's consider what effect multiplying the argument of a sine or cosine function by a constant,  $B$ , has on the graph of the function. The transformed function can be written as  $y = \sin(Bx)$  or  $y = \cos(Bx)$

### 1. Which characteristics of the transformed function

$y = \cos(Bx)$  differ from those of the basic function  $y = \cos x$  if  $|B| > 0$ ? Which characteristics remain the same? Explain your predictions.

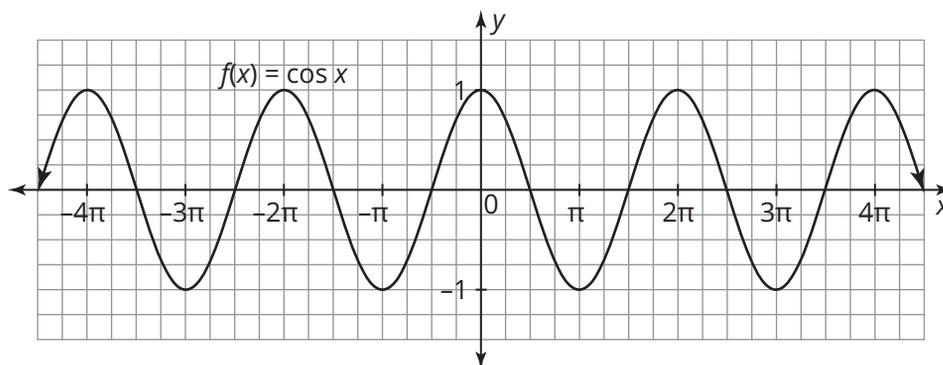
	$y = \cos(Bx)$	
	Will Change	Won't Change
y-intercept		
Domain		
Range		
Period		
Minimum Output Value		
Maximum Output Value		
Amplitude		
Midline		

## Ask

### yourself:

In general, what effect does multiplying the argument of a function  $y = f(x)$  by a constant,  $B$ , have on the graph of the function?

2. A graph of the function  $f(x) = \cos x$  is shown. Sketch the graphs of the functions  $g(x) = \cos(4x)$  and  $h(x) = \cos\left(\frac{1}{2}x\right)$  on the same coordinate plane.



3. What similarities and differences do you notice about the three functions with respect to their periods, intercepts, and maximum and minimum values?
4. How do your graphs of the transformed functions compare with your predictions in Question 1?
5. How do the equations of the functions you graphed relate to the similarities and differences in the graphs?

Recall that the period of a periodic function is the length of the smallest interval over which the function repeats.

**Think**

about:

What pattern do you see in the periods and the  $B$ -values?

6. Determine the period of each function from the graph.
- $f(x) = \cos(x)$
  - $g(x) = \cos(4x)$
  - $h(x) = \cos\left(\frac{1}{2}x\right)$

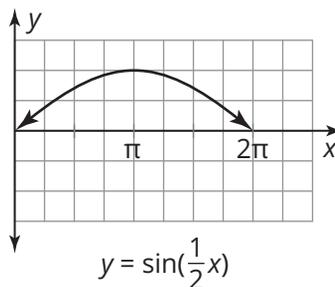
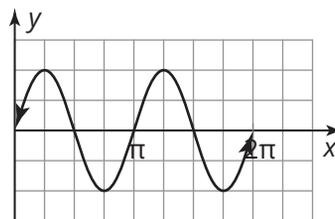
The  $B$ -value stretches or compresses a periodic function horizontally, so changes to the  $B$ -value have an effect on the period of the function.

### Worked Example

The basic function  $y = \sin x$  has a period of  $2\pi$  radians. You can determine the period of the transformed sine function by interpreting the  $B$ -value.

When the  $B$ -value is 2, there are 2 repetitions of the function in the original period, so the period is  $\frac{1}{|B|} \cdot 2\pi$ , or  $\frac{1}{2} \cdot 2\pi = \pi$  radians.

When the  $B$ -value is  $\frac{1}{2}$ , there is  $\frac{1}{2}$  of a repetition of the function in the original period, so the period is  $\frac{1}{|B|} \cdot 2\pi$ , or  $2 \cdot 2\pi = 4\pi$  radians.



**7. Write an expression to describe the period of the functions  $y = \sin(Bx)$  and  $y = \cos(Bx)$ .**

*Frequency* is related to the period of the function. The **frequency** of a periodic function is the reciprocal of the period and specifies the number of repetitions of the graph of a periodic function per unit.

**8. Write an expression to describe the frequency of the functions  $y = \sin(Bx)$  and  $y = \cos(Bx)$ . Explain your reasoning.**

**9. Determine the period and frequency of each sine function.**

a.  $f(x) = \sin(3x)$

b.  $g(x) = \sin\left(\frac{2}{3}x\right)$

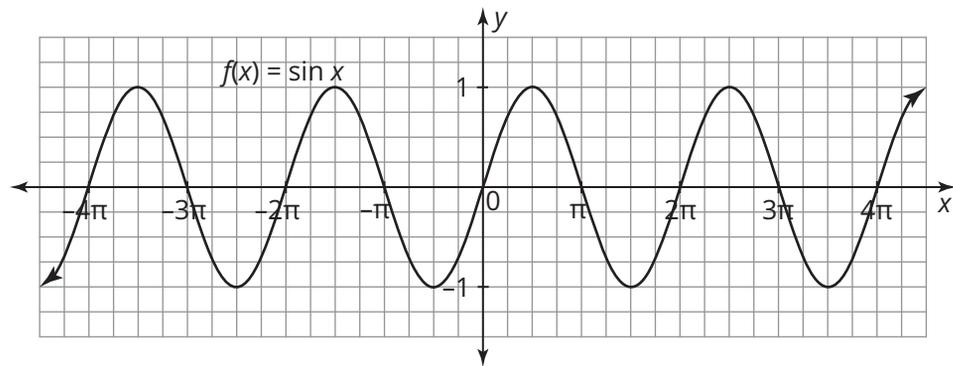
c.  $h(x) = \sin\left(\frac{1}{4}x\right)$



Now consider what effect subtracting a constant,  $C$ , from the argument of a sine or cosine function has on the graph of the function. The transformed function can be written as  $y = \sin(x - C)$  or  $y = \cos(x - C)$ .

1. Sketch graphs of the functions shown over the domain  $-4\pi \leq x \leq 4\pi$ .

a.  $g(x) = \sin\left(x + \frac{\pi}{2}\right)$   
 b.  $h(x) = \sin(x - \pi)$



2. What similarities and differences do you notice about the three functions in terms of their maximums, minimums, periods, and amplitudes?

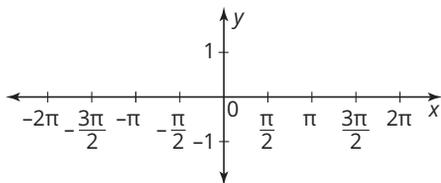
3. How do the equations of the functions you graphed relate to the similarities and differences in the graphs?

Transforming a periodic function by subtracting a  $C$ -value from the argument of the function results in horizontal translations of the function. These transformations act just as they have on other functions you have studied. For periodic functions, horizontal translations are called **phase shifts**.

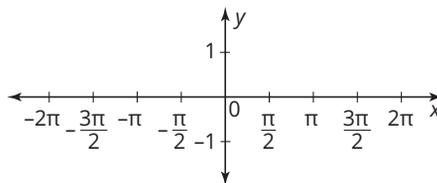
**4. Predict the effect of adding a constant,  $D$ , to a sine or cosine function  $y = f(x)$ .**

**5. Use what you know about transformations to sketch the graph of each function.**

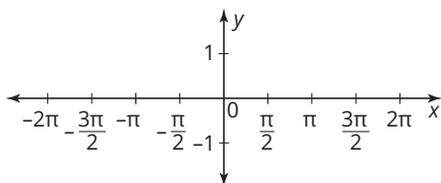
**a.  $y = -\sin x$**



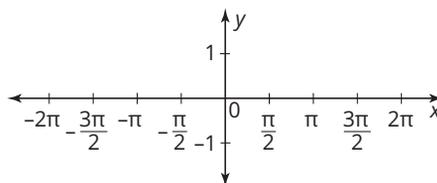
**b.  $y = \sin(-x)$**



**c.  $y = -\cos x$**



**d.  $y = \cos(-x)$**



**e. Compare and contrast the graphs you sketched. What do you notice?**

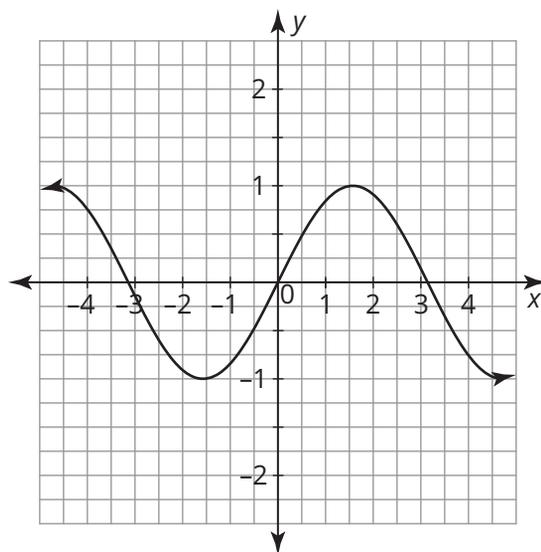
6. Complete the table to describe the graph of each function as a transformation of  $y = f(x)$ .

Sine or Cosine Function	Equation Information	Description of Transformation of Sine or Cosine Graph	Effect on Period, Amplitude, Midline, Phase Shift
$y = Af(x)$	$ A  > 1$	vertical stretch by a factor of $ A $ units	
	$0 <  A  < 1$	vertical compression by a factor of $ A $ units	
	$A < 0$	reflection across the x-axis	
$y = f(Bx)$	$ B  > 1$	horizontal compression by a factor of $\frac{1}{ B }$	
	$0 <  B  < 1$	horizontal stretch by a factor of $\frac{1}{ B }$	
	$B < 0$	reflection across the y-axis	
$y = f(x - C)$	$C > 0$	horizontal shift right $C$ units	
	$C < 0$	horizontal shift left $C$ units	
$y = f(x) + D$	$D > 0$	vertical shift up $D$ units	
	$D < 0$	vertical shift down $D$ units	

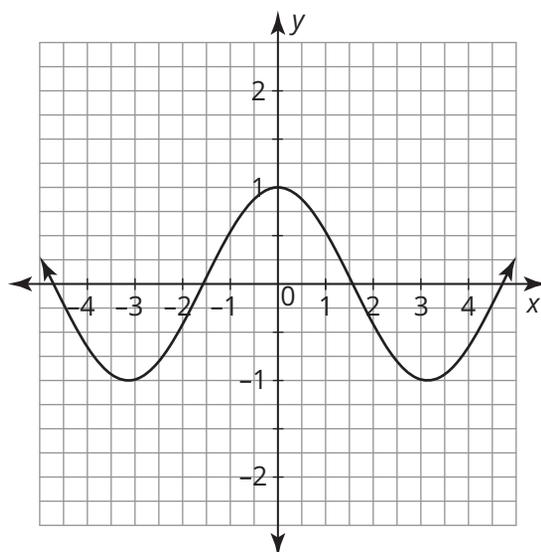
TALK the TALK 

## Shifting Perspectives

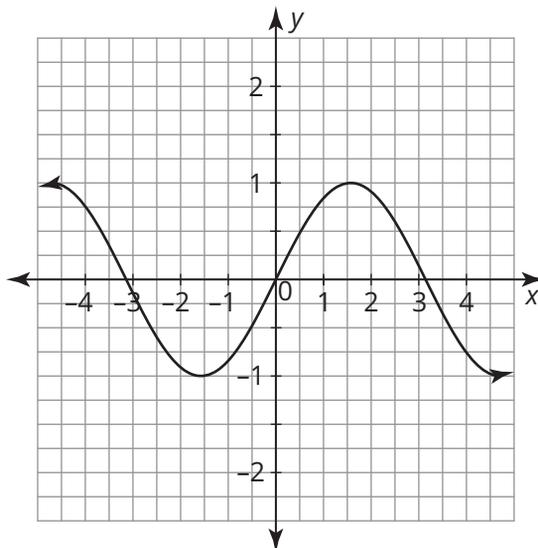
1. Identify the function graphed.



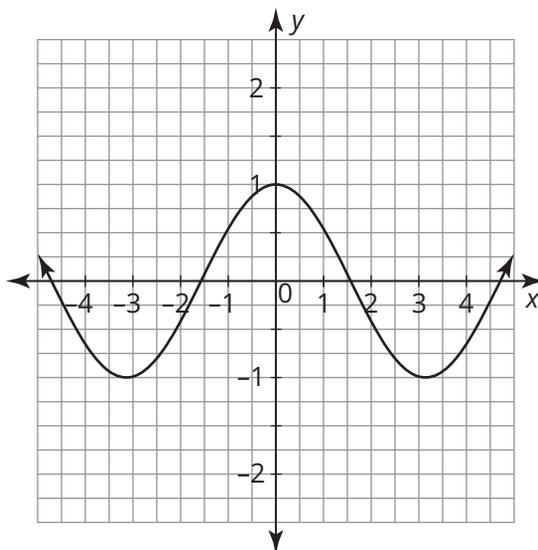
2. Identify the function graphed.



3. The graph shows  $y = \sin x$ . Rewrite the sine function as two different transformed cosine functions.



4. The graph shows  $y = \cos x$ . Rewrite the cosine function as two different transformed sine functions.



# Assignment

## Write

Write the word(s) that best completes each statement.

1. The \_\_\_\_\_ of a periodic function is the reciprocal of the period and specifies the number of repetitions of the graph of a periodic function per unit.
2. For periodic functions, a horizontal translation is called a \_\_\_\_\_.

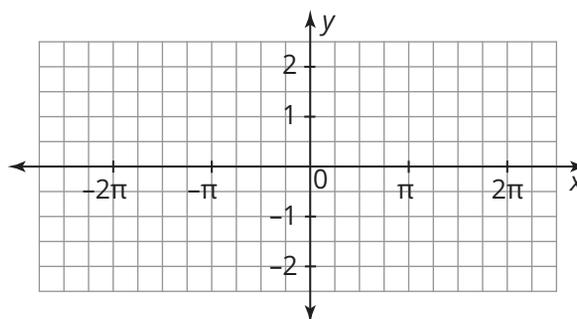
## Remember

Given the transformed functions  $y = A \sin(B(x - C)) + D$  and  $y = A \cos(B(x - C)) + D$ , the  $A$ -value affects the range, minimum and maximum output values, and the amplitude of the basic function, the  $B$ -value affects the period and frequency of the basic function, the  $C$ -value is interpreted as the phase shift, and the  $D$ -value affects the midline.

## Practice

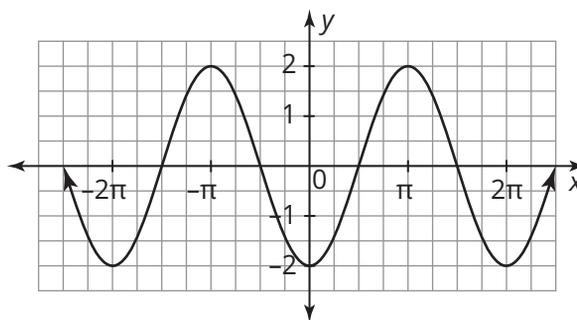
1. To create the function  $m(x)$ , the function  $f(x) = \sin x$  is first reflected across the  $x$ -axis. Then, the amplitude is increased to 1.5 and the period was changed to  $\pi$  radians.

- a. Graph the function  $m(x)$ .
- b. Write the function  $m(x)$ .



2. Consider the given graph of a trigonometric function.

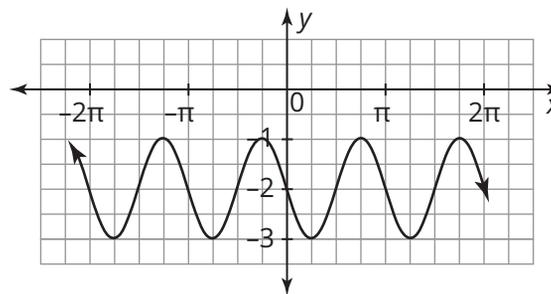
- a. Write the function  $g(x)$  that matches the given graph if the function  $g(x)$  is a transformation of the function  $f(x) = \sin x$ .
- b. Determine the amplitude, period, frequency, and phase shift of  $g(x)$ .
- c. Write the function  $h(x)$  that matches the given graph if the function  $h(x)$  is a transformation of the function  $f(x) = \cos x$ .
- d. Determine the amplitude, period, frequency, and phase shift of  $h(x)$ .



3. The function  $f(x) = \sin x$  has been horizontally stretched by a factor of 2 and shifted up 3 units to create the function  $t(x)$ . Write the function  $t(x)$ .
4. The function  $f(x) = \cos x$  has been vertically compressed by a factor of  $\frac{1}{4}$  and shifted  $\frac{3\pi}{2}$  radians to the right to create the function  $p(x)$ . Write the function  $p(x)$ .

## Stretch

- Consider the given graph of a trigonometric function.
  - Write the function  $g(x)$  if  $g(x)$  is a transformation of  $f(x) = \sin x$ .
  - Determine the amplitude, period, frequency, and phase shift of  $g(x)$ .
  - Write the function  $h(x)$  if  $h(x)$  is a transformation of  $f(x) = \cos x$ .
  - Determine the amplitude, period, frequency, and phase shift of  $h(x)$ .



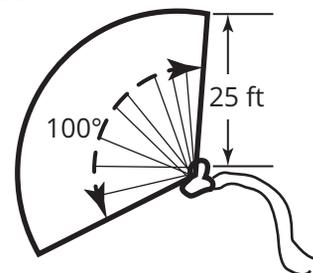
- The tangent of  $\theta$  is the ratio of  $\sin \theta$  to  $\cos \theta$ . Use your knowledge of the unit circle and the sine and cosine functions to determine  $\tan \theta$  for each value of  $\theta$ .
 

a. 0 radians	c. $\frac{2\pi}{3}$ radians	e. $\frac{3\pi}{2}$ radians
b. $\frac{\pi}{6}$ radians	d. $\frac{5\pi}{4}$ radians	f. $\frac{11\pi}{6}$ radians

## Review

- A satellite in a low Earth orbit completes one orbit every 90 minutes. The satellite follows a circular path with its center at the center of the earth. The satellite is at an altitude of 160 kilometers. The radius of the earth is 6371 kilometers.
  - Determine the angle of rotation, in radians, that corresponds to a 15-minute time period.
  - Determine the distance traveled by the satellite in a 15-minute time period.

- Archie is watering his lawn with a sprinkler attached to a hose. The outer path of the spray is an arc with the center at the sprinkler and a central angle of  $100^\circ$ . The distance from the sprinkler to any point on the outer path is 25 feet. Determine the central angle of the outer path in radians and the length of the outer path of the spray.



- An owner of two large commercial buildings is trying to make the buildings more environmentally friendly. She has the building's bathroom facilities revamped with more modern energy saving equipment. She also places signs in the buildings encouraging the occupants to conserve water. On the first day after the building reconstruction is complete, Building A used 21,150 gallons of water and Building B used 24,325 gallons of water. For the remaining 29 days of the first month, Building A's water usage decreased by 0.5% each day while Building B's water usage decreased by 0.75% each day.
  - Determine the total amount of water used by each building during the first month. Round decimals to the nearest hundredth.
  - The cost of water for the state Building A is located in is \$.00785 per gallon. After day 15 of the first month after reconstruction, the state raised its rates to \$.00795. Determine how much the owner paid for water for the first month after reconstruction was done at the building.

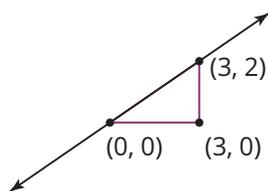
# Farmer's Tan

## The Tangent Function

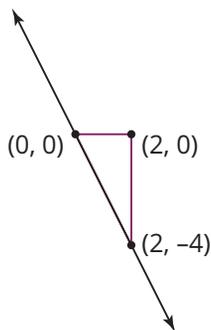
### Warm Up

Determine the slope of each line.

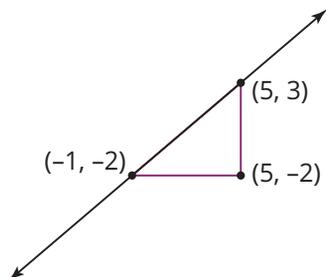
1.



2.



3.



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### Learning Goals

- Build the graph of the tangent function using the ratio  $\frac{\sin \theta}{\cos \theta}$ .
- Analyze characteristics of the tangent function, including period and asymptotes.
- Calculate values of the tangent function for common angles.
- Identify transformations of the tangent function.
- Use symmetry to determine the sine, cosine, and tangent of angle measures given by  $\theta$ ,  $\pi - \theta$ ,  $\pi + \theta$ , and  $2\pi - \theta$  in radians.

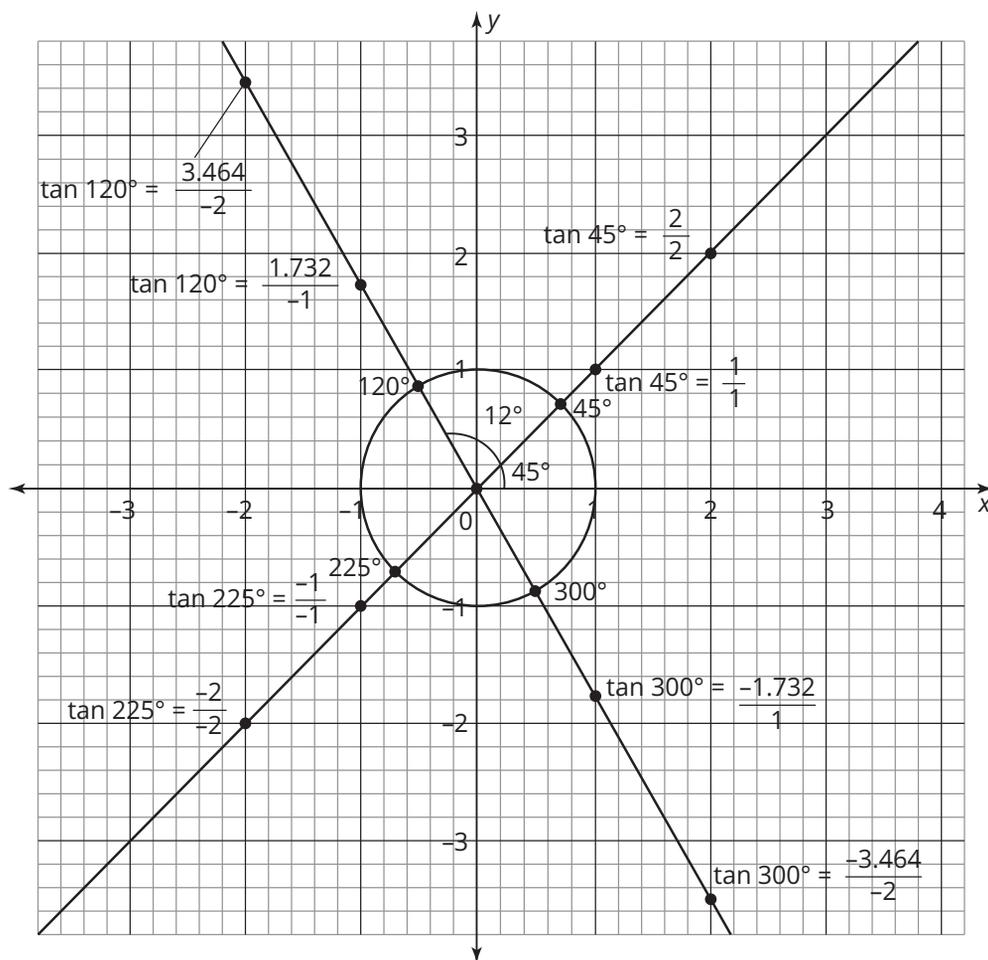
### Key Term

- tangent function

You have learned about the tangent ratio as defined in a right triangle. How can you build the tangent function using a unit circle?

## Let's Not Forget About Similarity

You know that the tangent of an acute angle in a right triangle is the ratio of the opposite side to the adjacent side. You can also determine the tangents of angles directly from the coordinate plane, using similar right triangles and the unit circle centered at the origin.



**1. Consider the unit circle shown.**

**a. How are similar triangles used to determine the tangent of a  $45^\circ$  angle?**

**b. How are similar triangles used to determine the tangent of a  $120^\circ$  angle?**

**2. Explain why the tangent of a  $45^\circ$  angle is the same as the tangent of a  $225^\circ$  angle, and why the tangent of a  $120^\circ$  angle is the same as the tangent of a  $300^\circ$  angle.**

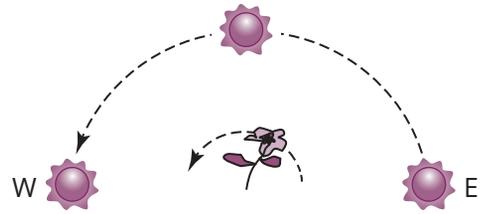


ACTIVITY  
**6.1**

# Constructing the Tangent Function



Many plants exhibit the ability to track sunlight as the Sun moves across the sky during the day. This movement is called phototropism.



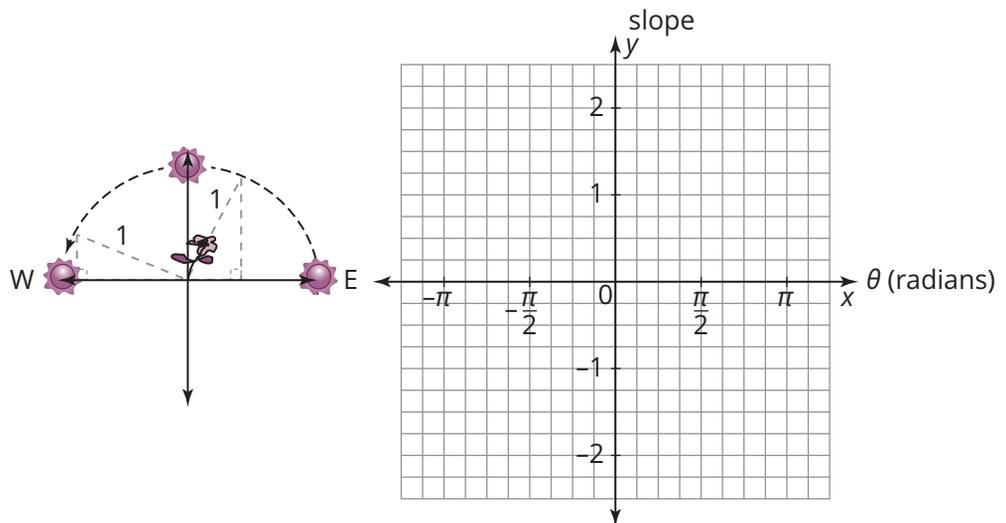
Imagine that flowers face due east in the morning where the Sun rises, and they track the sunlight throughout the day as the Sun moves directly overhead and then to the west.

**1. Suppose you track the slope of the angle that a flower makes with the ground over the course of a day. Create a visual interpretation of the changing slope on the graph as you answer each question.**

**a. What is the value of the slope at  $\theta = 0$  radians,  $\frac{\pi}{4}$  radian, and  $\frac{\pi}{2}$  radians on the unit circle? Explain your reasoning.**

**Ask yourself:**

Is the slope defined for all values of theta?



b. Describe the value of the slope as  $\theta$  increases from 0 radians and approaches  $\frac{\pi}{2}$  radians.

c. What is the value of the slope at  $\theta = \frac{3\pi}{4}$  radians and  $\pi$  radians? Explain how you determined each value.

Think

about:

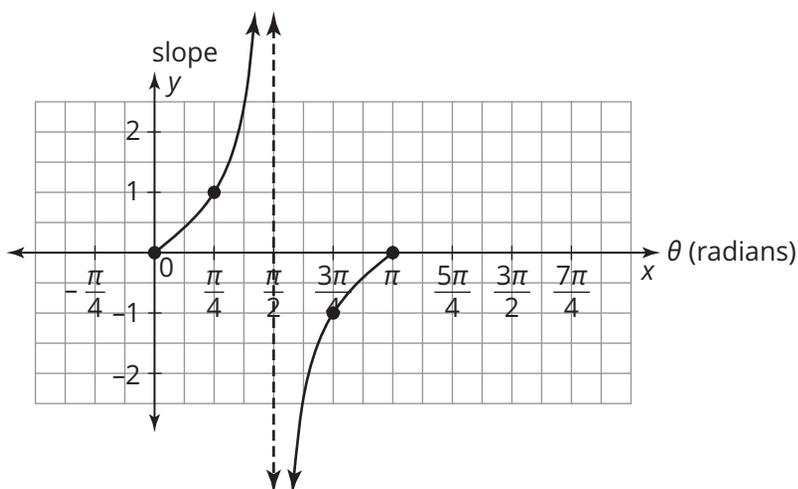
Can you use symmetry to determine other slope values?

d. Describe the value of the slope as  $\theta$  decreases from  $\pi$  radians and approaches  $\frac{\pi}{2}$  radians.

At night, flowers do not continue to follow the Sun after it sets.

But suppose the flower represents the terminal ray of a central angle in standard position. Let's continue to model the change in the slope of the terminal ray as it traverses the unit circle.

2. Use your answers to Question 1 and what you know about symmetry to answer each question.

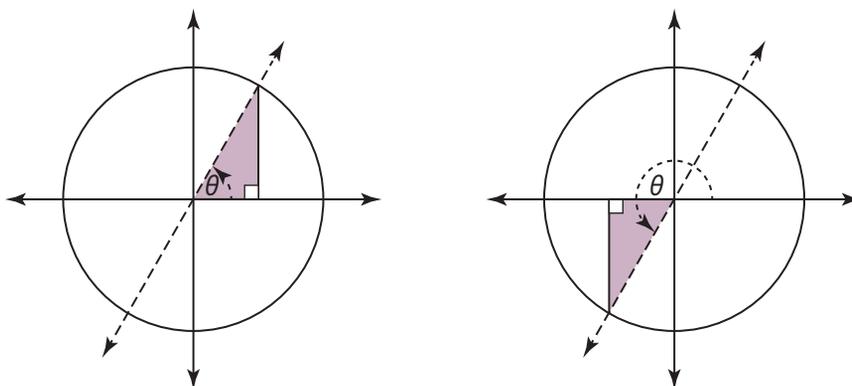


- Complete the graph of the slope values from  $-\frac{\pi}{2}$  radians to  $2\pi$  radians.
- For what value(s) of  $\theta$  is the slope equal to 0?
- For what value(s) of  $\theta$  is the slope undefined?

To help you think about slope values, you can remember that the terminal ray is a part of a line.

### Worked Example

The triangles shown in the diagram are congruent. The hypotenuse of each triangle represents a terminal ray of a central angle with measure  $\theta$ .



The slope of the terminal ray shown in Quadrant I is the same as the slope of the terminal ray shown in Quadrant III, because both rays are part of the same line. Both slopes are positive.

3. Use the worked example and your completed graph in Question 2 to answer each question.

a. For what value(s) of  $\theta$  is the slope equal to 1?

b. For what value(s) of  $\theta$  is the slope equal to  $-1$ ?

4. Use your completed graph to answer each question.

a. Explain why the relation you graphed is a function.

b. Is the function periodic? If so, determine the period of the function. If not, explain why not.

What special triangle has a “rise” and “run” that are equal?

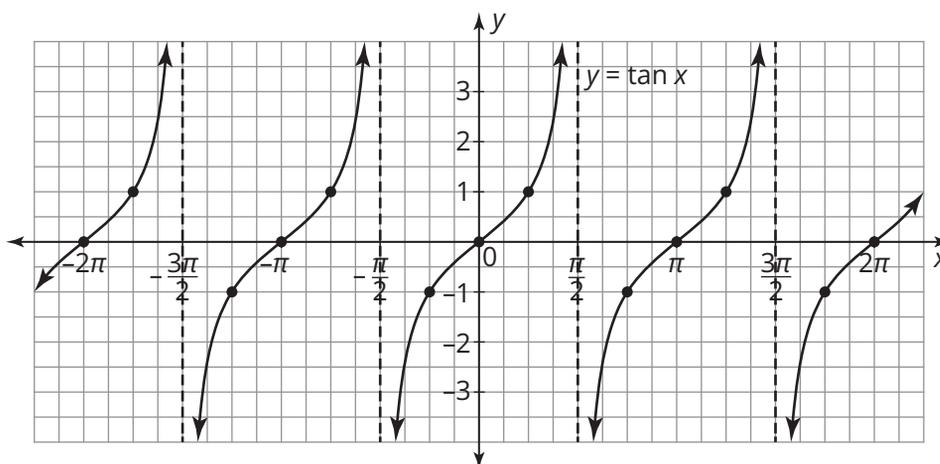
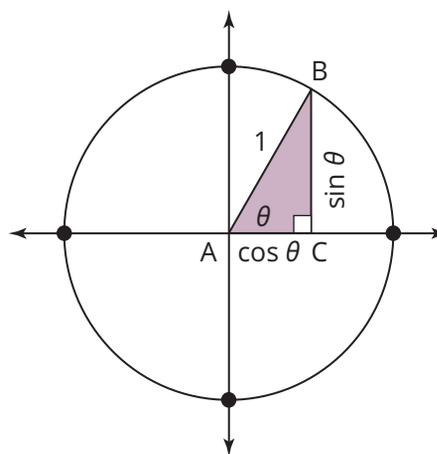
5. James said that the period of the function is  $2\pi$  radians because the graph starting at  $2\pi$  radians repeats the same values as it does starting at 0 radians. Juli says that the period of the function is  $\frac{\pi}{2}$  radians, because there is an asymptote at multiples of  $\frac{\pi}{2}$  radians.

Who is correct? Explain your reasoning.





The function that you graphed in the previous problem is the **tangent function**. Recall that the tangent ratio ( $\tan$ ) is the ratio of the lengths of the opposite side and the adjacent side in a right triangle. The tangent ratio is equal to the slope of the hypotenuse, which represents the terminal ray of the central angle on the unit circle.



1. How can you write the tangent function in terms of sine and cosine, using the unit circle?
2. In which quadrants is the tangent function positive and negative? Explain your reasoning. Record this information on the Sine, Cosine, and Tangent on the Unit Circle diagram located at the end of the lesson.
3. Use what you know about rational functions to describe the discontinuities in the graph of the tangent function.

4. What is the value of  $\tan\left(\frac{n\pi}{2}\right)$  for any odd integer value of  $n$ ?

5. Identify the periodicity identity for the tangent function. Explain your reasoning.

6. The table shows some of the characteristics of the sine and cosine functions that you have identified. Complete the table for the tangent function.

	$y = \sin x$	$y = \cos x$	$y = \tan x$
y-intercept	(0, 0)	(0, 1)	
Domain	$(-\infty, \infty)$	$(-\infty, \infty)$	
Range	$[-1, 1]$	$[-1, 1]$	
Period	$2\pi$	$2\pi$	
Minimum Output Value	-1	-1	
Maximum Output Value	1	1	
Amplitude	1	1	
Midline	$y = 0$	$y = 0$	

7. Complete the Sine, Cosine, and Tangent on the Unit Circle diagram located at the end of the lesson by labeling the tangent values for each angle measure.

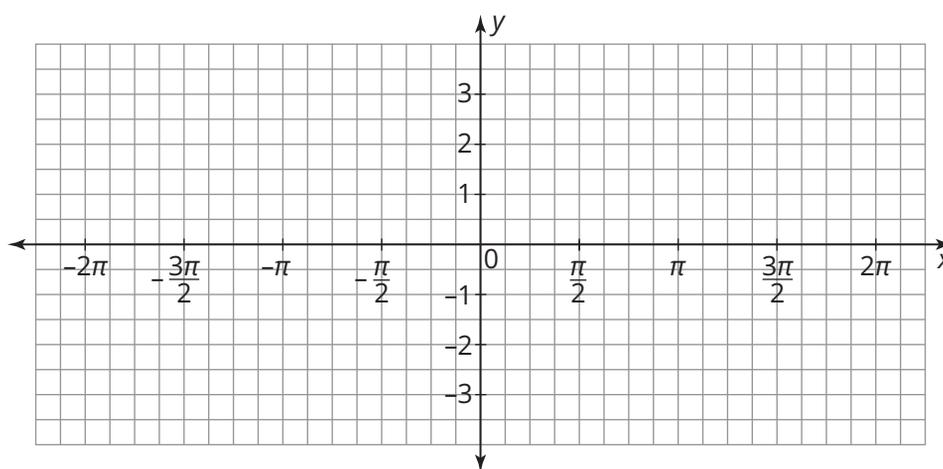
**Remember:**

You have identified periodicity identities for both the sine function and cosine function.

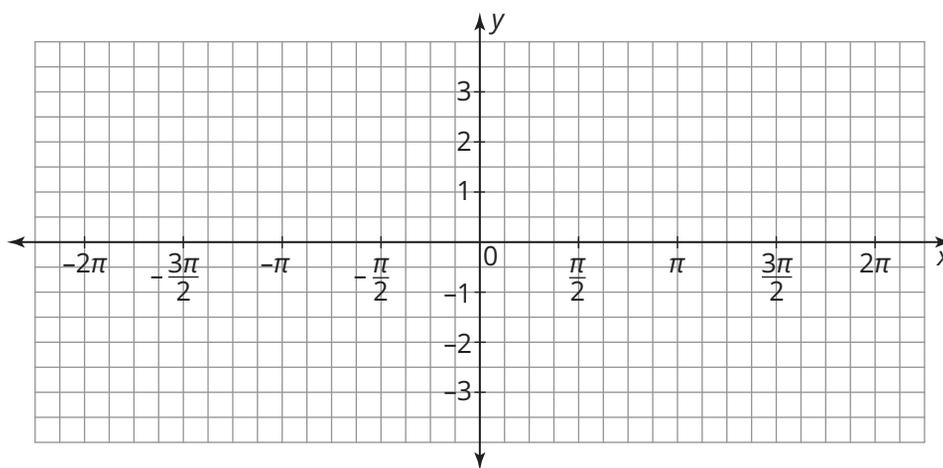


1. Use what you know about transformations to sketch each graph.

a.  $f(x) = -\tan x$



b.  $g(x) = \tan(-x)$



c. What do you notice about the graphs in parts (a) and (b)?

Ask

yourself:

What happens to the slope of a line when you reflect it across the  $x$ -axis or the  $y$ -axis?

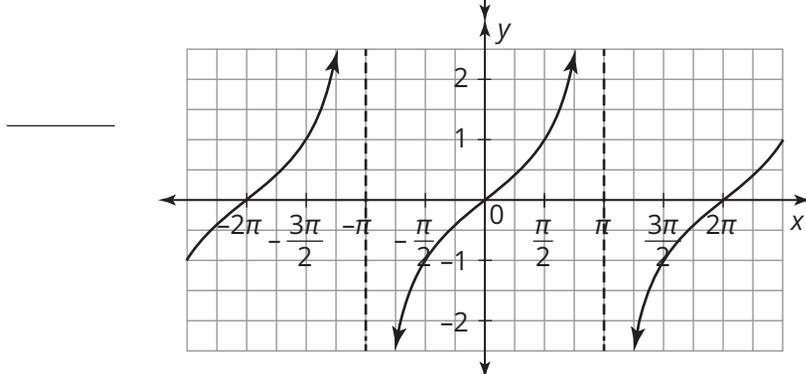
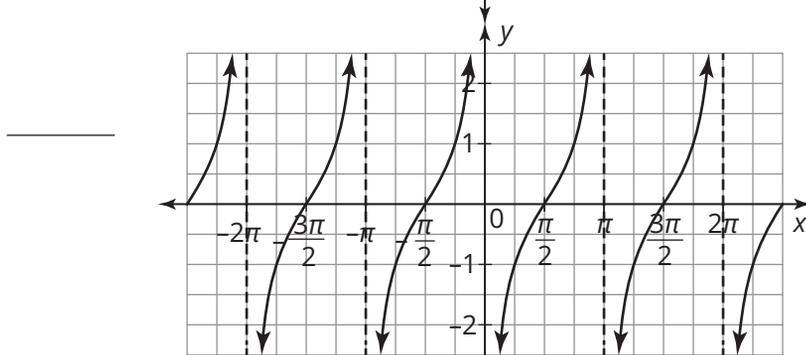
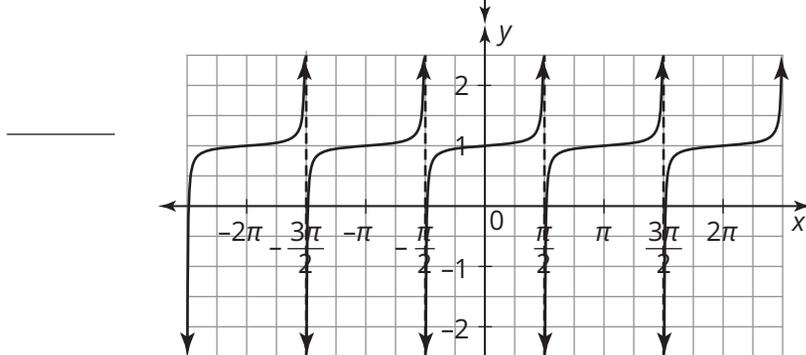
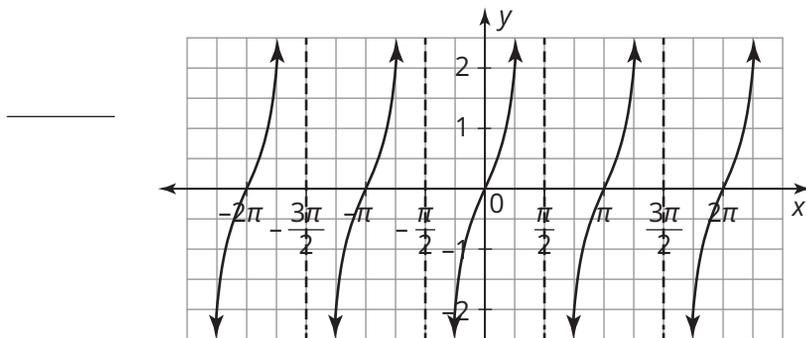
2. Match each equation with its corresponding graph. Explain your reasoning.

a.  $y = \tan\left(\frac{1}{2}x\right)$

b.  $y = \tan\left(x + \frac{\pi}{2}\right)$

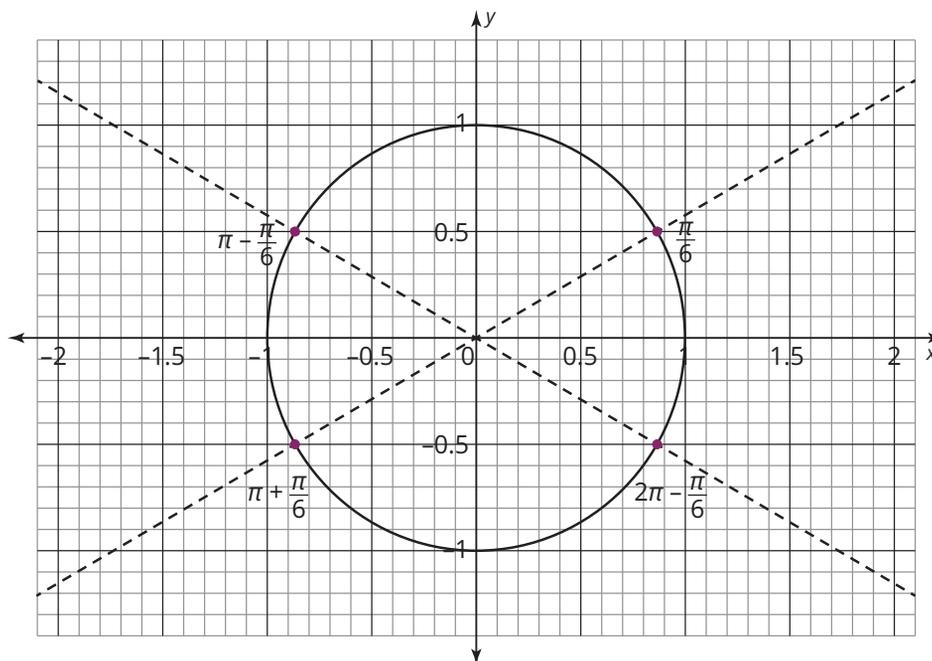
c.  $y = \frac{1}{20} \tan x + 1$

d.  $y = 2 \tan x$



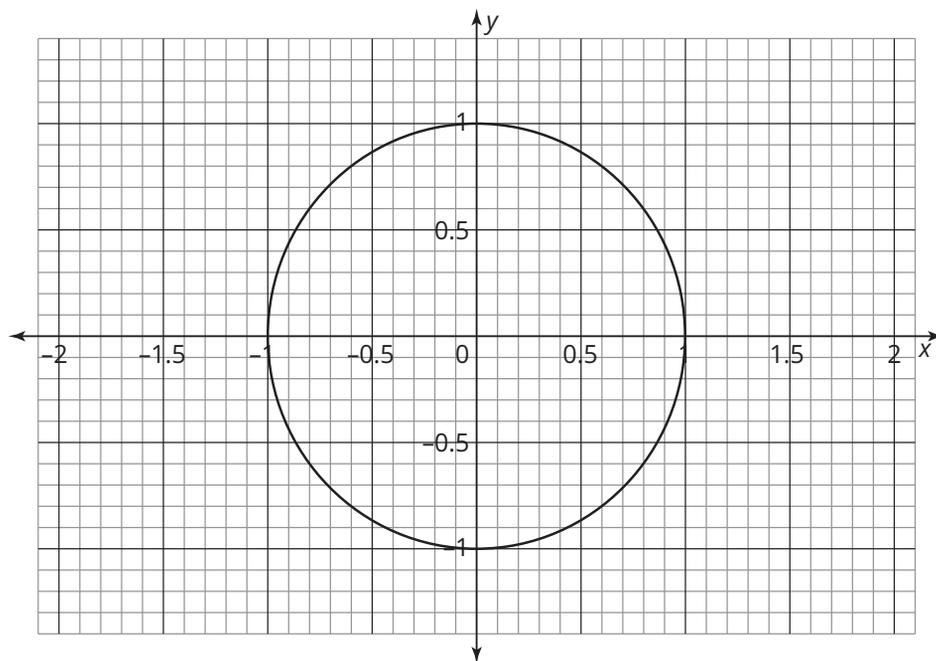
TALK the TALK **Oh, Also, Don't Forget About Symmetry**

The locations of  $\frac{\pi}{6}$ ,  $\pi - \frac{\pi}{6}$ ,  $\pi + \frac{\pi}{6}$ , and  $2\pi - \frac{\pi}{6}$  are plotted on the unit circle shown.

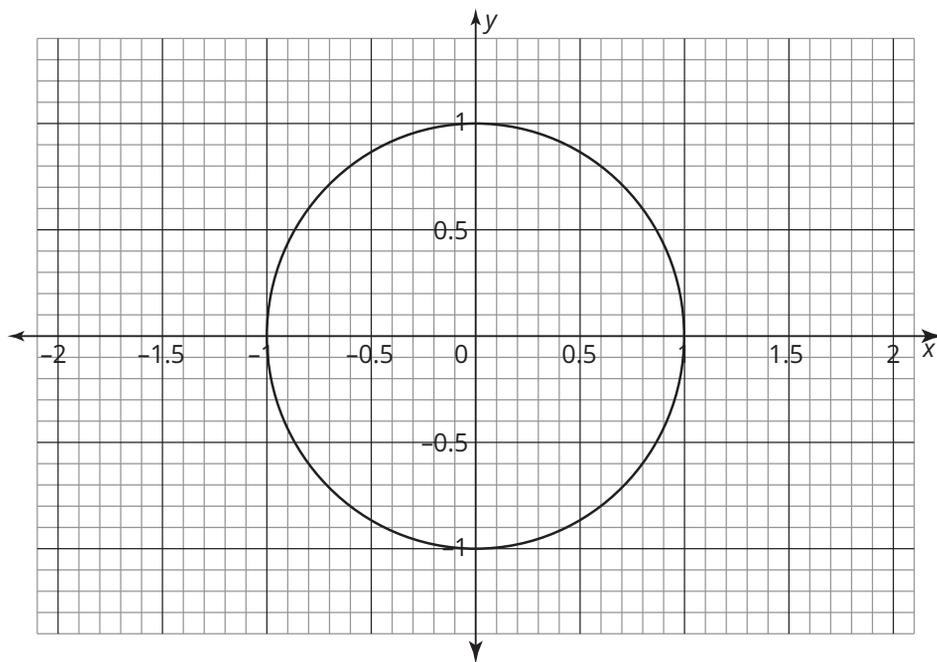


1. Describe the central angle measure associated with each location, and determine the sine, cosine, and tangent of each angle measure.

2. Identify the locations of  $\frac{\pi}{4}$ ,  $\pi - \frac{\pi}{4}$ ,  $\pi + \frac{\pi}{4}$ , and  $2\pi - \frac{\pi}{4}$  on the unit circle. Determine the sine, cosine, and tangent of each central angle measure.



3. Identify the locations of  $\frac{\pi}{3}$ ,  $\pi - \frac{\pi}{3}$ ,  $\pi + \frac{\pi}{3}$ , and  $2\pi - \frac{\pi}{3}$  on the unit circle. Determine the sine, cosine, and tangent of each central angle measure.



4. Explain how you can use symmetry to determine the values of trigonometric functions at certain input values.

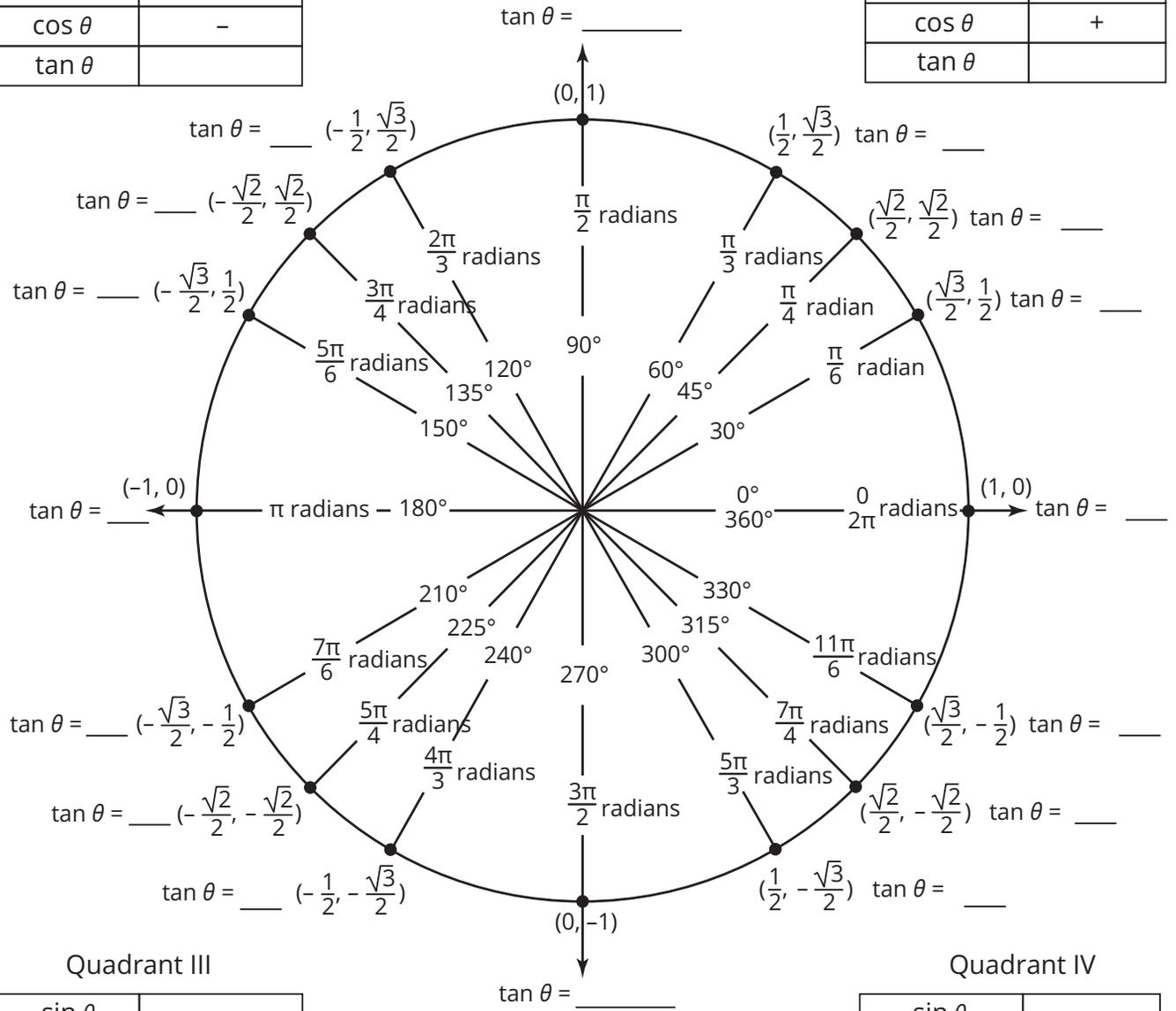
## Sine, Cosine, and Tangent on the Unit Circle

Quadrant II

$\sin \theta$	+
$\cos \theta$	-
$\tan \theta$	

Quadrant I

$\sin \theta$	+
$\cos \theta$	+
$\tan \theta$	





# Assignment

## Write

Explain how the tangent function is related to the sine and cosine functions.

## Remember

The tangent function is positive when  $\sin \theta$  and  $\cos \theta$  have the same sign, and the tangent function is negative when  $\sin \theta$  and  $\cos \theta$  have different signs.

The period of the function  $y = \tan x$  is  $\pi$  radians.

The periodicity identity for the tangent function is written as  $\tan(x + \pi) = \tan x$ .

## Practice

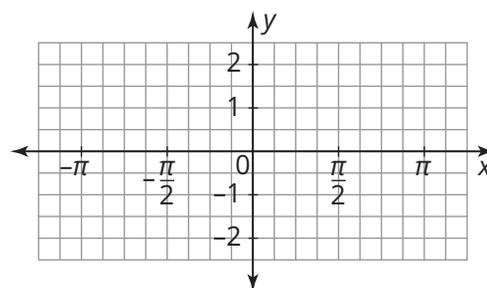
1. Consider Manuel's incorrect work. Identify the errors and correctly determine  $\tan\left(\frac{7\pi}{3}\right)$ .

Manuel

$$\begin{aligned}\tan\left(\frac{7\pi}{3}\right) &= \tan\left(\frac{6\pi}{3} + \pi\right) \\ &= \tan\left(\frac{6\pi}{3}\right) \\ &= \tan(2\pi) \\ &= 0\end{aligned}$$



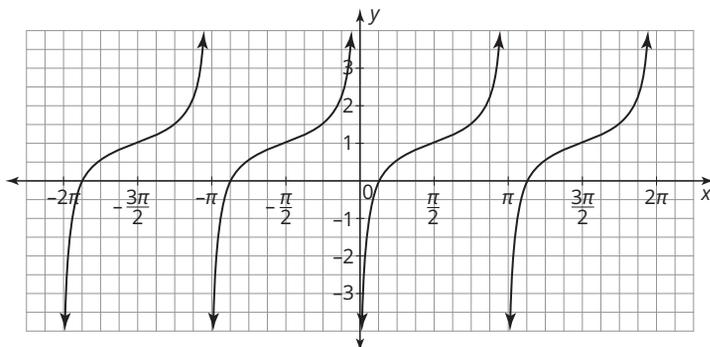
2. Given  $\tan \theta = -\sqrt{3}$ . Determine 2 values for  $\theta$  such that  $\theta < 0$  and 2 values for  $\theta$  such that  $\theta > 2\pi$ .
3. Given  $\tan \theta = 1$ . Determine 2 values for  $\theta$  such that  $\theta < 0$  and 2 values for  $\theta$  such that  $\theta > 2\pi$ .
4. Determine  $\tan\left(\frac{13\pi}{6}\right)$ .
5. Determine  $\tan\left(\frac{11\pi}{4}\right)$ .
6. To create the function  $g(x)$ , the function  $f(x) = \tan x$  was reflected across the  $x$ -axis and shifted  $\frac{\pi}{2}$  radians to the right.
- Graph the function  $g(x)$ .
  - Write the function  $g(x)$ .



7. The function  $f(x) = \tan x$  has been horizontally stretched by a factor of 4 and shifted down 3 units to create the function  $m(x)$ . Write the function  $m(x)$ .

## Stretch

1. Consider the graph of a trigonometric function  $g(x)$ .



Write the function  $g(x)$ , a transformation of the function  $f(x) = \tan x$ .

2. Determine the values of  $\theta$  in radians that would make each equation true for  $0 \leq \theta \leq 2\pi$ .

a.  $\cos \theta = 1$       b.  $\cos \theta = 0$       c.  $\cos \theta = \frac{\sqrt{3}}{2}$       d.  $\cos \theta = -\frac{1}{2}$       e.  $\cos(\theta) + 1 = 0$

## Review

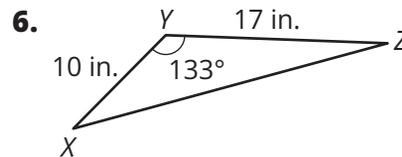
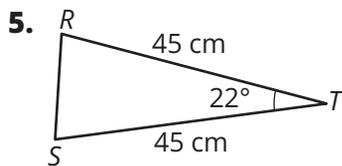
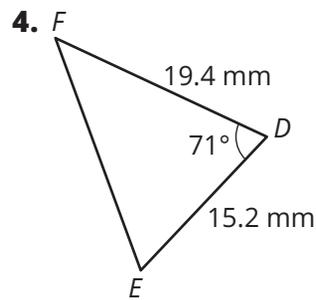
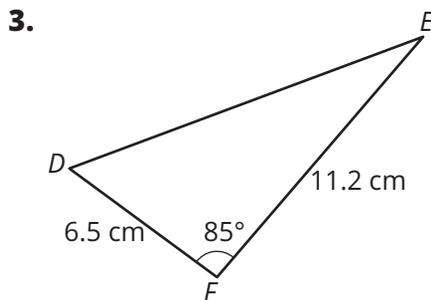
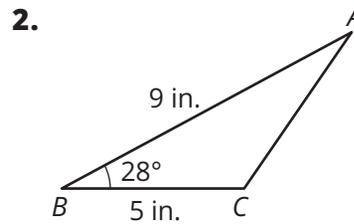
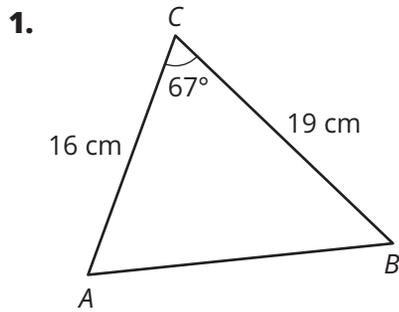
- Determine  $\theta$  and  $\cos \theta$  when  $\sin \theta = -\frac{\sqrt{2}}{2}$  and  $\cos \theta$  is negative. Restrict values for  $\theta$  such that  $0 \leq \theta \leq 2\pi$ .
- Determine  $\sin\left(\frac{15\pi}{4}\right)$ .
- Priscilla and Theo both bought farms the same year, and each dedicated one acre of the land for growing strawberries. The first year of operation, Priscilla's strawberry field yielded 22,000 pounds and Theo's field yielded 19,500 pounds. Since that first year, Priscilla's yield of strawberries has decreased by 1.5% each year while Theo's yield of strawberries has increased by 1.0% each year.
  - Whose farm yielded more strawberries in the 7th year of production? Round decimals to the nearest hundredth.
  - Which of the 2 farms had the biggest yield over the first 7 years? Round decimals to the nearest hundredth.
- Use long division to determine whether  $x + 2$  is a factor of  $2x^4 + 5x^3 + 5x^2 + 10x + 8$ . Show your work.

# Skills Practice

Name \_\_\_\_\_ Date \_\_\_\_\_

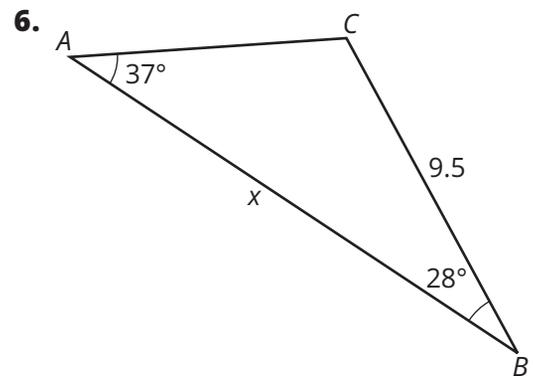
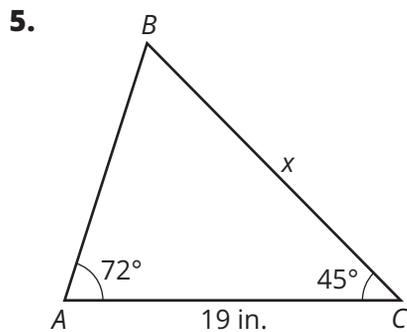
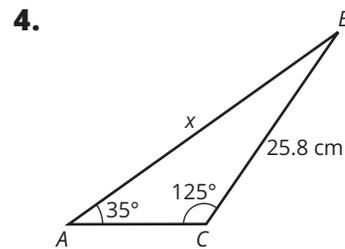
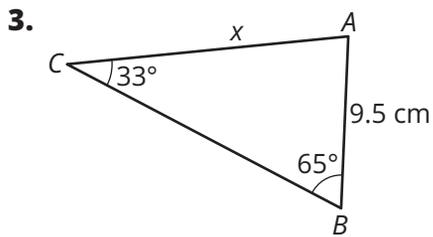
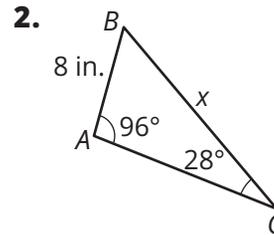
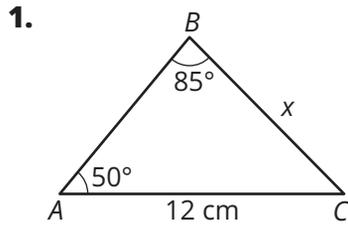
## I. Law of Sines and Law of Cosines

**A.** Determine the area of each triangle. Round your answers to the nearest tenth.

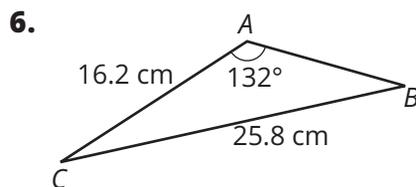
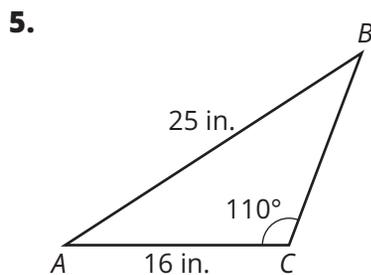
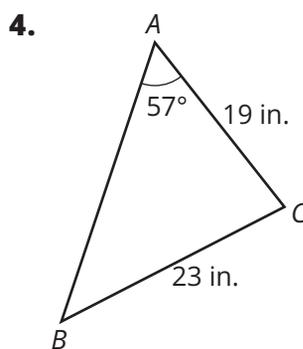
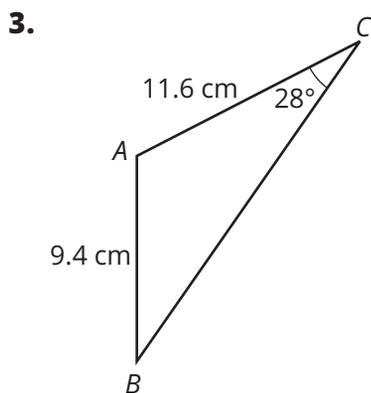
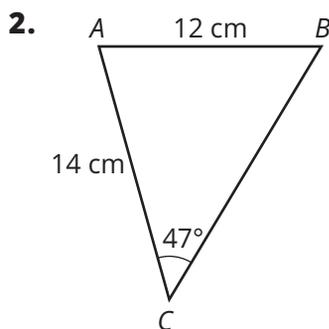
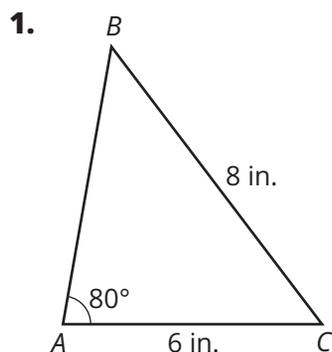


Name \_\_\_\_\_ Date \_\_\_\_\_

**B.** Determine the unknown side length  $x$  by using the Law of Sines. Round your answers to the nearest tenth.

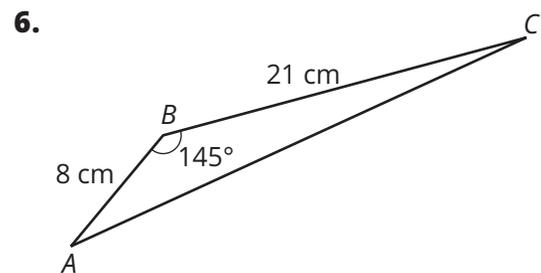
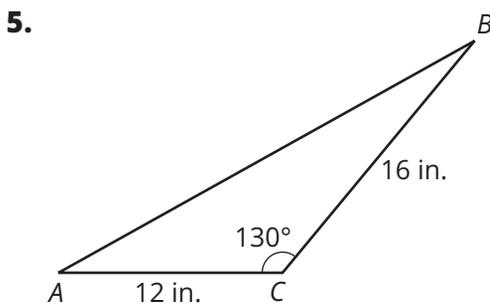
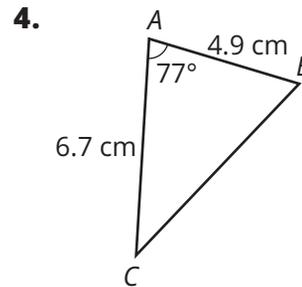
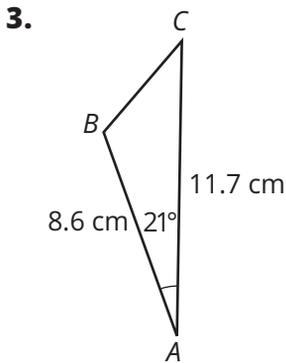
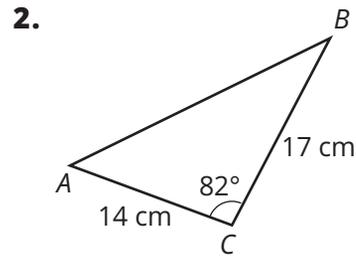
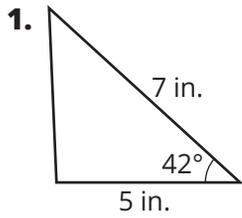


C. Determine  $m\angle B$  by using the Law of Sines. Round your answers to the nearest tenth.



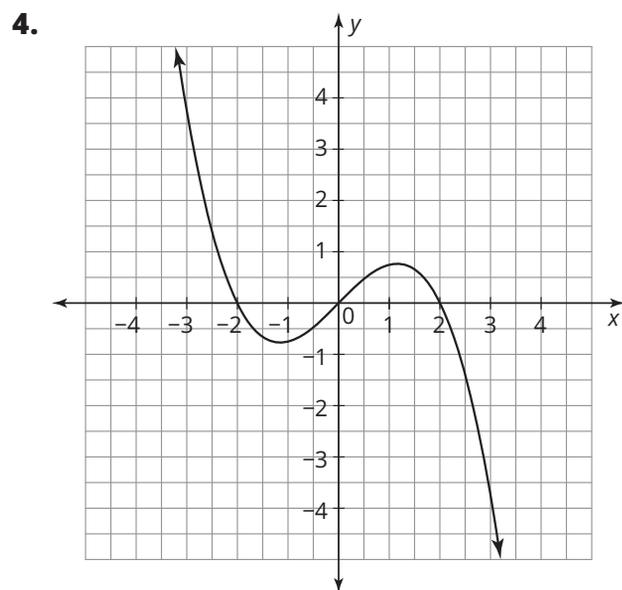
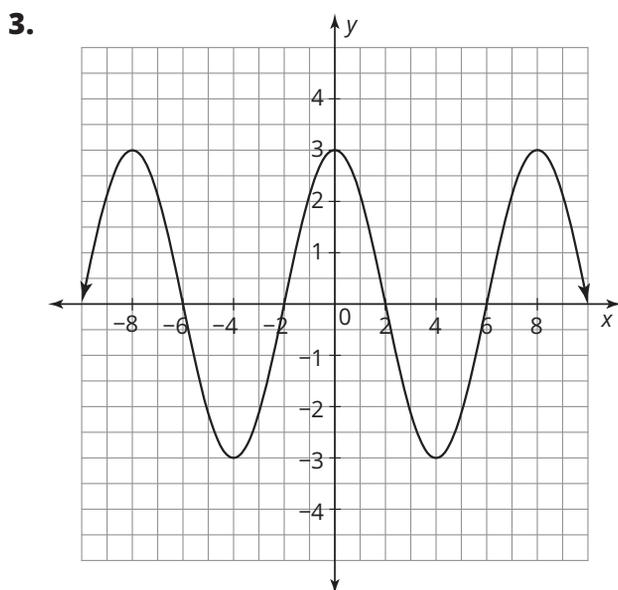
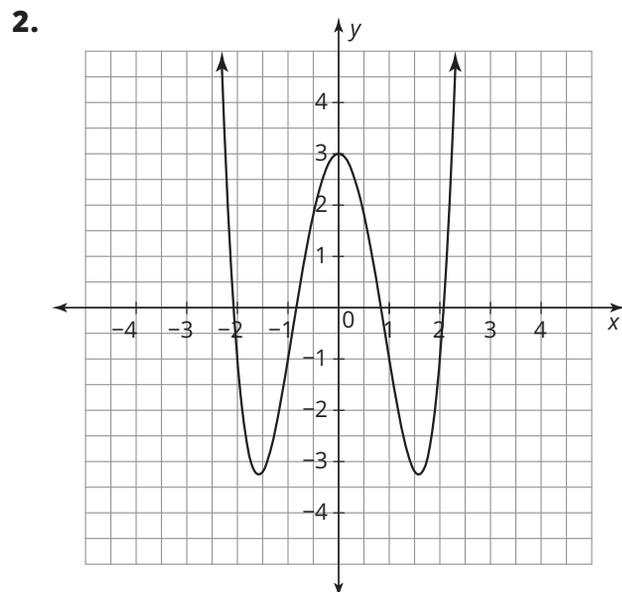
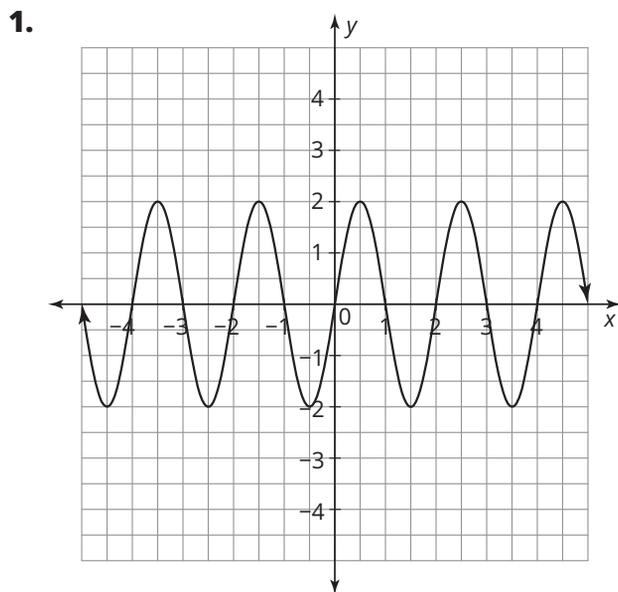
Name \_\_\_\_\_ Date \_\_\_\_\_

**D.** Determine the unknown side length by using the Law of Cosines. Round your answers to the nearest tenth.



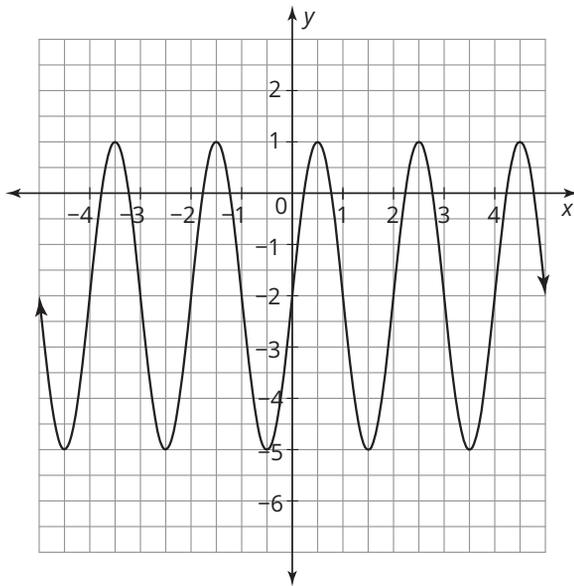
## II. Characteristics of Periodic Functions

**A.** Determine whether each graph represents a periodic function over the interval shown. If so, identify the period  $p$ .

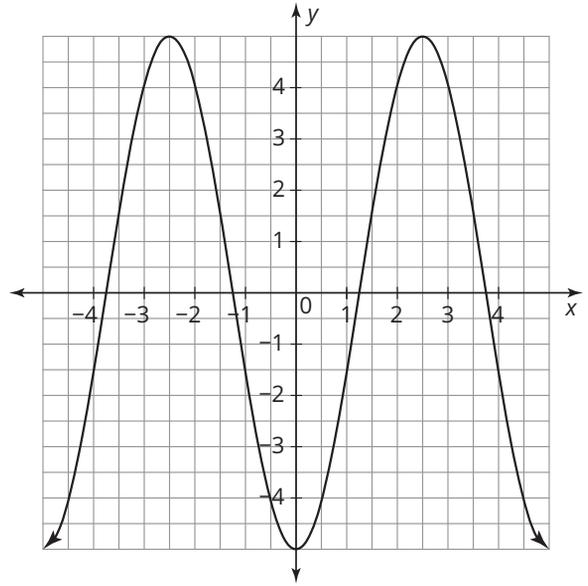


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5.

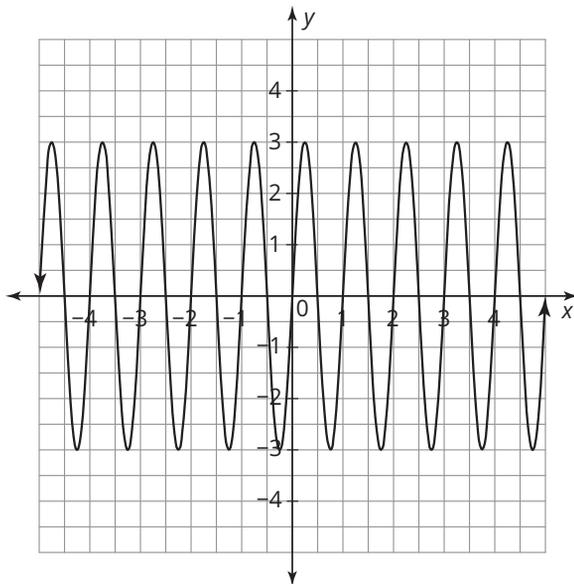


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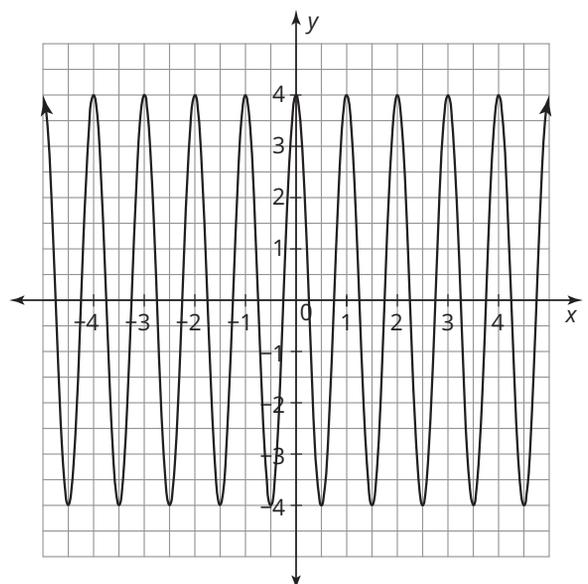


**B.** Determine the midline and amplitude of each graph.

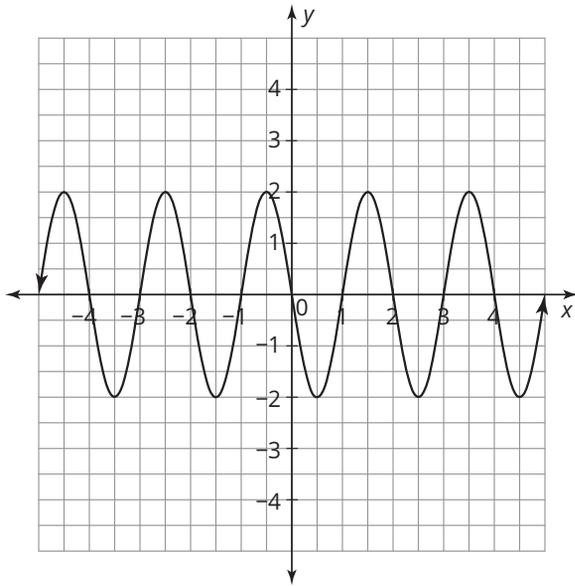
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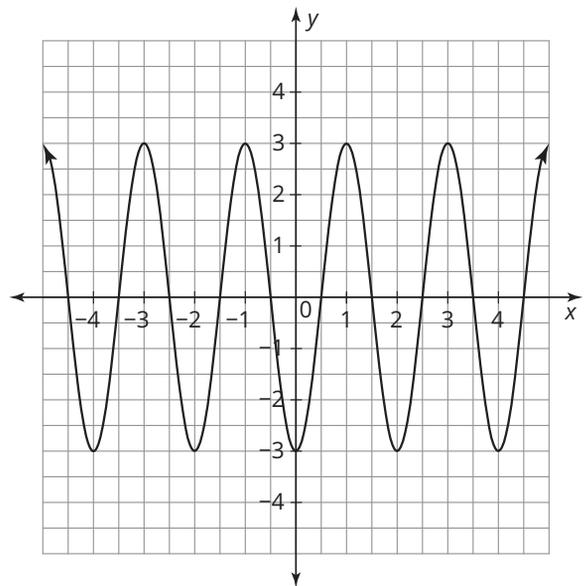
2.



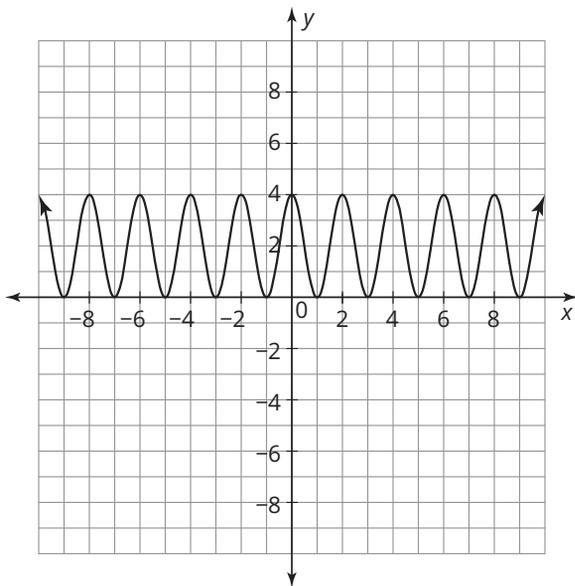
3.



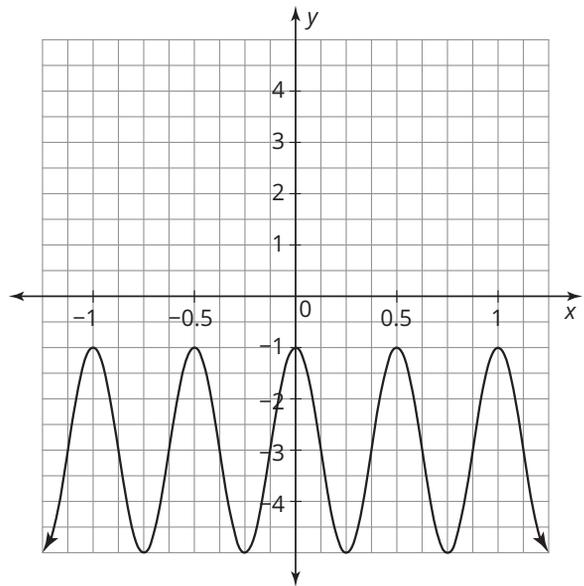
4.



5.



6.



Name \_\_\_\_\_ Date \_\_\_\_\_

### III. Using Radian Measures

**A.** Calculate the arc length and the radian measure of each angle in a circle with the given dimensions.

1.  $\theta = 30^\circ$ ; radius = 3 units

2.  $\theta = 270^\circ$ ; radius = 2 units

3.  $\theta = 45^\circ$ ; radius = 5 units

4.  $\theta = 100^\circ$ ; radius = 6 units

5.  $\theta = 135^\circ$ ; radius = 4 units

6.  $\theta = 180^\circ$ ; diameter = 10 units

7.  $\theta = 90^\circ$ ; diameter = 12 units

8.  $\theta = 15^\circ$ ; diameter = 15 units

9.  $\theta = 60^\circ$ ; diameter = 8 units

10.  $\theta = 300^\circ$ ; diameter = 3 units

**B.** Estimate the degree measure of each central angle given in radians in a unit circle. Explain your reasoning.

**1.** 4 radians

**2.** 2 radians

**3.** 5 radians

**4.** 6 radians

**5.** 1 radian

**6.** 2.5 radians

**7.** 3.25 radians

**8.** 5.1 radians

**9.** 1.57 radians

**10.** 6.28 radians

Name \_\_\_\_\_ Date \_\_\_\_\_

**C.** Convert each radian measure to degrees. Round each answer to the nearest hundredth.

**1.** 5 radians

**2.** 3 radians

**3.** 6 radians

**4.** 2 radians

**5.** 4 radians

**6.** 1.9 radians

**7.** 5.8 radians

**8.** 2.3 radians

**9.** 4.75 radians

**10.** 3.4 radians

**D.** Convert each degree measure to radians. Write each answer as a simplified ratio in terms of  $\pi$ .

**1.**  $121^\circ$

**2.**  $85^\circ$

**3.**  $204^\circ$

**4.**  $66^\circ$

**5.**  $18^\circ$

**6.**  $196^\circ$

**7.**  $320^\circ$

**8.**  $256^\circ$

**9.**  $102^\circ$

**10.**  $305^\circ$

Name \_\_\_\_\_ Date \_\_\_\_\_

#### IV. Sine and Cosine Functions and their Transformations

**A.** Use the unit circle to determine each value.

1.  $\sin\left(\frac{\pi}{2}\right)$

2.  $\sin\left(\frac{5\pi}{6}\right)$

3.  $\sin(2\pi)$

4.  $\sin\left(\frac{5\pi}{4}\right)$

5.  $\cos\left(\frac{\pi}{4}\right)$

6.  $\cos\left(\frac{2\pi}{3}\right)$

7.  $\cos\left(\frac{3\pi}{2}\right)$

8.  $\cos\left(\frac{7\pi}{6}\right)$

**B.** Evaluate the sine and cosine of the supplement of the given measure.

1.  $\theta = \frac{5\pi}{6}$

2.  $\theta = \frac{\pi}{4}$

3.  $\theta = \frac{2\pi}{3}$

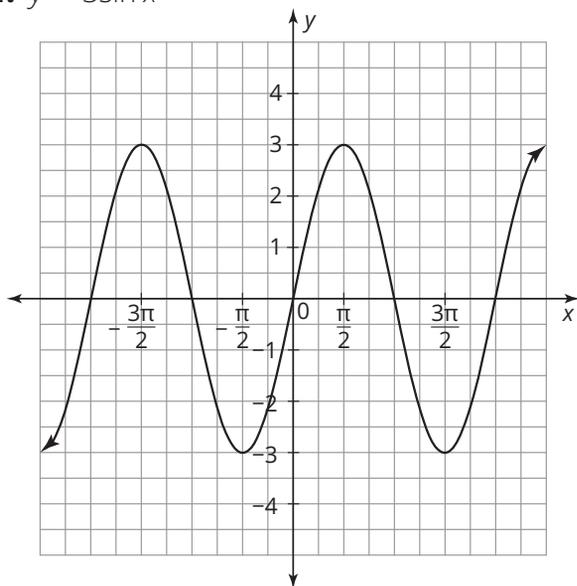
4.  $\theta = \frac{3\pi}{4}$

5.  $\theta = \frac{\pi}{2}$

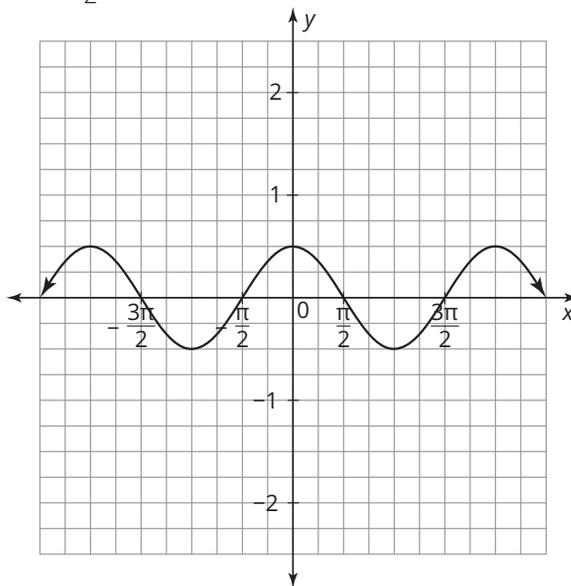
6.  $\theta = \frac{\pi}{6}$

**C.** Determine the amplitude of each graph.

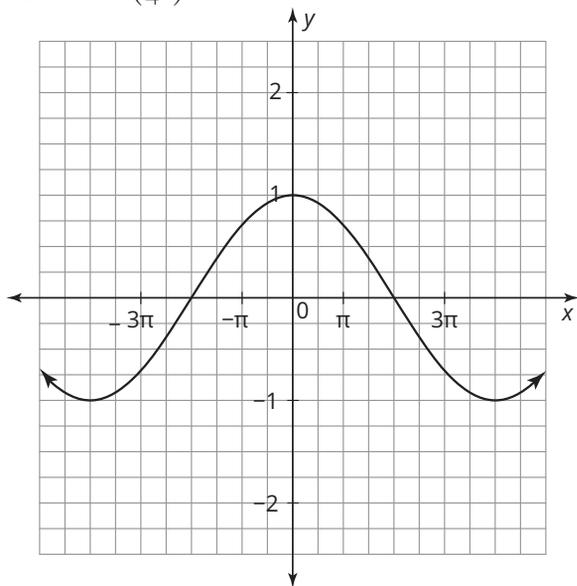
1.  $y = 3\sin x$



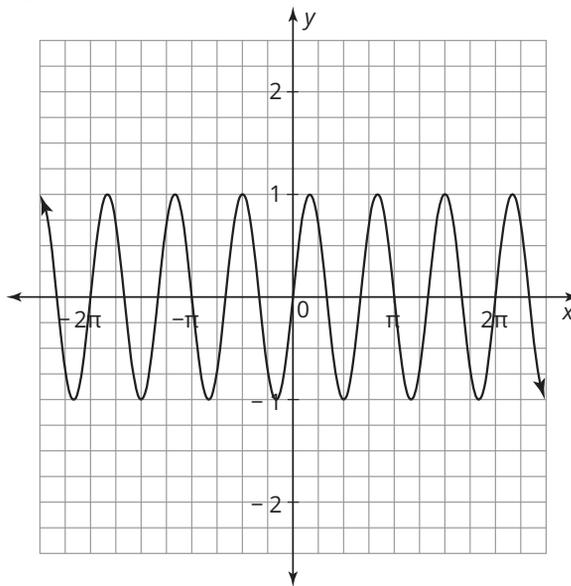
2.  $y = \frac{1}{2}\cos x$



3.  $y = \cos\left(\frac{1}{4}x\right)$

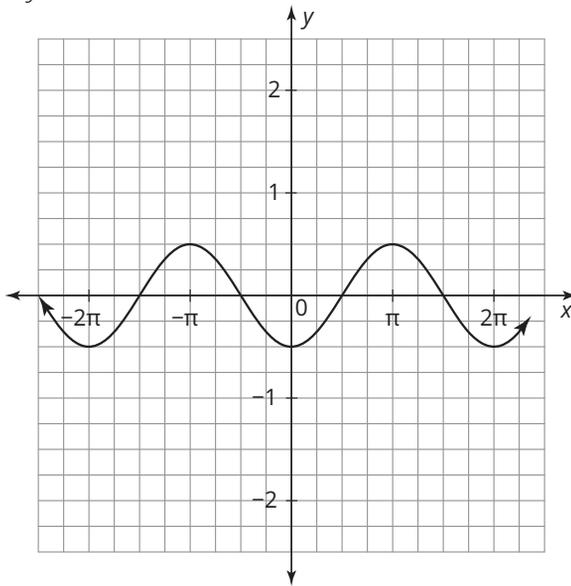


4.  $y = \sin(3x)$

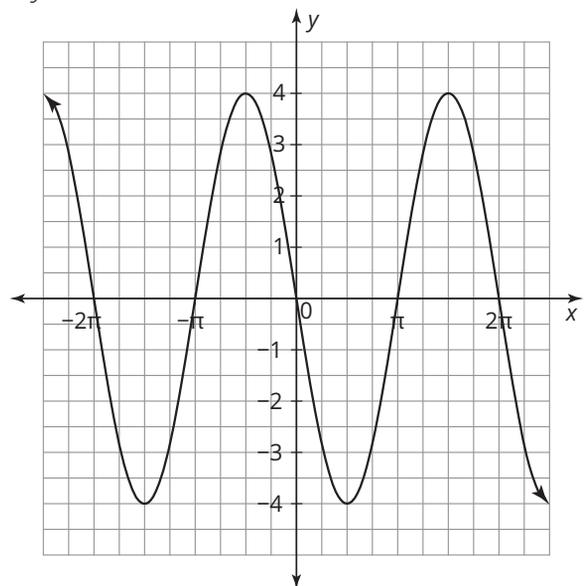


Name \_\_\_\_\_ Date \_\_\_\_\_

5.  $y = -0.5\cos x$

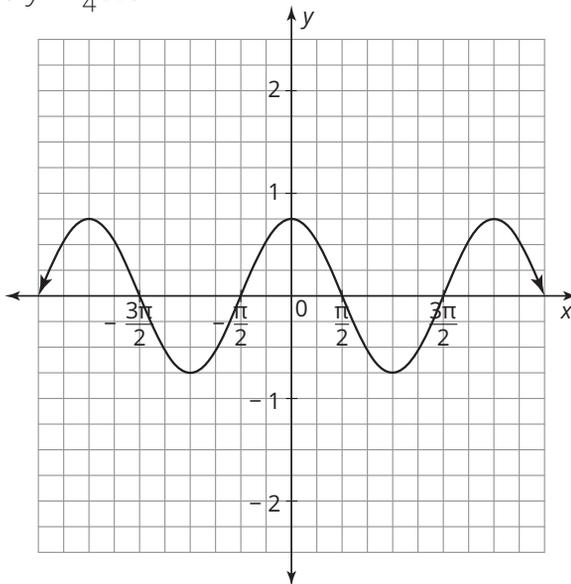


6.  $y = -4\sin x$

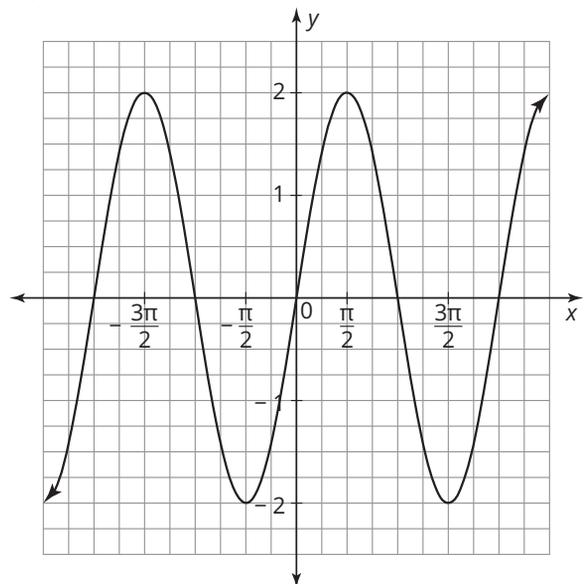


D. Determine the period and frequency of each graph.

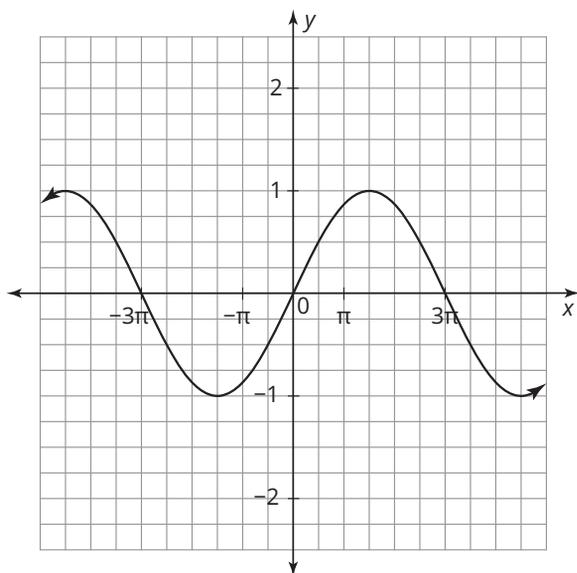
1.  $y = \frac{3}{4}\cos x$



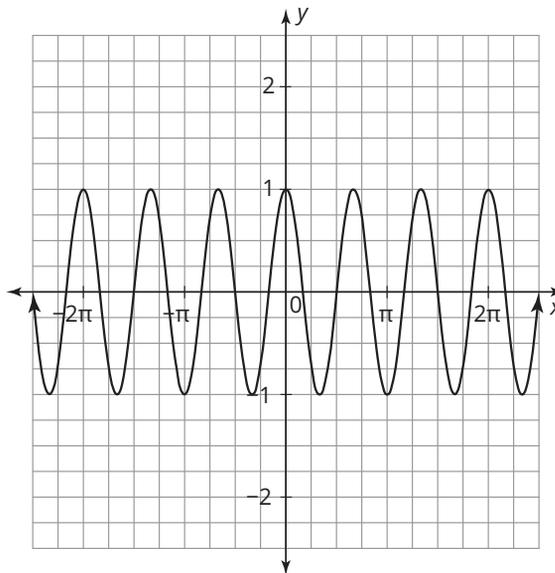
2.  $y = 2\sin x$



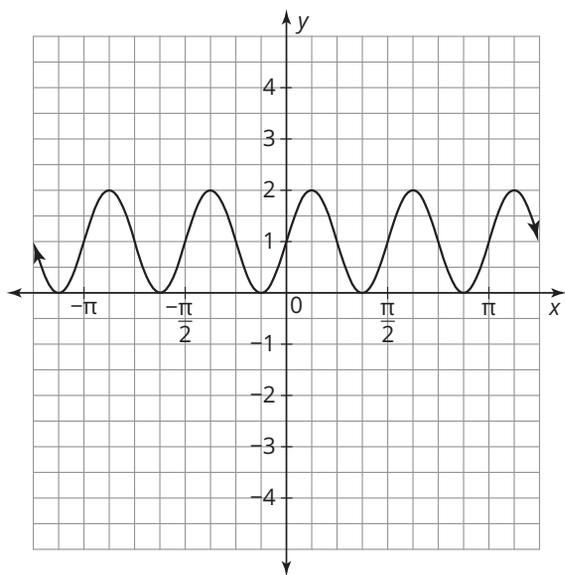
3.  $y = \sin\left(\frac{1}{3}x\right)$



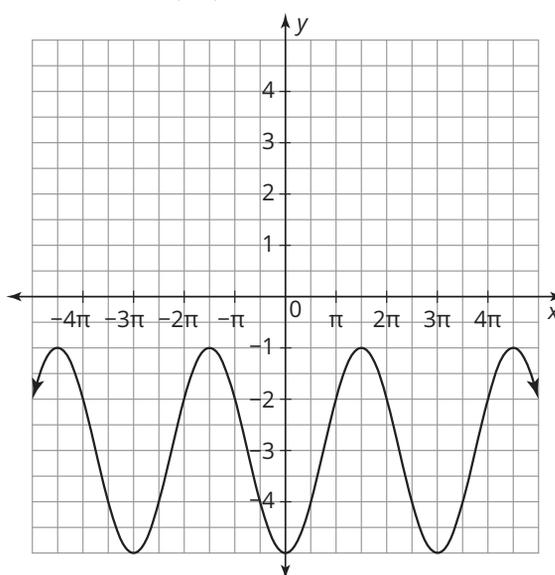
4.  $y = \cos(3x)$



5.  $y = \sin(4x) + 1$



6.  $y = -2\cos\left(\frac{2}{3}x\right) - 3$



Name \_\_\_\_\_ Date \_\_\_\_\_

## V. Tangent Function

**A.** Calculate the tangent of each angle given the cosine and sine of the angle.

1.  $\sin \theta = \frac{3}{5}, \cos \theta = \frac{4}{5}$

2.  $\sin \theta = \frac{7}{25}, \cos \theta = \frac{24}{25}$

3.  $\sin \theta = \frac{8}{17}, \cos \theta = \frac{15}{17}$

4.  $\sin \theta = \frac{12}{13}, \cos \theta = \frac{5}{13}$

5.  $\sin \theta = \frac{40}{41}, \cos \theta = \frac{9}{41}$

6.  $\sin \theta = \frac{20}{29}, \cos \theta = \frac{21}{29}$

7.  $\sin \theta = \frac{2\sqrt{5}}{5}, \cos \theta = \frac{\sqrt{5}}{5}$

8.  $\sin \theta = \frac{2\sqrt{13}}{13}, \cos \theta = \frac{3\sqrt{13}}{13}$

**B.** Evaluate each tangent function by using the relationship between the tangent function and the sine and cosine functions.

1.  $\tan\left(\frac{\pi}{2}\right)$

2.  $\tan(\pi)$

3.  $\tan\left(\frac{5\pi}{4}\right)$

4.  $\tan\left(\frac{2\pi}{3}\right)$

5.  $\tan(0)$

6.  $\tan\left(\frac{3\pi}{2}\right)$

7.  $\tan\left(\frac{\pi}{3}\right)$

8.  $\tan\left(\frac{4\pi}{3}\right)$

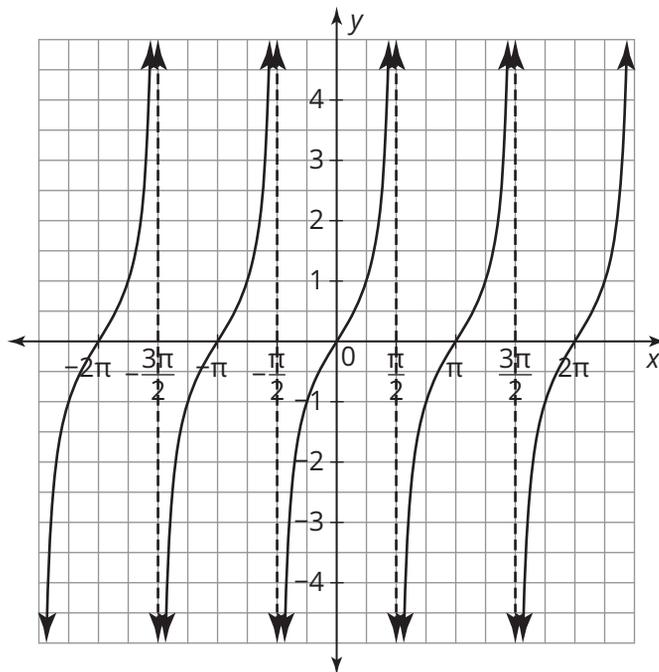
9.  $\tan\left(\frac{7\pi}{6}\right)$

10.  $\tan\left(\frac{\pi}{6}\right)$

11.  $\tan\left(\frac{3\pi}{4}\right)$

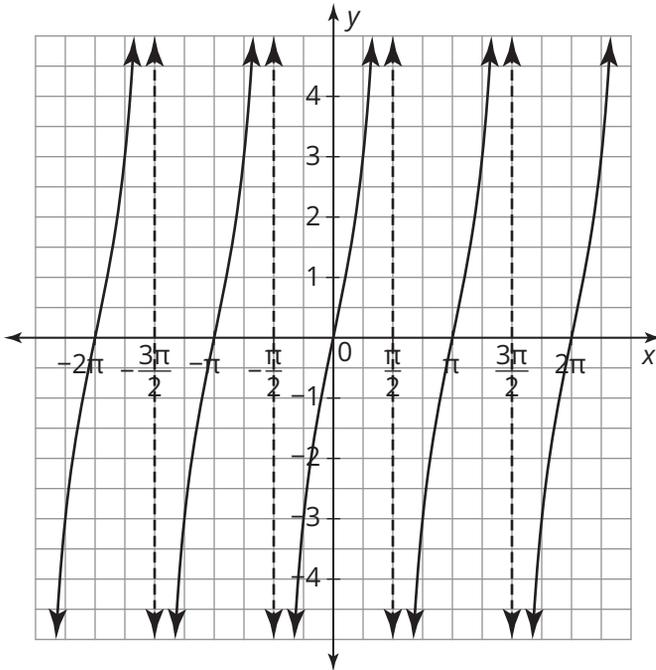
12.  $\tan\left(\frac{5\pi}{6}\right)$

C. Compare the graph of each transformation to the graph of  $\tan x$  shown below. Then, answer the question and explain how you determined your answer.

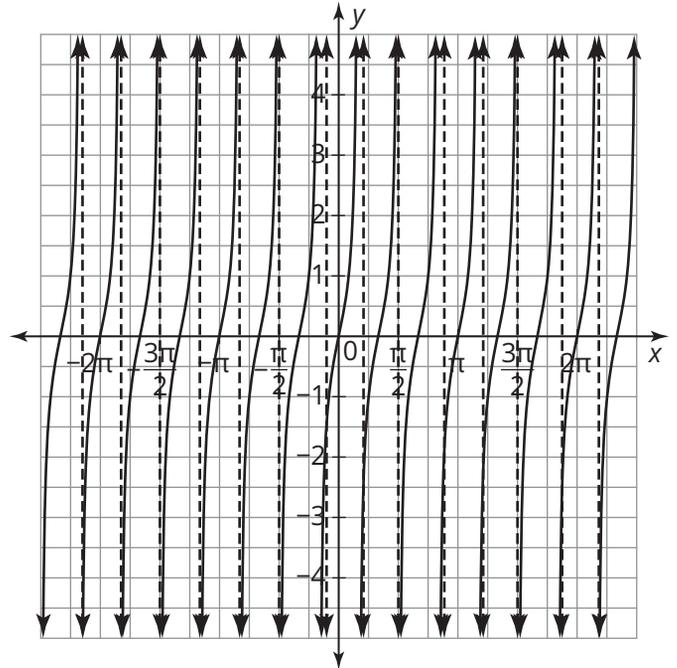


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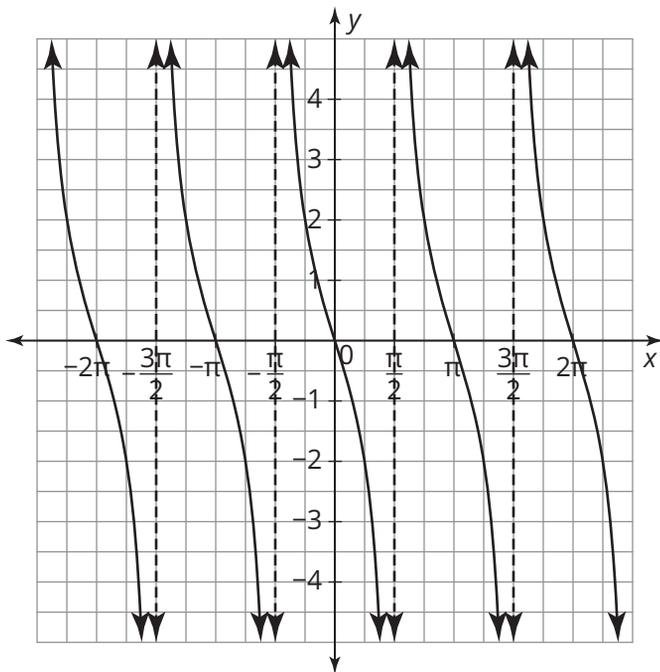
1. Does the graph below represent the function  $y = \tan(3x)$  or  $y = 3\tan x$ ?



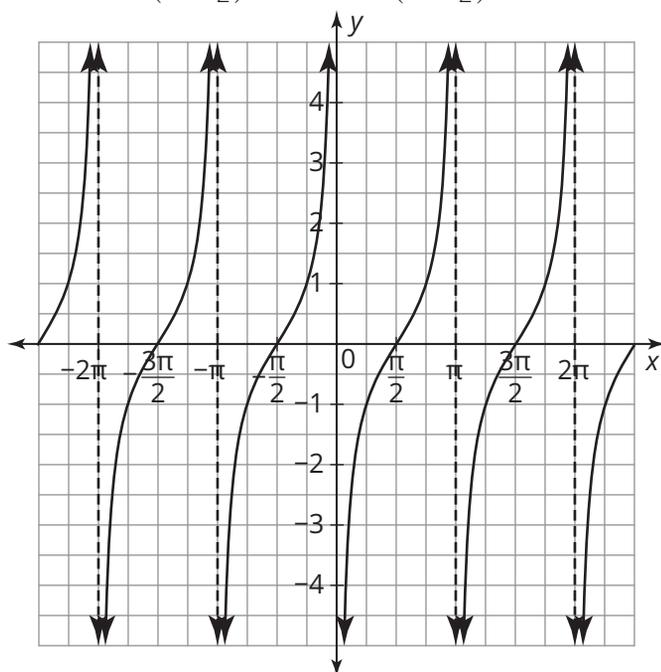
2. Does the graph below represent the function  $y = \tan(3x)$  or  $y = \tan\left(\frac{1}{3}x\right)$ ?



3. Does the graph below represent the function  $y = -2\tan x$  or  $y = -\tan x$ ?

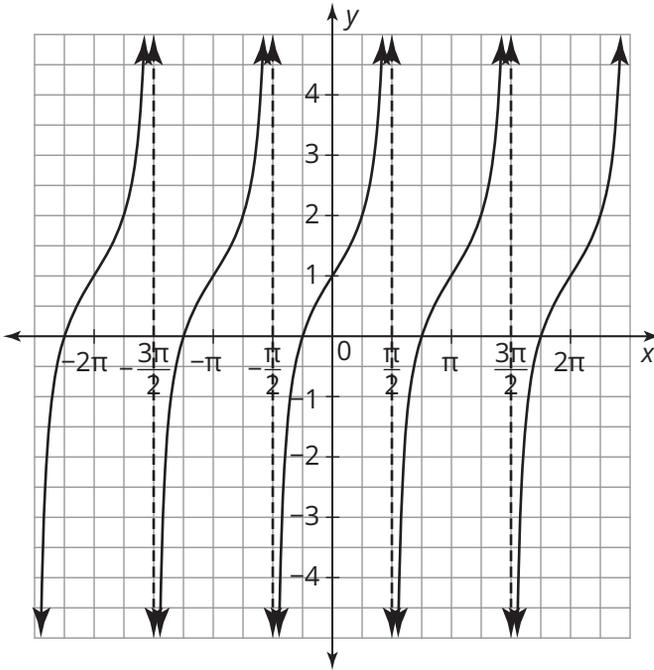


4. Does the graph below represent the function  $y = \tan(x - \frac{1}{2})$  or  $y = \tan(x - \frac{\pi}{2})$ ?

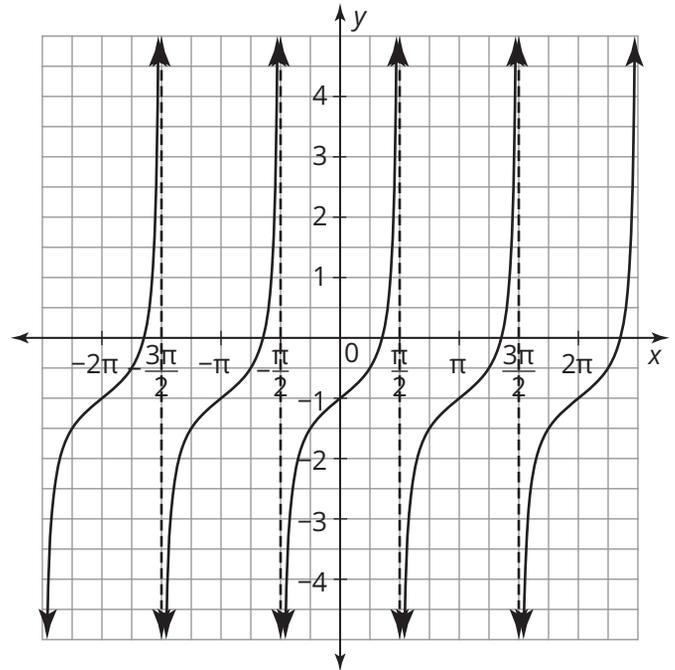


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5. Does the graph below represent the function  $y = \tan x - 1$  or  $y = \tan x + 1$ ?



6. Does the graph below represent the function  $y = 2\tan x - 1$  or  $y = \frac{1}{2}\tan x - 1$ ?

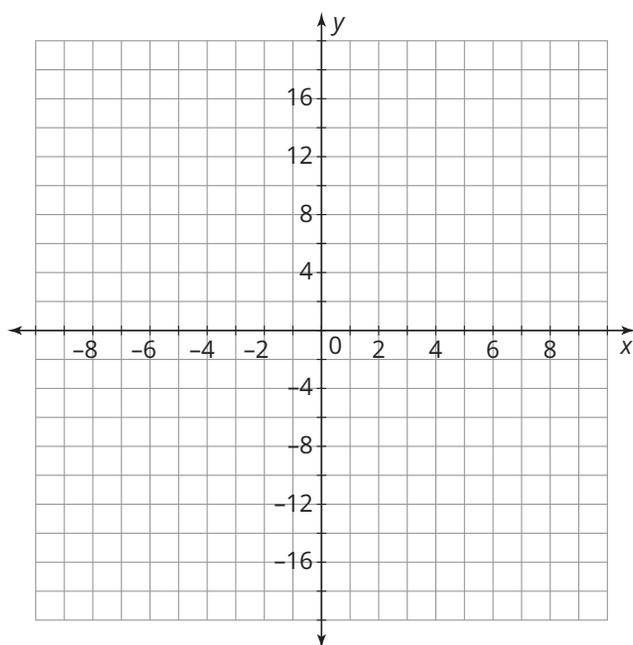


# Chasing Theta

## Solving Trigonometric Equations

### Warm Up

Graph the function  $f(x) = 2x^2 + 5x - 12$  and determine the zeros.



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### Learning Goals

- Write and solve trigonometric equations.
- Use periodicity identities to identify multiple solutions to trigonometric equations.
- Solve trigonometric equations using inverse trigonometric functions.
- Solve second-degree trigonometric equations.

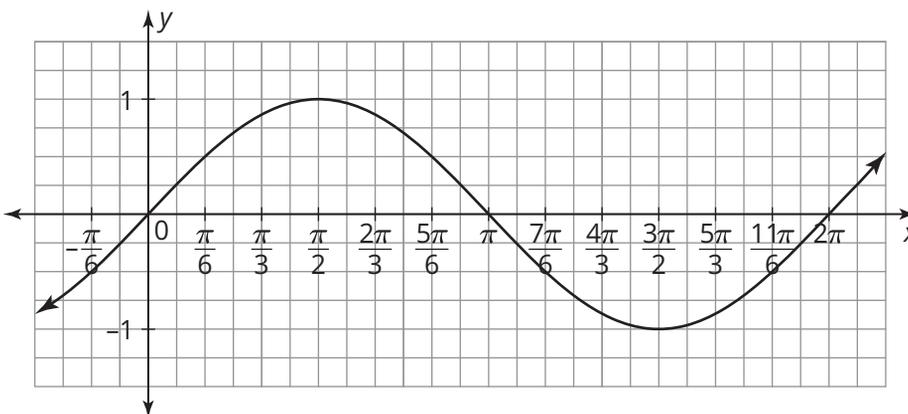
### Key Terms

- trigonometric equation
- inverse sine ( $\sin^{-1}$ )
- inverse cosine ( $\cos^{-1}$ )
- inverse tangent ( $\tan^{-1}$ )

You have explored trigonometric functions, which take an angle measure as input and output a linear measure. How can you solve a trigonometric equation for the angle measure?

## Sine, Sine, Everywhere a Sine

The graph shows the function  $f(x) = \sin x$ .



1. Draw a horizontal line to approximate the solutions to the equation  $\sin x = \frac{1}{2}$ . What are the solutions?
2. List the solution(s) of the equation  $\sin x = \frac{1}{2}$ , given each of the domain restrictions.
  - a.  $0 \leq x \leq \frac{\pi}{2}$
  - b.  $0 \leq x \leq 4\pi$
  - c.  $-\pi \leq x \leq 0$



A **trigonometric equation** is an equation in which the unknown is associated with a trigonometric function. The number of solutions of a trigonometric equation can vary depending on how the domain of the function is restricted.

You can solve trigonometric equations using what you already know.

### Worked Example

Consider the equation  $\sin x = \frac{1}{2}$ .

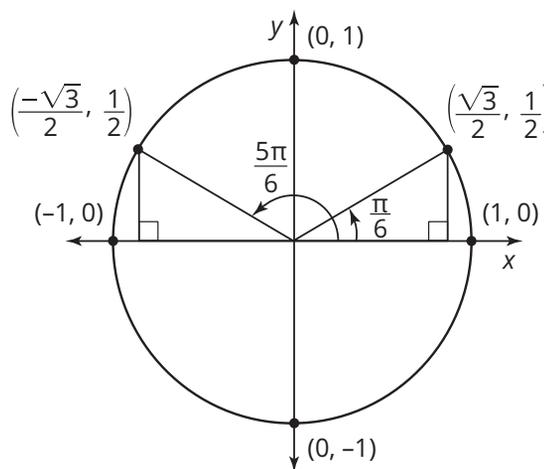
On the unit circle, you can see that

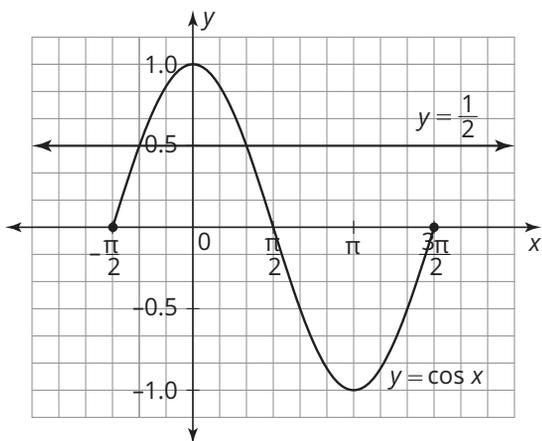
$$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2} \text{ and } \sin\left(\frac{5\pi}{6}\right) = \frac{1}{2}.$$

$$\text{So, } x = \frac{\pi}{6} \text{ or } \frac{5\pi}{6}.$$

When the domain is restricted to  $0 \leq x \leq 2\pi$ , these are the only 2 solutions to the equation.

When there are no domain restrictions, the equation has an infinite number of solutions.





You can also use what you know about the graphs of trigonometric functions to solve trigonometric equations.

Let's consider the equation  $\cos x = \frac{1}{2}$ .

The equations  $y = \cos x$  and  $y = \frac{1}{2}$  are graphed on the coordinate plane.

**1. Study the graph of  $y = \cos x$ .**

**a. Over what domain is the function graphed?**

**b. Write the solutions to the equation  $\cos x = \frac{1}{2}$ , given the domain restrictions. Then, plot and label the solutions on the coordinate plane.**

**2. Write the solution(s) to each equation, given the same domain restrictions in Question 1.**

**a.  $\cos x = 1$**

**b.  $\cos x = 0$**

**c.  $\cos x = -\frac{1}{2}$**

**d.  $\cos x = -1$**

**Think**

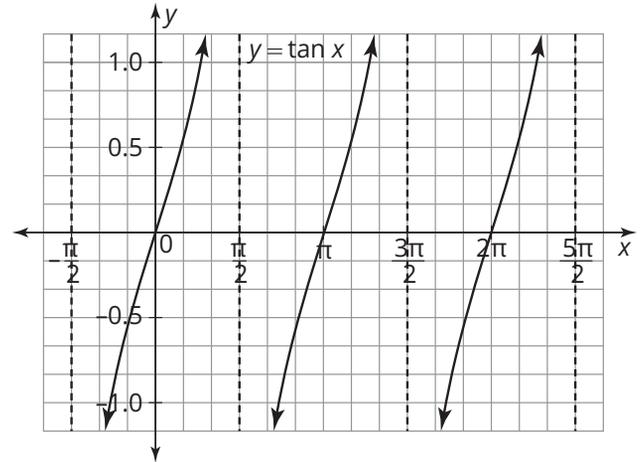
about:

How can you use reference angles on the unit circle?

3. Use the graph of  $y = \tan x$  over the domain  $-\frac{\pi}{2} \leq x \leq \frac{5\pi}{2}$  to solve each equation.

a.  $\tan x = 0$

b.  $\tan x = \text{undefined}$



You can use what you know about the periods of trigonometric functions to solve trigonometric equations. The periodicity identities you have learned are shown. Adding or subtracting integer multiples of the period for each function ( $2\pi n$  or  $\pi n$ ) generates solutions to trigonometric equations.

Periodicity Identities	
Sine	$\sin(x + 2\pi n) = \sin x$
Cosine	$\cos(x + 2\pi n) = \cos x$
Tangent	$\tan(x + \pi n) = \tan x$

4. Use a periodicity identity to list 4 solutions to each equation.

a.  $\cos x = \frac{\sqrt{2}}{2}$

b.  $\tan x = \sqrt{3}$



# Using Inverse Trigonometric Functions to Solve Equations



When a trigonometric equation involves transformations on the basic function, solving the equation requires the same techniques you have used to solve other equations.

## Worked Example

Solve  $\sqrt{3} \tan x + 5 = 4$  over the domain  $0 \leq x \leq \pi$ .

$$\sqrt{3} \tan x + 5 = 4$$

Subtract 5 from both sides.

$$\sqrt{3} \tan x = -1$$

Divide both sides by  $\sqrt{3}$ .

$$\tan x = \frac{-1}{\sqrt{3}}$$

Rewrite the radical expression by rationalizing the denominator.

$$= \frac{-\sqrt{3}}{3}$$

Identify the reference angle with a value of  $\frac{-\sqrt{3}}{3}$ .

$$x = \frac{5\pi}{6}$$

**1. Identify the solution set of the equation in the worked example over the domain of all real numbers. Show your work.**

**2. Explain why Fletcher is incorrect.**

Fletcher



If  $\tan x = \frac{-\sqrt{3}}{3}$  and  $\tan(x) = \frac{\sin x}{\cos x}$ , then I

know that  $\sin x = -\sqrt{3}$  and  $\cos x = 3$ .

3. Solve the equation  $2 \sin x + \sqrt{3} = 0$  over the domain  $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ .

You can use the inverse of each of the trigonometric functions to determine solutions to equations. The **inverse sine ( $\sin^{-1}$ )**, **inverse cosine ( $\cos^{-1}$ )**, and **inverse tangent ( $\tan^{-1}$ )** functions are used to determine solutions to sine, cosine, and tangent equations, respectively. If you do not recognize the reference angle for the given value of the function, you can use technology.

4. Sofia and Tyhir each used a graphing calculator to solve the equation  $\sin x = \frac{1}{2}$ . Explain the differences in their answers.

Sofia 

$$\sin^{-1}\left(\frac{1}{2}\right) = x$$
$$x = 0.5235987756$$

Tyhir 

$$\sin^{-1}\left(\frac{1}{2}\right) = x$$
$$x = 30$$

**Remember:**

From a previous worked example, you know that  $\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$ .

5. Solve each equation over the domain of all real numbers.

a.  $-5 + 2\sqrt{3} \cos x = -8$

b.  $5 \sin x + 9 = 3$

c.  $6 \tan x - 4 = -19$

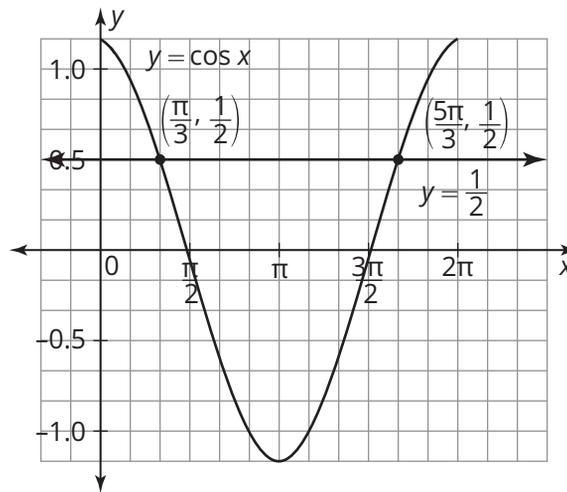
d.  $5 - 8 \cos x = 3$



When the  $B$ -value is changed from a basic trigonometric function, you must take the change in period into account when determining solutions.

Let's consider the equation  $\cos x = \frac{1}{2}$  over the domain  $0 \leq x \leq 2\pi$ .

The equations  $y = \cos x$  and  $y = \frac{1}{2}$  are graphed on the coordinate plane.



The solutions for  $\cos x = \frac{1}{2}$  over the domain  $0 \leq x \leq 2\pi$  are  $x = \frac{\pi}{3}$  or  $\frac{5\pi}{3}$ .

The solutions for  $\cos x = \frac{1}{2}$  over the domain for all real numbers are  $x = \frac{\pi}{3} + 2\pi n$  or  $\frac{5\pi}{3} + 2\pi n$ .

**1. Now, let's consider the equation  $\cos(2x) = \frac{1}{2}$  over the domain  $0 \leq x \leq 2\pi$ .**

**a. Determine the period of this function.**

**b. The period of  $y = \cos(2x)$  is different than  $y = \cos x$ . How does your answer to part (a) affect the number of possible solutions for  $\cos(2x) = \frac{1}{2}$  over the domain  $0 \leq x \leq 2\pi$ ?**

You can use what you know about reference angles to determine solutions for  $x$ .

### Worked Example

Solve  $\cos(2x) = \frac{1}{2}$ .

You know that  $\cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$ .

So, to begin, let  $\frac{\pi}{3} = 2x$  and solve for  $x$ .

$$2x = \frac{\pi}{3}$$

$$x = \frac{\pi}{6}$$

Because the period of  $\cos(2x)$  is  $\pi$ , you know that two of the solutions are  $x = \frac{\pi}{6}$  or  $\frac{7\pi}{6}$  for  $0 \leq x \leq 2\pi$ .

**c. Determine the remaining solutions for  $\cos(2x) = \frac{1}{2}$  over the domain  $0 \leq x \leq 2\pi$  given  $\cos\left(\frac{5\pi}{3}\right) = \frac{1}{2}$ .**

**d. Write the solution for  $\cos(2x) = \frac{1}{2}$  over the domain for all real numbers.**

**2. Solve the equation  $2 \sin(4x) + 1 = -1$  over the set of real numbers.**



If an equation that can be written in the form  $ax^2 + bx + c = 0$  has  $x$  replaced with a trigonometric function, the result is a trigonometric equation in quadratic form. These equations can be solved as you would solve other quadratic equations, by factoring or by using the Quadratic Formula.

Note that  $(\sin x)^2$  is usually written as  $\sin^2 x$ .

### Worked Example

You can solve  $2 \sin^2 x + 5 \sin x = 3$  over the domain of all real numbers.

Start with a substitution. This equation involves the sine function, so let  $z = \sin x$ .

$2z^2 + 5z = 3$	
$2z^2 + 5z - 3 = 0$	Write the equation in general form.
$(2z - 1)(z + 3) = 0$	Factor the quadratic expression.
$2z - 1 = 0$ or $z + 3 = 0$	Set each factor equal to 0.
$z = \frac{1}{2}$ or $z = -3$	Solve each equation.
$\sin x = \frac{1}{2}$ or <del><math>\sin x = -3</math></del>	Replace $z$ with the sine function.
$x = \frac{\pi}{6}, \frac{5\pi}{6} \dots + 2\pi n$	Determine the angle measure using $\sin^{-1}$ .

**1. Explain why  $\sin x = -3$  is crossed off in the worked example.**

**2. Solve  $4 \sin^2 x - 1 = 0$  over the domain of all real numbers.**

**3. Solve each equation over the domain of all real numbers.**

**a.  $2 \cos^2 x + \cos x = 1$**

**b.  $2 \tan^2 z + 3 \tan z - 1 = 0$**

**c.  $6 \sin^2 z - 16 \sin z - 33 = 0$**

TALK the TALK **Problem Solved**

1. Solve  $2 \sin x + \sqrt{2} = 0$  over the domain  $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ .

2. Solve  $\cos^2 x + 2 \cos x - 5 = -2$  over the domain of all real numbers.

# Assignment

## Write

Describe when you would use an inverse sine, inverse cosine, or inverse tangent function.

## Remember

The inverse of each of the trigonometric functions—inverse sine ( $\sin^{-1}$ ), inverse cosine ( $\cos^{-1}$ ), and inverse tangent ( $\tan^{-1}$ )—along with a calculator can be used to determine solutions to equations.

## Practice

1. Use a periodicity identity to list 3 solutions for each equation.

a.  $\sin x = -\frac{\sqrt{2}}{2}$

b.  $\cos x = \frac{\sqrt{3}}{2}$

c.  $\tan x = \frac{\sqrt{3}}{3}$

2. Solve each equation over the domain of all real numbers.

a.  $4 + 2 \sin x = 5$

b.  $8 \cos x + 2 = -1$

c.  $5 \tan x - 3 = -11$

d.  $14 - 3 \sin x = 19$

e.  $2 \sin(3x) + 4 = 5$

f.  $4 \cos^2 x - 3 = 0$

## Stretch

The average person's blood pressure can be modeled by the periodic function  $P(t) = 20 \sin(160\pi t) + 100$ , where  $t$  represents the time in minutes, and  $P(t)$  represents the blood pressure at time  $t$ . Determine the amplitude, maximum and minimum values, period, and frequency of the function.

## Review

1. Given  $\cos \theta = -\frac{5}{13}$  in Quadrant III, use the Pythagorean identity to determine  $\sin \theta$ .

2. Given  $\cos \theta = \frac{2}{9}$  in Quadrant IV, determine  $\sin \theta$  and  $\tan \theta$ .

3. Solve each equation. Round your answer to the thousandths.

a.  $10^{(x+1)} = 7$

b.  $8^{-2a} - 5 = 55$



# 2

# Wascally Wabbits

## Modeling with Periodic Functions

### Warm Up

Describe the transformation performed on the graph of the basic function  $f(x) = \sin x$  to produce the graph of  $g(x)$ .

1.  $g(x) = \sin\left(\frac{1}{3}x\right)$

2.  $g(x) = \sin x - 4$

3.  $g(x) = \sin\left(x + \frac{\pi}{6}\right)$

4.  $g(x) = -2 \sin x$

### Learning Goals

- Model real-world situations with periodic functions.
- Interpret key characteristics of periodic functions in terms of problem situations.

You have explored trigonometric functions and solved trigonometric equations. How can you model real-life situations using trigonometric functions?

### Rabbits, Rabbits Everywhere!

The rabbit population in a national park rises and falls throughout the year. The population is at its approximate minimum of 6000 rabbits in December. As the weather gets warmer and food becomes more available, the population grows to its approximate maximum of 16,000 rabbits in June.

**1. Which trigonometric function best models this situation?  
Justify your answer.**

**2. Sketch a graph of the function.**



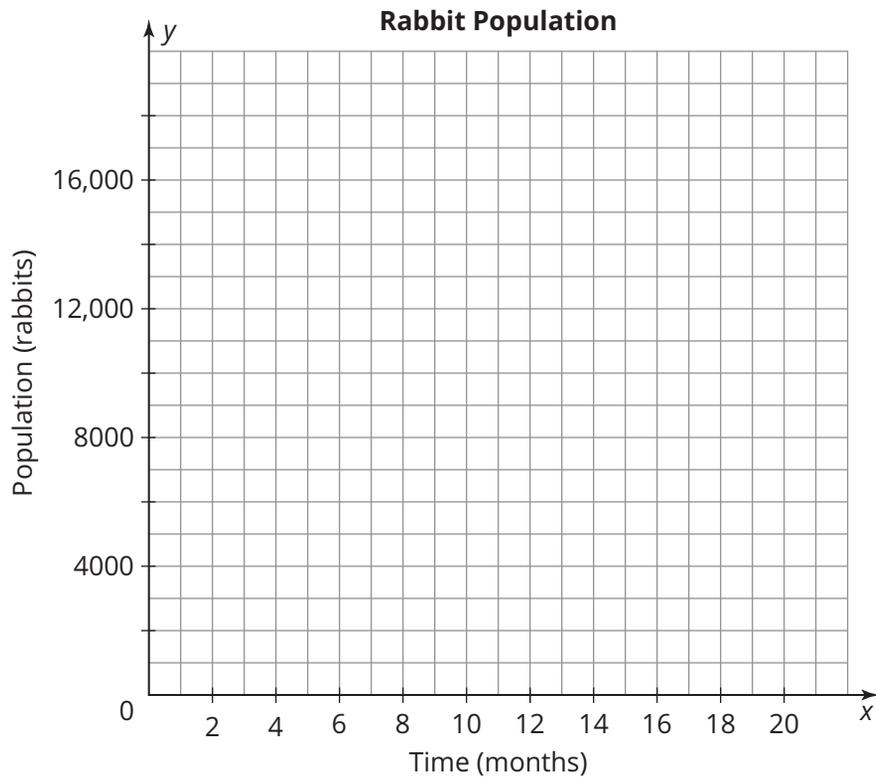
The function to describe the rabbit population is

$f(x) = 5000 \sin\left(\frac{\pi}{6}x - \frac{\pi}{2}\right) + 11,000$ , where  $x$  is the time in months and  $f(x)$  is the rabbit population.

1. Complete the table to show the rabbit population through one year.

Month	Time (month)	Rabbit Population (rabbits)
December		
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

**2. Graph the function representing the rabbit population.**



**3. How has the function been translated vertically from the basic sine function?**

**4. Determine each characteristic of the function.**

**a. Amplitude**

**b. Period**

**c. Phase shift**

**5. How is the vertical translation related to the algebraic function? What does it represent in terms of this problem situation?**

**6. How is the amplitude related to the algebraic function? What does it represent in terms of this problem situation?**

**7. How is the period related to the algebraic function? What does it represent in terms of this problem situation?**

**8. How is the phase shift related to the algebraic function? What does it represent in terms of this problem situation?**

**9. If the rabbit population cycle occurred over six months instead of one year, how would the graph and equation change?**

**10. If the rabbit population had a minimum of 4000 and a maximum of 20,000, how would the graph and equation change?**

**11. Describe the time(s) in months when the rabbit population is equal to 12,000. Show your work.**



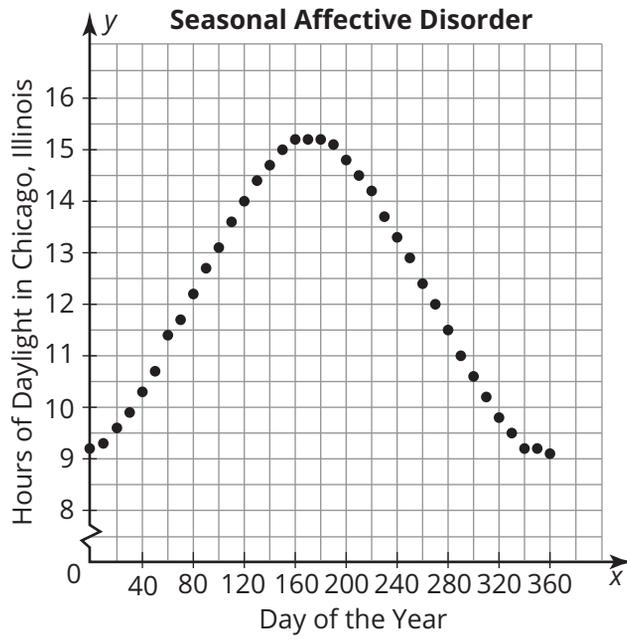


Patterns of daylight are related to seasonal affective disorder (SAD). The amount of daylight varies in a periodic manner and can be modeled by a sine function. The table shows the number of approximate daylight hours in Chicago, Illinois, which has latitude of  $42^\circ$  N.

Date	Day	Daylight Hours
Dec. 31	0	9.2
Jan. 10	10	9.3
Jan. 20	20	9.6
Jan. 30	30	9.9
Feb. 9	40	10.3
Feb. 19	50	10.7
Mar. 1	60	11.4
Mar. 11	70	11.7
Mar. 21	80	12.2
Mar. 31	90	12.7
Apr. 10	100	13.1
Apr. 20	110	13.6
Apr. 30	120	14.0
May 10	130	14.4
May 20	140	14.7
May 30	150	15.0
June 9	160	15.2
June 19	170	15.2
June 29	180	15.2

Date	Day	Daylight Hours
July 9	190	15.1
July 19	200	14.8
July 29	210	14.5
Aug. 8	220	14.2
Aug. 18	230	13.7
Aug. 28	240	13.3
Sept. 7	250	12.9
Sept. 17	260	12.4
Sept. 27	270	12.0
Oct. 7	280	11.5
Oct. 17	290	11.0
Oct. 27	300	10.6
Nov. 6	310	10.2
Nov. 16	320	9.8
Nov. 26	330	9.5
Dec. 6	340	9.2
Dec. 16	350	9.2
Dec. 26	360	9.1

The graph shown models the data in the table.



1. Determine each characteristic.

a. Minimum and maximum values

b. Amplitude

c. Period

d. Phase shift

e. Vertical shift

2. To model this situation with a sine function in transformation function form, you need to determine the  $A$ -,  $B$ -,  $C$ -, and  $D$ -values.
  - a. Determine the value of  $A$ . What does it represent in terms of this situation?
  - b. Determine the value of  $B$ . Explain your reasoning.
  - c. Determine the value of  $C$ .
  - d. Determine the value of  $D$ . What does it represent in terms of this situation?
  - e. Write an algebraic function to model the data for the number of daylight hours in Chicago, Illinois.
3. Use technology to perform a sinusoidal regression for this data and write the regression equation. How does it compare to your equation?

4. Use the regression equation to describe times of the year when there are exactly 12 hours of daylight. Show your work.
  
5. Seasonal affective disorder appears to vary according to latitude. The farther a location is from the equator, the more prevalent cases of SAD become. Why might this happen?
  
6. Anchorage, Alaska, is located at a latitude of  $61^\circ$  N. This is considerably farther north than Chicago. If you created a graph to model the daylight hours in Anchorage, how do you think it would compare to the graph for daylight hours in Chicago? In what ways would it be the same? In what ways would it be different?
  
7. In locations like Chicago and Anchorage, SAD is most likely to occur around the month of January. In locations in the southern hemisphere, like Santiago, Chile (latitude  $33.5^\circ$  S), SAD occurs around the month of July. Why does this happen?

TALK the TALK **Transforming Trig Functions**

1. Write a sine function to represent the data shown.  
Explain your reasoning.

$x$	$y$
0	200
1	170
2	110
3	80
4	110
5	170
6	200

# Assignment

## Write

Describe the types of situations that can be modeled using trigonometric functions.

## Remember

The key characteristics of periodic functions, including period, amplitude, midline, and phase shift, are used to model components of real-world situations.

## Practice

- The height of a roller coaster can be modeled by the function  $f(x) = 20 \cos\left(\frac{\pi}{60}x\right) + 30$ , where  $x$  represents the horizontal distance from the start of the ride in meters, and  $f(x)$  represents the vertical height of the ride in meters.
  - Determine the amplitude of the function. What does it represent in terms of this problem situation?
  - Determine the period of the function. What does it represent in terms of this problem situation?
  - Determine the vertical shift of the function. What does it represent in terms of this problem situation?
- The table shows the average monthly high temperature for a town in Tennessee. This data can be modeled with a sine function.

Month	1	2	3	4	5	6	7	8	9	10	11	12
Average High Temperature (°F)	50	53	60	71	80	87	90	89	84	73	59	50

- Plot the points from the table using the number of the month for your independent variable and the average high temperature for your dependent variable.
- Determine the amplitude, period, and vertical shift of the function that could be used to model this data. Explain your reasoning.
- Use technology to perform a sinusoidal regression for the data. Write the regression equation. Is this model a good fit for the data? Explain your reasoning.

## Stretch

- The data in the tables show the fraction of the Moon illuminated at midnight each day in the month of February, 2018. This data can be modeled with a sine function.

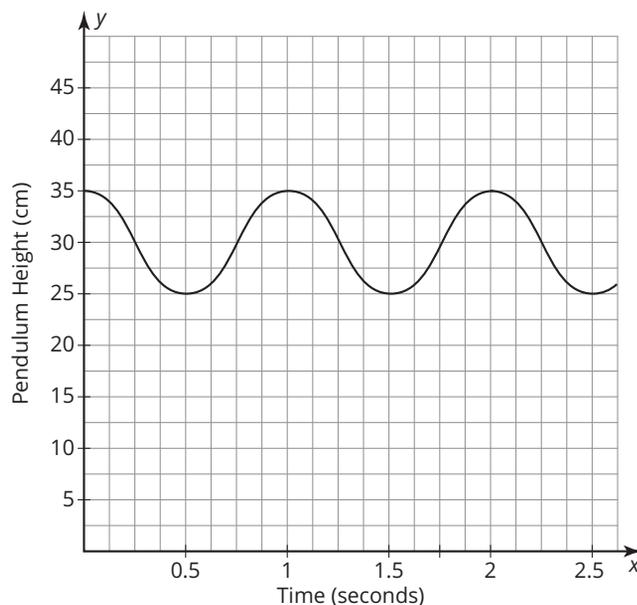
Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Fraction of Moon Illuminated	0.99	0.96	0.90	0.83	0.74	0.64	$\frac{0.5}{5}$	0.45	0.35	0.27	0.19	0.12	0.07	0.03

Day	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Fraction of Moon Illuminated	0	0	0.02	$\frac{0.05}{5}$	0.11	0.18	0.27	0.38	0.49	0.6	0.71	0.81	0.89	0.95

- Plot the points from the table using the number of the day for the independent variable and the fraction of the Moon illuminated for the dependent variable.
- Determine the amplitude and period of the function that could be used to model this data. Explain your reasoning.
- Use technology to perform a sinusoidal regression for the data. Write the regression equation. Is this model a good fit for the data? Explain your reasoning.

## Review

- Use a periodicity identity to list three solutions for the equation  $\cos x = -\frac{1}{2}$ .
- Solve the equation over the domain of all real numbers:  $5 + 4 \cos \theta = 3$ .
- A pendulum clock swings back and forth. At rest, the pendulum is 25 cm above the base. At the highest point of the swing, the pendulum is 35 cm above the base. It takes the pendulum 2 seconds to swing back and forth. The graph shows the height of the pendulum above the base as a function of seconds. Assume the pendulum is released from its highest point.
  - Determine the amplitude of the function.
  - Determine the period of the function.
  - Determine the height of the pendulum at 3.75 seconds.



- Solve each equation. Round your answers to the thousandths, if necessary.
  - $\left(\frac{2}{3}\right)^x = 5^{3-x}$
  - $2 \log_5 x = 3 \log_5 2$

# 3

## The Wheel Deal

Modeling Motion with a Trigonometric Function

### Warm Up

Describe the transformation of the graph of each function from the basic function  $f(\theta) = \sin \theta$ .

1.  $f(\theta) = 3.5 \sin \theta$

2.  $f(\theta) = \sin(\theta + \pi)$

3.  $f(\theta) = -\sin \theta + \frac{1}{2}$

### Learning Goals

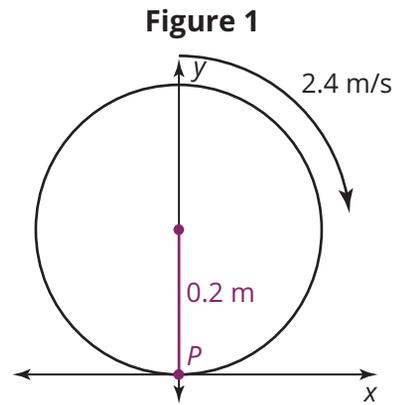
- Interpret characteristics of a graph of a trigonometric function in terms of a problem situation.
- Construct a trigonometric function to model a problem situation.

You have used the unit circle to explore trigonometric functions. You have also explored how the values of the transformed function form affect the shape of the graph of a periodic function. How can you use what you know to build a trigonometric function to model circular motion in real-world problems?

## Big Wheel Keeps on Turning

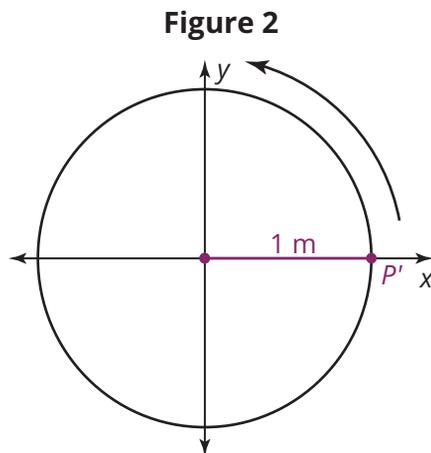
Suppose a wheel with a radius of 0.2 meter rolls clockwise on a street at a rate of 2.4 m/s.

You can build a trigonometric function to model the height,  $h$ , from the street of a point,  $P$ , on the wheel as a function of time,  $t$ , in seconds. As the wheel rolls, the position of point  $P$  will move along the circle.



In order to build this trigonometric function, let's first think about point  $P$  from Figure 1 in standard position on a unit circle as point  $P'$  in Figure 2, moving counterclockwise.

- Point  $P'$  is located where a terminal ray in standard position intersects the circle at 0 radians.
- The point is moving counterclockwise instead of clockwise.
- The wheel is rotating in place and has a radius of 1 meter.
- The x-axis represents the ground.



**1. Which trigonometric function models the height,  $h$ , of point  $P'$  for each angle measure,  $\theta$ , in radians?**

# Modeling Motion with a Trigonometric Function

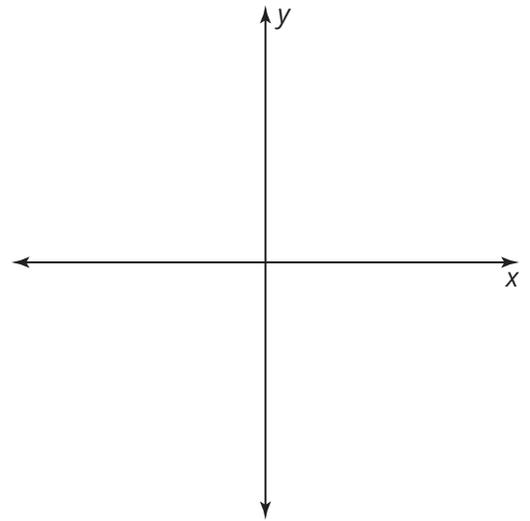


Let's consider each piece of information in the original problem situation from the Getting Started and how you can use transformations to build an equation to model Figure 1.

**1. Use the given information to sketch each figure and write each corresponding equation. Describe the transformation.**

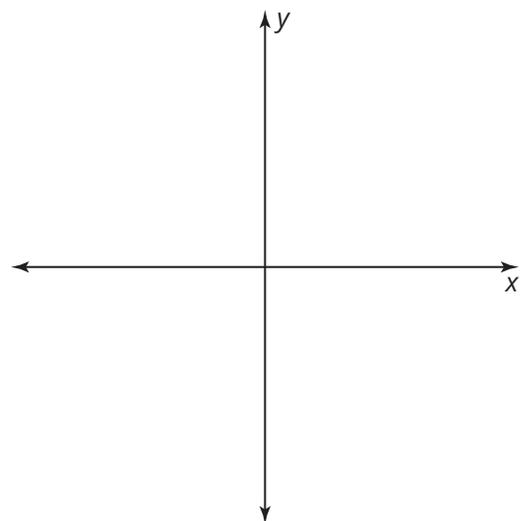
**a. To sketch Figure 3, consider Figure 2 but the radius is 0.2 meter. Label point  $P'$  on your graph.**

**Figure 3**



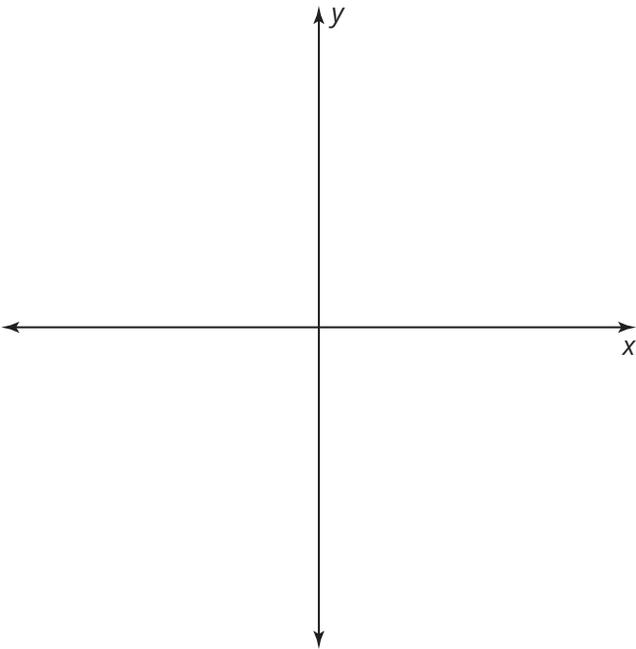
**b. To sketch Figure 4, consider Figure 3 but the wheel rests on the ground. Label point  $P'$  on your graph.**

**Figure 4**



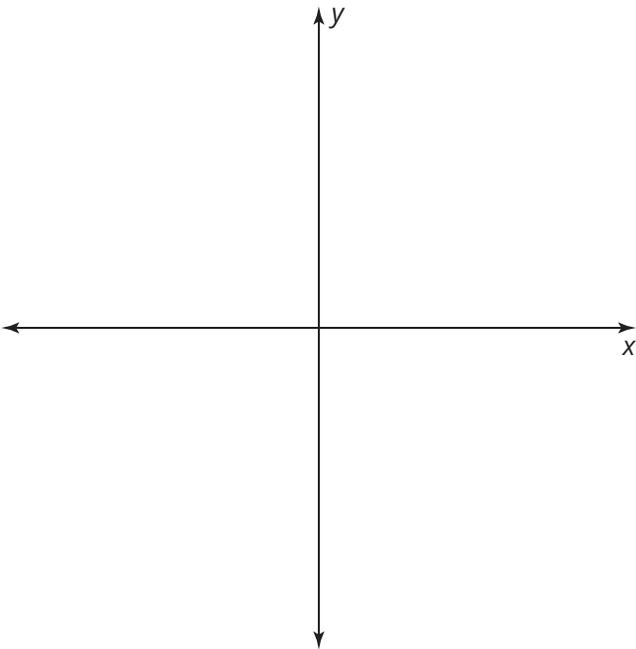
- c. To sketch Figure 5, consider Figure 4 but translate point  $P'$  to the original starting position, point  $P$ , in Figure 1. Label point  $P$  on your graph.

**Figure 5**



- d. To sketch Figure 6, consider Figure 5 but the wheel turns clockwise. Label point  $P$  on your graph.

**Figure 6**



You have just written an equation that models the height of point  $P$  on the wheel with a radius of 0.2 meter in terms of  $\theta$ .

Now let's consider the relationship between time and  $\theta$  to write an equation for the height of point  $P$  on the wheel in terms of time.

**2. Write an equation for the height of point  $P$  on the wheel in terms of time  $t$ .**

**a. Determine the relationship between time,  $t$ , and  $\theta$ .**

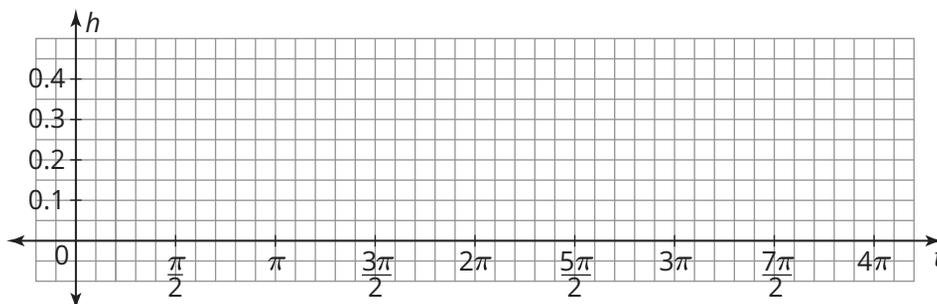
**Think**

**about:**

Use the relationship for distance in terms of rate and time to write distance as a function of  $\theta$ .

**b. Write the final equation in terms of time  $t$ .**

**3. Sketch a graph of your function from Question 2. Label the axes.**



**4. Determine the height of the point at 1 second.**

**5. Rewrite your function as a cosine function.  
Explain your reasoning.**

**6. What are the advantages of rewriting your function as a cosine function?**

**7. At what time(s) is the height of the point at 0.2 meter?**

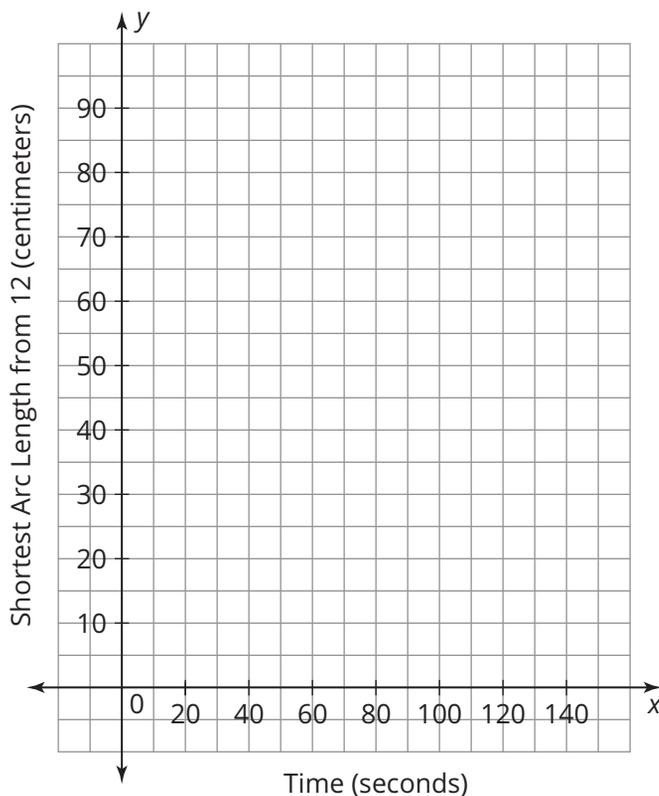
## TALK the TALK

### Time Stops for No One!

Consider the second hand on the face of a clock. The length of the second hand and radius of the clock face are each 30 centimeters. Suppose the second hand begins its movement at exactly 12:00 midnight.



1. Complete the table to describe the time in seconds and the shortest arc length between the tip of the second hand and its starting position at 12:00, in centimeters. For each complete revolution, suppose that the distance resets to 0. Then create a graph.



Time (seconds)	Shortest Arc Length from 12 (centimeters)
0	
10	
20	
30	
40	
50	
60	0
70	
80	
90	
100	
110	
120	

2. What is the amplitude of this function?

3. What is the vertical shift of this function? Why is a vertical shift necessary?

4. Consider the relationship between time and  $\theta$ .

a. Write a proportion with ratios for length and angle measure. Solve for  $d$ .

b. Use the Distance Formula to express  $\theta$  in terms of time.

5. Choose the trigonometric function that best models this situation.

$$f(x) = -30\pi \cos\left(\frac{\pi}{30}x\right) + 30\pi$$

$$f(x) = -30\pi \cos\left(\frac{\pi}{6}x\right) + 15\pi$$

$$f(x) = -15\pi \cos\left(\frac{\pi}{30}x\right) + 15\pi$$

$$f(x) = -15\pi \cos\left(\frac{\pi}{6}x\right) + 15\pi$$

# Assignment

## Write

Describe how you can model the motion of points on a circle by using transformations of a trigonometric function.

## Remember

Transformations of periodic functions can be used to map function behavior to the behavior of periodic phenomena, such as amplitude, period, frequency, phase shift, and midline.

## Practice

- Angela rode the Ferris wheel at Navy Pier in Chicago. The Ferris wheel has a diameter of 140 feet. She was curious about how long it would take her to get from the lowest point to the highest point of the ride. She began timing her ride while she was at the bottom of the wheel and noticed that it took her 3 minutes and 45 seconds to get to the top. At the highest point, Angela was 150 feet off the ground. The vertical height,  $h$ , of a person riding the Ferris Wheel can be modeled as a trigonometric function of time,  $t$ , in seconds. The Ferris wheel moves in a clockwise direction.
  - Determine Angela's vertical height when she is at the lowest point of the ride.
  - Determine the amount of time it takes for Angela to complete one revolution on the Ferris wheel. Write your answer in seconds.
  - Sketch a graph of Angela's height in feet on the Ferris wheel as a function of time in seconds.
  - Determine the amplitude of the function. Explain your reasoning.
  - Calculate the period and value of  $B$  of the function. Explain your reasoning.
  - Determine the values of  $C$  and  $D$  of the function if a cosine function is used to model the problem situation. Explain how you determined your answers.
  - Write a cosine function to model Angela's height on the Ferris wheel as a function of time.
  - Explain how Angela could write a sine function to model the height of the Ferris wheel as a function of time.

## Stretch

The hour hand of a large clock on a wall of a train station measures 18 inches in length. At noon, the tip of the hour hand is 40 inches from the ceiling. Let  $y$  equal the distance from the tip of the hour hand to the ceiling  $x$  hours after noon. Determine a trigonometric equation that best models the motion of the hour hand and sketch the graph.

## Review

- The tide at a pier can be modeled by the equation  $h(t) = 2 \cos\left(\frac{\pi}{6}t\right) + 7$ , where  $t$  represents the number of hours past noon and  $h(t)$  represents the height of the tide in feet.
  - Determine the amplitude of the function. What does it represent in terms of this problem situation?
  - Determine the period of the function. What does it represent in terms of this problem situation?
  - Determine the vertical shift of the function. What does it represent in terms of this problem situation?
- A satellite in a medium Earth orbit completes one orbit every 12 hours. The satellite follows a circular path with its center at the center of the earth. The satellite is at an altitude of 12,552 miles. The radius of the earth is 3959 miles.
  - Determine the angle of rotation, in radians, that corresponds to a 5-hour time period.
  - Determine the distance traveled by the satellite in a 5-hour time period.
- Multiply the rational expressions.

a.  $\frac{x^2 + 6x + 9}{x - 3} \cdot \frac{x^2 + 3x - 18}{x^2 - 9}$

b.  $\frac{x^3 - 8}{x^4 - 9x^2} \cdot \frac{x^5 - 6x^4 + 9x^3}{x^2 - 4x + 4}$

# 4

# Springs Eternal

## The Damping Function

### Warm Up

Solve for  $x$ .

1.  $8^x = 262,144$

2.  $\left(\frac{3}{5}\right)^x = \frac{81}{625}$

3.  $0.9^x = 0.5$

### Learning Goals

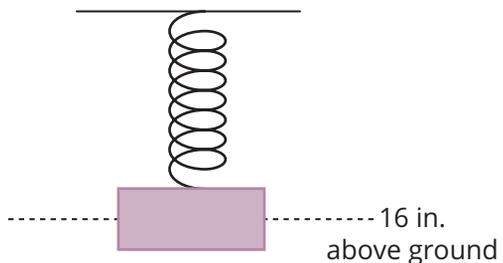
- Choose a trigonometric function to model a periodic phenomenon.
- Determine the graphical attributes (amplitude, midline, frequency) of a periodic function from a description of a problem situation.
- Build a function that is a combination of a trigonometric function and an exponential function.

### Key Term

- damping function

You know how to model a real-world situation that displays periodic tendencies with a trigonometric function. You also know how to model a situation that increases or decreases at a constant ratio using an exponential function. How can you combine these two types of functions to model a real-world situation that is both periodic and decreasing?

## Bouncing Up and Down

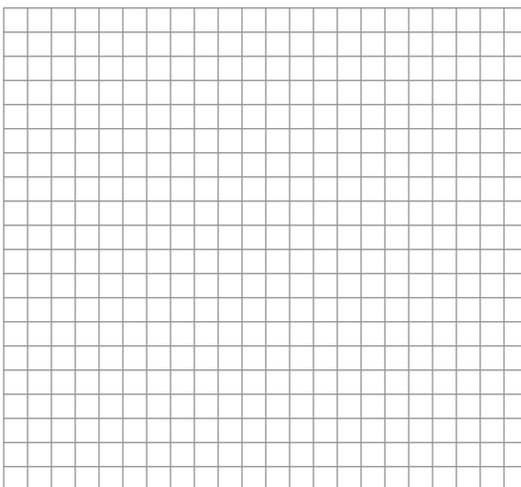


An object suspended from a spring is pulled 5 inches below its resting position and released, causing the object to bounce up and down once every second. At rest, the object's height above the ground is 16 inches.

Suppose that the object bounces up 5 inches above its resting height and then back down to 5 inches below its resting height without stopping on every bounce. Let's build a periodic function to model the bouncing of the object on the spring over time.

**1. Determine the independent and dependent quantities for this situation.**

**2. Sketch and label the graph of the function to model the bouncing object over time  $h(t)$ , given what you know about the height of the object. Represent at least two bounces of the object on the graph.**



Using a Graph to Write  
a Periodic Function

Consider the problem situation from the Getting Started and the graph you created.

**1. Use your graph to determine each characteristic of the periodic function that will model this situation. Explain your reasoning.**

**a. Determine the equation of the midline of the graph.**

**b. Determine the minimum, maximum, and amplitude of the function.**

**2. Does your sketch model a sine curve or a cosine curve? Explain your reasoning.**

**3. Write the values of  $A$ ,  $C$ , and  $D$  for the function  $h(t)$ . Explain how you determined each value.**

**Think**

about:

What characteristics of the graphed function correspond to the  $A$ -,  $B$ -,  $C$ -, and  $D$ -values of the transformed function?

## Remember:

The period of a sine or cosine function is  $\frac{2\pi}{|B|}$ .

4. Determine the period of the function  $h(t)$ . Then write the  $B$ -value of the function. Show your work.

5. Write the equation for the function  $h(t)$  to represent the height of the object over time.

## Think

about:

What are the cosine values on the unit circle?

6. Explain why the sign of the  $B$ -value in this function can be either positive or negative.

7. Solve an equation to determine when the object on the spring is at its minimum height. Show your work.

## Ask

yourself:

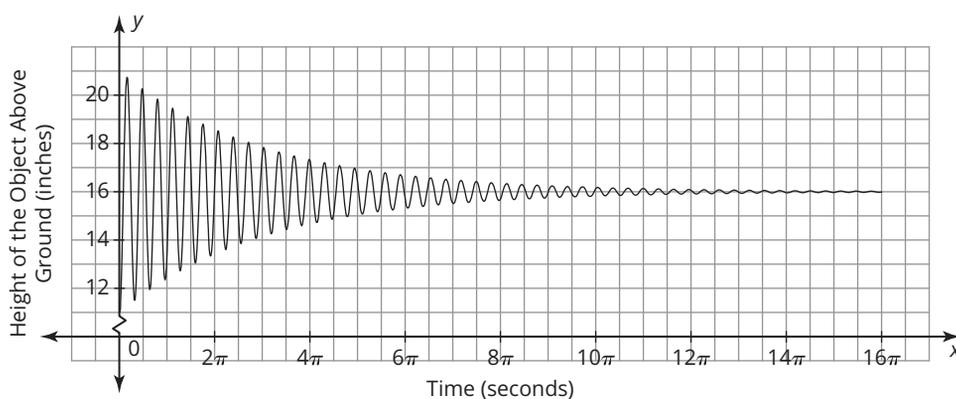
Do your solutions represent every time the object is at the midline?

8. Solve an equation to determine when the object on the spring is at a height of 16 inches. Show your work.



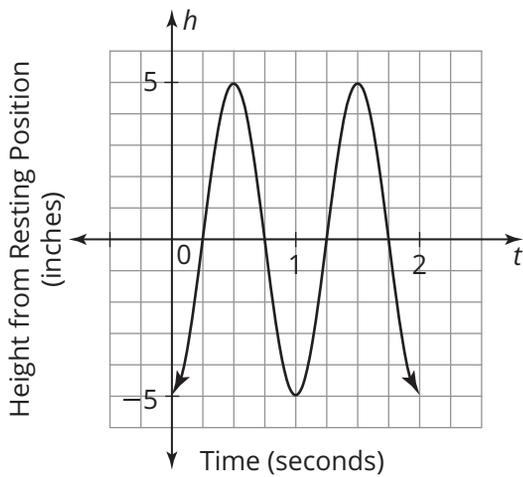
An object connected to a string and bouncing up and down the same amount forever is not realistic. Starting from when the object is released, the energy produced will eventually fade away. The object will bounce closer and closer to the midline until it once again comes to rest.

Let's consider the same situation from the Getting Started. A more realistic model of the object's motion is shown.



Recall the function that models the situation from the Getting Started is  $h(t) = -5\cos(2\pi t) + 16$ .

1. How do you think you can adjust the function  $h(t)$  to create the shape of the graph shown? What is changing in each period of this function?



A graph of the function  $k(t) = h(t) - 16$  is shown. This is the function relative to its resting position. Suppose that the distance the object bounces from its resting position decreases at a rate of 10% each second.

**2. At  $t = 0$ , the object is at  $-5$  inches from its resting position.**

**a. Determine the object's new height at  $t = 1$  second and  $t = 2$  seconds.**

**b. Write an equation to describe the object's new height,  $n$ , over time,  $t$ . Explain your reasoning.**

**c. Does your equation correctly describe the object's new height at  $t = \frac{1}{2}$  second? At  $t = 1\frac{1}{2}$  seconds? If not, what equation would be correct?**

### 3. Explain why Kent is correct.

Kent



The equation  $b(t) = |A| \cdot 0.9^t$  describes the change in the object's height over time, because  $|A|$  represents the amplitude of the function.

### 4. Write the complete function that represents the height of the object on the spring over time.

### 5. After how many seconds is the maximum height of the object on the spring equal to 18 inches? Explain how you determined your solution.

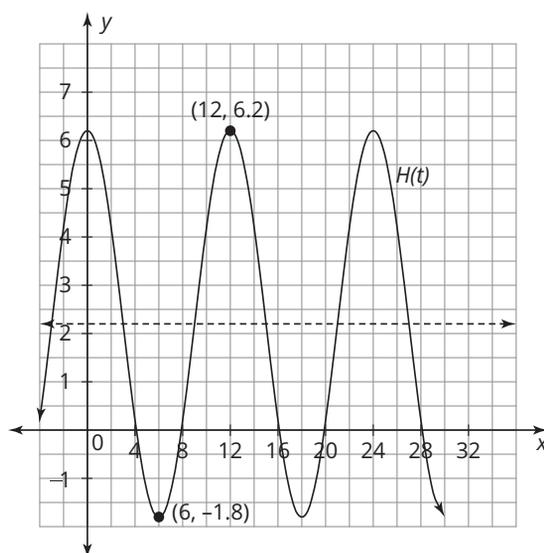
The function that you multiply to the periodic function to decrease its amplitude over time is called a **damping function**. A damping function can be linear, quadratic, exponential, and on and on!

6. Write a function  $g(t)$  to model the height of an object connected to a spring with decreased amplitude over time given the conditions:
- At rest, the object's height is 10 inches above the ground.
  - The object bounces up and down once every 2 seconds.
  - At  $t = 0$ , the object's height is 14 inches.
  - The distance the object bounces from its resting position decreases at a rate of 15% each second.
7. How would the exponent of the  $A$ -value in the function you wrote in Question 6 change if the rate of decrease for the amplitude is per bounce and not per second? Explain your reasoning.

## TALK the TALK

### The Turning of the Tides

A trigonometric function can be used to model the changes in high and low tides at particular locations. The gravitational force of both the Moon and Sun affect the height of the tide. The graphed function models the high and low tides, where  $H(t)$  represents the height of the tide in feet over time.



1. What is the amplitude of the function? Explain how you can use the graph to determine this value.
2. What is the vertical shift of the function? How is it determined?

3. Choose the trigonometric function that models this situation.

$$H(t) = 4 \cos\left(\frac{\pi}{6}(t + 3)\right) + 2.2$$

$$H(t) = 4 \sin\left(\frac{\pi}{6}(t + 3)\right) + 2.2$$

$$H(t) = 4 \cos(12(t + 3)) + 2.2$$

$$H(t) = 4 \sin(12(t + 3)) + 2.2$$

Interpret the different characteristics of the periodic function with respect to this problem situation.

4. What is the phase shift? How is it related to the problem situation?

5. What is the period of the function? How is it related to the problem situation?

6. What is the high tide at midnight?

# Assignment

## Write

Describe a real-world example of a damping function.

## Remember

A trigonometric function and an exponential function can be combined to model a periodic function whose amplitude decreases over time. The function that is multiplied to the periodic function is called a damping function.

## Practice

- Jordan is swinging on a rope swing that swings over a creek. When he jumps on the swing, he is 20 feet away from the center of the creek. He then swings out to 20 feet past the center of the creek to the other side. As he swings, he pumps his legs to keep his swinging motion constant. Amelia times Jordan as he swings. Jordan's distance in feet from the center of the creek,  $d$ , can be modeled with a trigonometric function of the time he swings,  $t$ , in seconds. It takes Jordan 2 seconds to swing from one side of the creek to the other.
  - Sketch the graph of a function that could be used to model this problem situation.
  - Write the equation of the cosine function,  $d(t)$ , that can be used to model the distance Jordan is from the center of the creek as a function of time.
  - Use the equation from part (b) to determine Jordan's distance from the center of the creek at 9.5 seconds. Round your answer to the nearest foot.
  - Use the equation from part (b) to determine when Jordan is 6 feet from the center of the creek. Round your answer to the nearest tenth of a second.
- Amelia is swinging on a rope swing over a creek. When she jumps on the swing, she is 20 feet away from the center of the creek. She then swings out past the center of the creek toward the other side. She decides that she will not pump her legs to keep the swing moving and will just let it swing until it stops. Jordan times Amelia as she swings. Suppose Amelia's distance on each side of the creek decreases at a rate of 20% on each swing. It takes her 2 seconds to swing toward the other side of the creek on her first swing.
  - Determine the distance Amelia swings past the center of the creek on her first trip over the creek on her initial swing.
  - Determine the distance Amelia swings past the center of the creek on her second trip over the creek.
  - Write an equation to represent Amelia's distance,  $d$ , in terms of the time,  $t$ , after each trip across the creek. Hint: It takes 2 seconds for Amelia to swing from one side of the creek to the other.
  - Let the function  $d(t) = -20 \cos\left(\frac{\pi}{2}t\right)$  represent Amelia's distance from the center of the creek if she was swinging at a constant rate back and forth. Use this function to write a new function that represents Amelia's actual distance from the center of the creek given that her distance decreases by 20% each time she swings back over the creek.
  - Determine Amelia's distance from the center of the creek after 10 seconds. Round your answer to the nearest foot.

## Stretch

1. Lian is swinging on a rope swing over a creek. As she swings, she pumps her legs to keep her swinging motion constant. The table shows her distances from the center of the creek from the moment she jumps on the swing until 8 seconds have passed.

Time (seconds)	0	1	2	3	4	5	6	7	8
Distance (feet)	-15	0	15	0	-15	0	15	0	-15

- Sketch the graph of a function that could be used to model this problem situation.
- Write the equation of the cosine function,  $d(t)$ , that can be used to model the distance Lian is from the center of the creek as a function of time.

When Lian is at the spot where she first jumped on the swing, she decides to stop pumping her legs and just let it swing until it stops. The table shows her distances from the center of the creek from the moment she stops pumping her legs until 8 seconds have passed.

Time (seconds)	0	1	2	3	4	5	6	7	8
Distance (feet)	-15	0	11.25	0	-8.4375	0	6.328125	0	-4.74609375

- Sketch the graph of a function that could be used to model this problem situation.
- Write an equation to represent Lian's distance,  $d$ , in terms of the time,  $t$ , after each trip across the creek.
- Use your function from part (b) to write a new function to represent Lian's actual distance from the center of the creek in terms of the time,  $t$ .

## Review

- A person is riding a Ferris wheel. The graph shows the person's height from the ground in feet as a function of time in seconds. The time starts when the rider boards the ride.
  - Determine the amplitude of the function. Explain your reasoning.
  - Calculate the period and value of  $B$  of the function. Explain your reasoning.
  - Determine the values of  $C$  and  $D$  of the function if a cosine function is used to model the problem situation. Explain how you determined your answers.
  - Write a trigonometric function to model the height of the rider from the ground as a function of time.
- Add the rational expressions.

a.  $\frac{6}{x-1} + \frac{x}{4}$

b.  $\frac{3}{x-1} + \frac{4}{x+2}$



# Physics

# Experiment: What do you hear underwater?

By Scientific American/Science Buddies on 03.28.20

Word Count **606**

Level **MAX**



Use these items to learn more about how hearing sounds changes when you go underwater. Newsela staff

Have you ever listened to noises underwater? Sound travels differently in the water than it does in the air. To learn more, try making your own underwater noises — and listening carefully.

## Materials

Bathtub or swimming pool (a very large bucket can work, too)

Water

Two stainless steel utensils (for example, spoons or tongs)

Two plastic utensils

Small ball

Towel

Adult helper

An area that can get wet (if not performing the activity at a pool)

Floor cloth to cleanup spills (if not performing the activity at a pool)

Other materials to make underwater sounds (optional)

Access to a swimming pool (optional)

Internet access (optional)

### **Preparation**

Fill the bathtub with lukewarm water — or head to the pool — and bring your helper and other materials.

### **Procedure**

1. Ask your helper to click one stainless steel utensil against another. Listen. How would you describe the sound? In a moment, your helper will click one utensil against the other underwater. Do you think you will hear the same sound?
2. Ask your helper to click one utensil against the other underwater. Listen. Does the sound appear to be louder or softer? Is what you hear different in other ways, too?
3. Submerge one ear in the water. Ask your helper to click one utensil against the other underwater. Listen. How would you describe this sound?
4. Ask your helper to click one utensil against the other underwater soon after you submerge your head. Take a deep breath, close your eyes and submerge your head completely or as much as you feel comfortable doing. Listen while you hold your breath underwater. (Come up for air when you need to.) Does the sound appear to be louder or softer? Does it appear to be different in other ways?
5. Repeat this sequence but have your helper use two plastic utensils banging against each other instead.
6. Repeat the sequence again, but this time listen to a small ball being dropped into the water. Does the sound of a ball falling into the water change when you listen above or below water? Does your perception of this sound change? Why would this happen?
7. Switch roles. Have your helper listen while you make the sounds.
8. Discuss the findings you gathered. Do patterns appear? Can you conclude something about how humans perceive sounds when submerged in water?

**Extra:** Test with more types of sounds: soft as well as loud sounds, high- as well as low-pitched sounds. Can you find more patterns?

**Extra:** To investigate what picks up the sound wave when you are submerged, use your fingers to close your ears or use earbuds when submerging your head. How does the sound change when you close off your ear canal underwater? Does the same happen when you close off your ear canal when you are above water? If not, why would this be different?

**Extra:** Go to the swimming pool and listen to the sound of someone jumping into the water. Compare your perception of the sound when you are submerged with when your head is above the water. How does your perception change? Close your eyes. Can you tell where the person jumped into the water when submerged? Can you tell when you have your head above the water?

**Extra:** Research ocean sounds and how sounds caused by human activity impact aquatic animals.

### **Observations And Results**

When you submerged only your ear, the sound probably appeared muffled. When you submerged your head, the sound probably sounded fuller. If you tried to detect where the sound came from when submerged, you probably had a hard time.

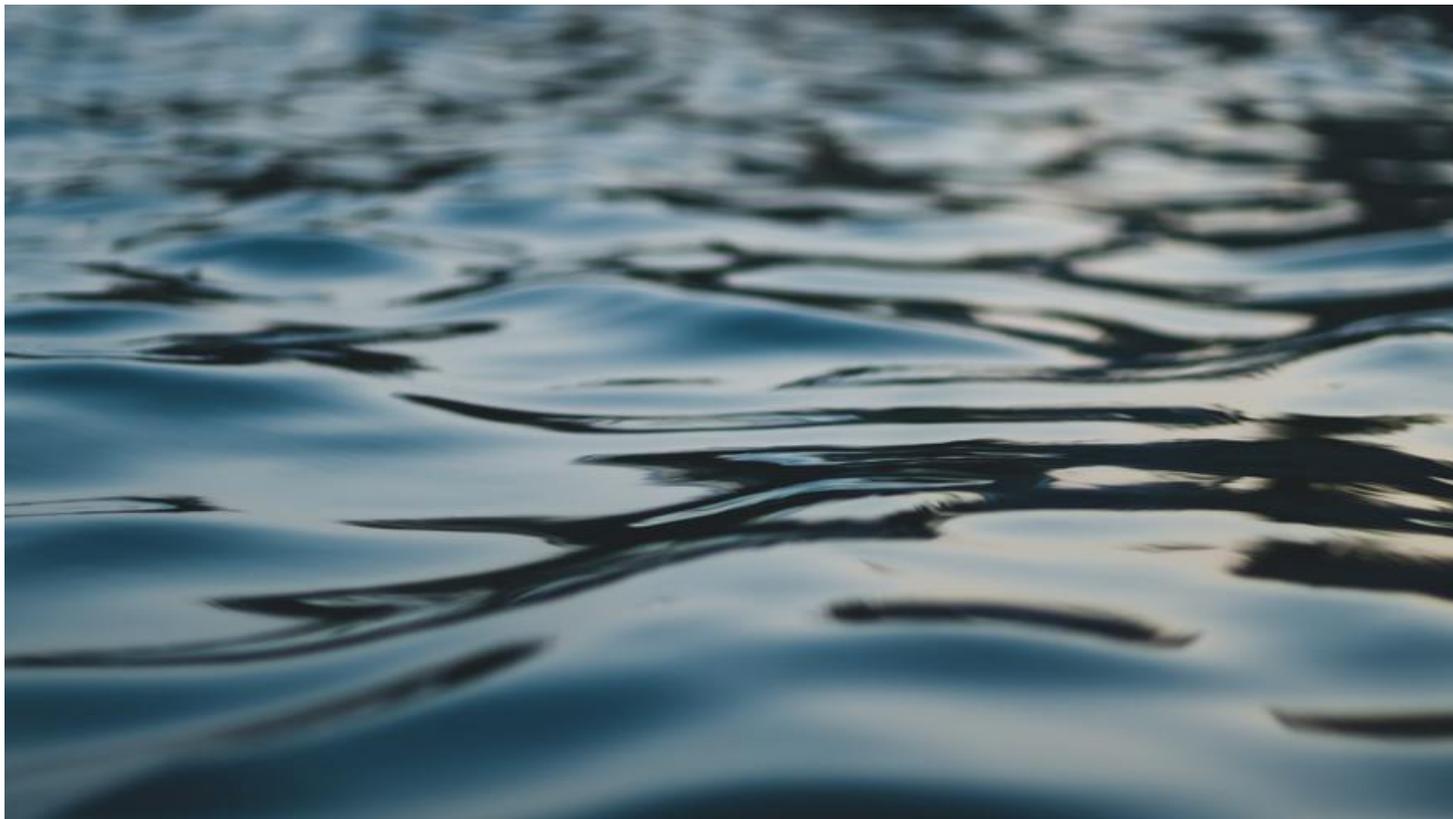
## Quiz

# What do you hear underwater?

By Sabine de Brabandere, Scientific American on 01.12.20

Word Count **1,173**

Level **MAX**



Sound travels differently through water than it does through air. It travels faster and farther in water because there are more particles for the sound waves to bump into. Photo: Rahul/Pexels

Have you ever listened to noises underwater? Sound travels differently in the water than it does in the air. To learn more, try making your own underwater noises — and listening carefully.

## Background

Sound is a wave created by vibrations. These vibrations create areas of more and less densely packed particles. So sound needs a medium to travel, such as air, water — or even solids.

Sound waves travel faster in denser substances because neighboring particles will more easily bump into one another. Take water, for example. There are about 800 times more particles in a bottle of water than there are in the same bottle filled with air. Thus, sound waves travel much faster in water than they do in air. In freshwater at room temperature, for example, sound travels about 4.3 times faster than it does in air at the same temperature.

Sound traveling through air soon becomes less loud as you get farther from the source. This is because the waves' energy quickly gets lost along the way. Sound keeps its energy longer when

traveling through water because the particles can carry the sound waves better. In the ocean, for example, the sound of a humpback whale can travel thousands of miles!

Underwater sound waves reaching us at a faster pace and keeping their intensity longer seem like they should make us perceive those sounds as louder when we are also underwater. The human ear, however, evolved to hear sound in the air and is not as useful when submerged in water. Our head itself is full of tissues that contain water and can transmit sound waves when we are underwater. When this happens, the vibrations bypass the eardrum, the part of the ear that evolved to pick up sound waves in the air.

Sound also interacts with boundaries between two different mediums, such as the surface of water. This boundary between water and air, for example, reflects almost all sounds back into the water. How will all these dynamics influence how we perceive underwater sounds? Try the activity to find out!

## Key Concepts

Physics Sound Waves Biology

## Materials

Bathtub or swimming pool (a very large bucket can work, too)

Water

Two stainless steel utensils (for example, spoons or tongs)

Two plastic utensils

Small ball

Towel

Adult helper

An area that can get wet (if not performing the activity at a pool)

Floor cloth to cleanup spills (if not performing the activity at a pool)

Other materials to make underwater sounds (optional)

Access to a swimming pool (optional)

Internet access (optional)

## Preparation

Fill the bathtub with lukewarm water — or head to the pool — and bring your helper and other materials.

## Procedure

1. Ask your helper to click one stainless steel utensil against another. Listen. *How would you describe the sound?*

In a moment, your helper will click one utensil against the other underwater. *Do you think you will hear the same sound?*

2. Ask your helper to click one utensil against the other underwater. Listen. *Does the sound appear to be louder or softer? Is what you hear different in other ways, too?*

3. Submerge one ear in the water. Ask your helper to click one utensil against the other underwater. Listen. *How would you describe this sound?*

4. Ask your helper to click one utensil against the other underwater soon after you submerge your head. Take a deep breath, close your eyes and submerge your head completely or as much as you feel comfortable doing. Listen while you hold your breath underwater (come up for air when you need to). *Does the sound appear to be louder or softer? Does it appear to be different in other ways?*

5. Repeat this sequence but have your helper use two plastic utensils banging against each other instead.

6. Repeat the sequence again, but this time listen to a small ball being dropped into the water. *Does the sound of a ball falling into the water change when you listen above or below water? Does your perception of this sound change? Why would this happen?*

7. Switch roles. Have your helper listen while you make the sounds.

8. Discuss the findings you gathered. *Do patterns appear? Can you conclude something about how humans perceive sounds when submerged in water?*

Extra: Test with more types of sounds: soft as well as loud sounds, high- as well as low-pitched sounds. *Can you find more patterns?*

Extra: To investigate what picks up the sound wave when you are submerged, use your fingers to close your ears or use earbuds when submerging your head. *How does the sound change when you close off your ear canal underwater? Does the same happen when you close off your ear canal when you are above water? If not, why would this be different?*

Extra: Go to the swimming pool and listen to the sound of someone jumping into the water. Compare your perception of the sound when you are submerged with when your head is above the water. *How does your perception change? Close your eyes. Can you tell where the person jumped into the water when submerged? Can you tell when you have your head above the water?*

Extra: Research ocean sounds and how sounds caused by human activity impact aquatic animals.

## **Observations And Results**

Was the sound softer when it was created underwater and you listened above the water? Did it sound muffled when you had only your ear submerged? Was it fuller when you had your head submerged?

Sound travels faster in water compared with air because water particles are packed in more densely. Thus, the energy the sound waves carry is transported faster. This should make the sound appear louder. You probably perceived it as softer when you were not submerged, however,

because the water surface is almost like a mirror for the sound you created. The sound most likely almost completely reflected back into the water as soon as it reached the surface.

When you submerged only your ear, the sound probably still appeared muffled. This happens because the human ear is not good at picking up sound in water; after all, it evolved to pick up sound in air.

When you submerged your head, the sound probably sounded fuller. That is because our head contains a lot of water, which allows the tissue to pick up underwater sound — without relying on the eardrum. It also explains why closing your ear canal makes almost no difference in the sound you pick up while you are underwater.

If you tried to detect where the sound came from when submerged, you probably had a hard time. Our brain uses the difference in loudness and timing of the sound detected by each ear as a clue to infer where the sound came from. Because sound travels faster underwater and because you pick up sound with your entire head when you are submerged, your brain loses the cues that normally help you determine where the sound is coming from.

## Quiz

1 Which section from the article BEST explains why you can benefit from trying the experiment in different ways?

- (A) "Background"
- (B) "Materials"
- (C) "Procedure"
- (D) "Observations And Results"

2 Read the paragraph from the section "Background."

*Sound traveling through air soon becomes less loud as you get farther from the source. This is because the waves' energy quickly gets lost along the way. Sound keeps its energy longer when traveling through water because the particles can carry the sound waves better. In the ocean, for example, the sound of a humpback whale can travel thousands of miles!*

Which conclusion is BEST supported by this paragraph?

- (A) Sounds heard underwater always seem louder to the human ear than sounds heard above the water.
- (B) Sounds travel faster underwater because the cooler temperatures help them move easily.
- (C) You should research ocean sounds and the way that human activities affect aquatic animals.
- (D) You might be able to hear sounds underwater that would be too far away to hear through the air.

3 According to the article, why do underwater sounds seem fuller when a person's head is fully submerged?

- (A) The ear canal is closed so the brain can pick up additional cues and determine where the sound is coming from.
- (B) The tissues in a human head contain water that allows them to pick up vibrations without relying on the eardrum.
- (C) The human ear evolved to use differences in loudness and timing as a clue about where sound came from.
- (D) The surface of the water acts like a mirror that allows sound waves in water to be transported faster than in the air.

4 Which of the following MOST influences the speed of sound waves?

- (A) the density of the medium they travel through
- (B) the use of earbuds when submerging your head
- (C) the boundaries between two different mediums
- (D) the volume of the source of the sound waves

# How dolphins communicate with whistles and clicks

By Jack Myers, Highlights on 03.08.20

Word Count **891**

Level **MAX**



Image 1. Dolphins use sound to communicate. Two kinds of sounds — whistles and clicks — are a big part of dolphin life. In fact, dolphins are so good at using these sounds that many studies have been designed to find out how dolphins use them. Photo: Howard Hall/Photophile  
Howard Hall/Photophile

In the seawater world of the dolphin, sound is the very best way to communicate or to learn about its surroundings: obstacles or prey or predators.

Scientists have studied two kinds of sounds that are a big part of dolphin life. One kind is a whistle, usually a few seconds long and in many different patterns. Among its many whistles, each dolphin has a special pattern, like a signature, that it uses to tell others where it is.

A very different dolphin sound is the click. That's a sharp burst less than one-thousandth of second long. It is mostly ultrasonic (with a pitch too high for human ears) and use for sonar. By making that loud click and listening to the echoes, a dolphin can find out a lot about what's out there. That works especially well in water, where sound travels about five times faster than it does through air.

An echo may contain a lot of information. The direction of the echo tells the direction of an object that reflected the sound. The time delay tells about the distance the click traveled plus the distance

for the echo to travel back. And the details of the echo may tell about what kind of object reflected it.

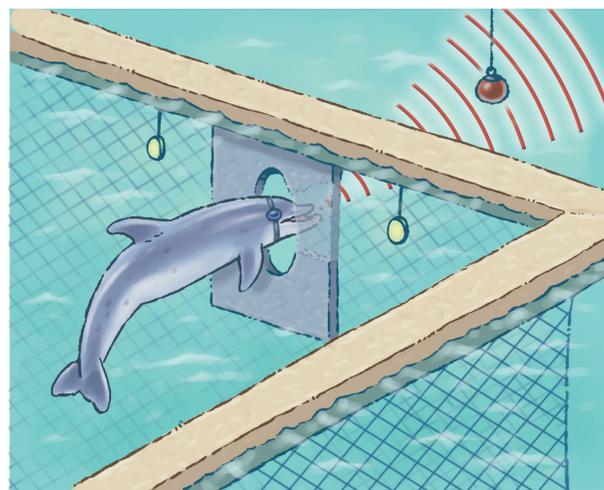
Dolphins are so good at using their sonar that lots of studies have been designed to find out how they do it.

### **A Sonar Game**

As in most studies of animal abilities, scientists first teach the animal a game that it can play over and over. For dolphins, the game usually is designed to tell about how they use sonar. The dolphin floats in a playpen especially designed for the game.

The best way to understand the game is to imagine that you are playing it yourself. You be the dolphin, and I'll be the trainer helping with the game.

You are blindfolded by rubber eyecups so that you can tell what's around you only through your ears. You have been trained to start in a special position with your head in a hoop, as shown in the diagram. A game trial starts when I pull a string and lower a sound-blocking screen out of the way. That's your cue to start making clicks and listening to their echoes.



### **Directing The Target**

Today's target is a four-inch steel ball, but sometimes it may be much smaller. It may be hung at some measured distance in front of you. (In the diagram it is about 20 feet away). My job is to control the target.

It is suspended by fishing line so I can pull it up out of the way. The target is either there or not there. Your job is to use your sonar to tell which.

If you hear an echo from the target, you swim up and push the right paddle to say, "It's there." If you can't hear any echo telling about the target, you swim up and push the left paddle to say, "No, it's not there."

If your choice was correct, I press a buzzer that tells you to come up for a snack. (For a dolphin, that's a tasty fish.) If you have made the wrong choice, there is no buzzer and no reward. You just swim back to the hoop and get ready for the next trial.

At first the game seems too easy. You can always hear echoes when the steel ball is there, and you never make a mistake when the target is not there.

The game gets harder as I move the target farther away and the echoes become weaker. Then you will begin making mistakes.

I move the steel ball way out to 230 feet – about three-fourths the length of a football field. At that distance, you can detect it only nine times in every 10 trials. Now, every extra small distance makes the echoes harder to hear. At 240 feet, you are correct in your echo detection only about 5 times in every 10 trials.

## Mysteries Of Sonar

Our game was taken from a book by Dr. Whitlow Au. He played the game for real with a dolphin named Sven in Kaneohe Bay, Hawaii. The diagram I used was taken from one of his experiments. From the results of the game, you can see that a dolphin can easily find a table-tennis ball in a big, Olympic-size swimming pool.

Dr. Au has gone on to do a whole book full of experiments on dolphin sonar. He trained dolphins to listen to echoes from a standard target and then tell when some other target was used instead. He has used targets of different shapes and different materials.

He is still searching for the dolphin's secret: How does a dolphin use echoes to learn if an object is round or flat, rough or smooth, and hard or soft?

Dr. Au has said, "The dolphin's ability to discriminate and recognize features of targets with its sonar is a characteristic that man-made sonar systems do not possess." By studying dolphins he hopes to make man-made sonar as good as theirs.

## Quiz

- 1 Which sentence from the article would be MOST important to include in a summary of the article?
- (A) Among its many whistles, each dolphin has a special pattern, like a signature, that it uses to tell others where it is.
  - (B) By making that loud click and listening to the echoes, a dolphin can find out a lot about what's out there.
  - (C) You have been trained to start in a special position with your head in a hoop, as shown in the diagram.
  - (D) He played the game for real with a dolphin named Sven in Kaneohe Bay, Hawaii.

- 2 Which statement is a central idea of the article?
- (A) Dolphins can easily find a small table-tennis ball that is floating in an Olympic-size swimming pool.
  - (B) Dolphins that do well at practicing their sonar or jumping through a hoop are given fish as a reward.
  - (C) Scientists create games to help them learn more about what makes dolphins so good at using sonar.
  - (D) Scientists believe the best way to teach dolphins or other animals is by training them to play games.

- 3 How does the author build understanding of dolphin sonar studies?
- (A) by providing a description of steps that asks the reader to imagine being a dolphin
  - (B) by listing the various reasons why dolphins would need to use sonar underwater
  - (C) by comparing and contrasting the traits of dolphin sonar with man-made sonar
  - (D) by describing differences between the whistles and clicks dolphins use to communicate

- 4 Read the following selection from the section "Mysteries Of Sonar."

*He is still searching for the dolphin's secret: How does a dolphin use echoes to learn if an object is round or flat, rough or smooth, and hard or soft?*

*Dr. Au has said, "The dolphin's ability to discriminate and recognize features of targets with its sonar is a characteristic that man-made sonar systems do not possess."*

Why did the author include this idea?

- (A) to suggest that scientists' studies have done little to advance their understanding of dolphin sonar
- (B) to emphasize the unique traits of dolphin sonar that scientists are still working to fully understand
- (C) to introduce the specific differences in the types of targets that are used to understand dolphin sonar
- (D) to demonstrate that scientists trying to understand sonar often find dolphins difficult to work with

# Everyday Mysteries: What is static electricity?

By Library of Congress on 01.13.17

Word Count **405**

Level **MAX**



Ryan Solymar of San Jose Street Elementary School in Los Angeles, California, got to experience the wonders of static electricity as he and his hair became part of an experiment. Photo by David Bohrer/Los Angeles Times via Getty Images

**Question:** How does static electricity work?

**Answer:** An imbalance between negative and positive charges in objects.

Have you ever walked across the room to pet your dog, but got a shock instead? Perhaps you took your hat off on a dry winter's day and had a "hair raising" experience! Or, maybe you have made a balloon stick on the wall after rubbing it against your clothes?

Why do these things happen? Is it magic? No, it's not magic; it's static electricity!

Before understanding static electricity, we first need to understand the basics of atoms and magnetism.

All physical objects are made up of atoms. Inside an atom are protons, electrons and neutrons. The protons are positively charged, the electrons are negatively charged and the neutrons are neutral.

Therefore, all things are made up of charges. Opposite charges attract each other (negative to positive). Like charges repel each other (positive to positive or negative to negative). Most of the time positive and negative charges are balanced in an object, which makes that object neutral.

Static electricity is the result of an imbalance between negative and positive charges in an object. These charges can build up on the surface of an object until they find a way to be released or discharged. One way to discharge them is through a circuit.

The rubbing of certain materials against one another can transfer negative charges, or electrons. For example, if you rub your shoe on the carpet, your body collects extra electrons. The electrons cling to your body until they can be released. As you reach and touch your furry friend, you get a shock. Don't worry, it is only the surplus electrons being released from you to your unsuspecting pet.

And what about that "hair raising" experience? As you remove your hat, electrons are transferred from hat to hair, creating that interesting hairdo! Remember, objects with the same charge repel each other. Because they have the same charge, your hair will stand on end. Your hairs are simply trying to get as far away from each other as possible!

When you rub a balloon against your clothes and it sticks to the wall, you are adding a surplus of electrons (negative charges) to the surface of the balloon. The wall is now more positively charged than the balloon. As the two come in contact, the balloon will stick because of the rule that opposites attract (positive to negative).

# What causes lightning and thunder?

By NASA.gov on 11.22.16

Word Count **642**

Level **MAX**



TOP: Lightning strikes near a rainbow over Lake Mead National Recreation Area July 1, 2015 in Lake Mead, Nevada. The storm brought very little rain to the lake, which was at a historic low. BOTTOM: Ice crystals and water droplets bump together and move apart to create a cloud with two charges. NASA.

Zap! You just touched a metal doorknob after shuffling your rubber-soled feet across the carpet. Yipes! You've been struck by lightning! Well, not really, but it's the same idea.

Your rubber-soled shoes picked up stray electrons from the carpet. Those electrons built up on your shoes, giving them a static charge. (Static means not moving.) Static charges are always "looking" for the first opportunity to "escape," or discharge. Your contact with a metal doorknob — or car handle or anything that conducts electricity — presents that opportunity, and the excess electrons jump at the chance.

## What Causes Lightning?

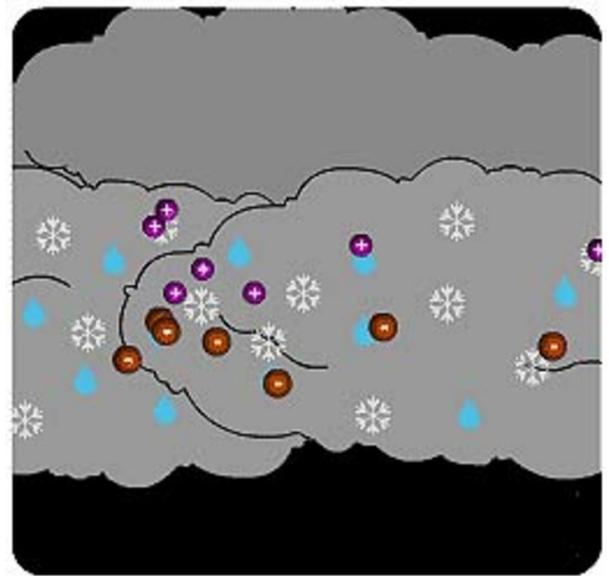
So, do thunderclouds have rubber shoes? Not exactly, but there is a lot of shuffling going on inside the cloud.

Lightning begins as static charges in a rain cloud. Winds inside the cloud are very turbulent. Water droplets in the bottom part of the cloud are caught in the updrafts and lifted to great heights where

the much colder atmosphere freezes them. Meanwhile, downdrafts in the cloud push ice and hail down from the top of the cloud. Where the ice going down meets the water coming up, electrons are stripped off.

It's a little more complicated than that, but what results is a cloud with a negatively charged bottom and a positively charged top. These electrical fields become incredibly strong, with the atmosphere acting as an insulator between them in the cloud.

When the strength of the charge overpowers the insulating properties of the atmosphere, Z-Z-Z-ZAP! Lightning happens.



### **How Does The Lightning "Know" Where To Discharge — Or Strike?**

The electric field "looks" for a doorknob. Sort of. It looks for the closest and easiest path to release its charge. Often lightning occurs between clouds or inside a cloud.

But the lightning we usually care about most is the lightning that goes from clouds to ground — because that's us!

As the storm moves over the ground, the strong negative charge in the cloud attracts positive charges in the ground. These positive charges move up into the tallest objects like trees, telephone poles and houses. A "stepped leader" of negative charge descends from the cloud, seeking out a path toward the ground. Although this phase of a lightning strike is too rapid for human eyes, it's possible to see it in a slow-motion video.

As the negative charge gets close to the ground, a positive charge, called a streamer, reaches up to meet the negative charge. The channels connect, and we see the lightning stroke. We might see several strokes using the same path, giving the lightning bolt a flickering appearance, before the electrical discharge is complete.

### **What Causes Thunder?**

In a fraction of a second, lightning heats the air around it to incredible temperatures — as hot as 54,000 degrees Fahrenheit. That's five times hotter than the surface of the Sun!

The heated air expands explosively, creating a shockwave as the surrounding air is rapidly compressed. The air then contracts rapidly as it cools. This creates an initial CRACK sound, followed by rumbles as the column of air continues to vibrate.

If we are watching the sky, we see the lightning before we hear the thunder. That is because light travels much faster than sound waves. We can estimate the distance of the lightning by counting how many seconds it takes until we hear the thunder. It takes approximately five seconds for the sound to travel one mile. If the thunder follows the lightning almost instantly, you know the lightning is too close for comfort!

### **What Does Lightning Look Like From Space?**

Lightning is an important part of weather forecasting. The new GOES-R Geostationary Lightning Mapper instrument will detect lightning activity over nearly the whole Western Hemisphere. This complete picture of lightning at any given time will improve "now-casting" of dangerous thunderstorms, tornadoes, hail and flash floods.

## Quiz

- 1 Which sequence of events would lead to a person being shocked by a doorknob?
1. *electrons in the carpet*
  2. *electricity into the hand*
  3. *flow of electrons*
  4. *static charge of electrons*
- (A) 1, 4, 3 then 2
- (B) 1, 3, 4 then 2
- (C) 4, 1, 3 then 2
- (D) 4, 3, 1 then 2
- 2 Which statement would be MOST important to include in an objective and accurate summary of the article?
- (A) The turbulent winds inside a rain cloud are partially responsible for creating the conditions that result in lightning.
- (B) The natural process that produces lightning includes a crucial period of time in which a cloud experiences more positive charges than negative charges.
- (C) Lightning rarely occurs between clouds because positive and negative charges within the clouds neutralize each other.
- (D) Lightning strikes have the potential to cause horrific damage because they create temperatures that are many times hotter than the surface of the sun.
- 3 Which factors contribute to making lightning?
- (A) charged electrons in the top and bottom of a cloud
- (B) positive charges in the top and bottom of a cloud
- (C) frozen droplets and electrons in the top of a cloud
- (D) frozen droplets and electrons in the bottom of a cloud
- 4 Which statement accurately describes the relationship between the article's CENTRAL ideas?
- (A) Lightning begins as static charges in a rain cloud; through movement, these charges transform into negative and positive charges.
- (B) Clouds look to release electrical energy in the easiest way they can; they usually discharge that energy directly to the ground.
- (C) Negative charges from clouds descend directly to the ground where they overpower positive charges; this confrontation of charges produces lightning.
- (D) Lightning results from the connection made between negative charges and positive charges; thunder is a reaction to lightning.
- 5 If lightning hit the flat ground with no tall objects anywhere near, what would likely happen?
- (A) The lightning would electrify the ground and spread out in all directions.
- (B) The lightning would weaken in the air with no streamers rising to meet it.
- (C) The lightning would become more powerful with no objects to dissipate it.
- (D) The lightning would hit the ground and weaken without objects to magnify it.

- 6 According to the article, each of the following contributes to the production of lightning EXCEPT:
- (A) ice and hail in a cloud
  - (B) insulating properties of the atmosphere in a cloud
  - (C) the rapid expansion and contraction of air in a cloud
  - (D) a negative charge descending from a cloud toward the ground
- 7 A person sees lightning, then hears thunder 2 minutes later.  
How far away is the lightning?
- (A) 2 miles
  - (B) 2.4 miles
  - (C) 20 miles
  - (D) 24 miles
- 8 Which sentence BEST summarizes the connection between rubber-soled shoes and lightning in the article?
- (A) The author uses rubber-soled shoes as an easy way to explain how electrons change from being static charges to lightning.
  - (B) The author uses rubber-soled shoes as an example to describe the power that both electricity and lightning have to shock.
  - (C) The author uses rubber-soled shoes as an analogy to describe how lightning works.
  - (D) The author uses rubber-soled shoes to suggest that lightning is an everyday natural phenomenon.

# Thunderstorms and homemade "lightning"

By M. Rae Nelson, Gale, Cengage Learning on 11.02.17

Word Count **1,585**

Level **MAX**



A thunderstorm rips through the night sky. Photo by: Gerlos/Wikimedia.

Right now, at least one area of the world is experiencing some type of powerful storm. Storms are periods of extreme bad weather that can bring powerful winds and torrential rains. Storms can rip buildings apart, toss cars through the air, cause deaths and spark forest fires. Every day there are as many as 50,000 storms occurring throughout the world. They can stretch for hundreds of miles, or remain isolated to a few hundred yards. Either way, storms can cause enormous devastation. One of the most common types of storm is the thunderstorm.

## Clouds Brewing

Thunderstorms need three basic ingredients to form. The first is moisture in the air or water vapor, which forms clouds and rain. The second is a column of unstable air, which provides relatively warm, moist air on the bottom layers with cold, dry air high above it. And lastly, a thunderstorm needs some kind of force to lift the air upward.

When the moist, warm air rises it eventually meets colder air and begins to cool. That forms the beginning of a cloud. Inside a cloud, currents of air move up and down quickly. This air is filled with tiny particles of dust. Water vapor is pushed upward by the warm air. When it comes into

contact with cooler air, the water vapor condenses. Condensation is when a gas (or vapor) changes into a liquid. The condensed drops of water will then surround a dust particle. Clouds form where millions of water-dust droplets gather together. Each of the particles in a cloud has a positive and a negative electrical charge.

These small, puffy clouds grow increasingly larger as more warm air rises from the ground. If the cloud gets large enough, it may continue to rise into the ever-colder air. Strong winds can blow the top of the cloud downwind, and this gives the top of the cloud an anvil shape. This thunderstorm cloud is called a cumulonimbus cloud and it can extend upward for miles.

### **Shocking Sights, Loud Noises**

To be called a thunderstorm there must be thunder. Thunder is caused by lightning, and lightning begins in the cumulonimbus clouds. Lightning is an intense discharge of electricity. Scientists estimate that about a hundred lightning flashes occur each second around the world. The electricity flowing within a lightning bolt is so powerful that it can kill instantly, split trees and spark fires. The average flash of lightning could turn on a 100-watt light bulb for more than three months.

As a storm advances, strong winds blow the particles of dust and water in the cloud and cause them to hit each other. Each particle contains positive and negative charges, which are attracted to each other under normal conditions, but collisions cause the positive and negative charges to separate. Positive charges tend to move toward the top of a cloud and negative charges move toward the bottom. Both types of charges hold energy. Charges that are alike repel each other and charges that are opposites pull together. When enough charges and time build up, the negative charge in the cloud reaches out toward the positive charges on the ground. The result is a burst of electricity, or a lightning bolt.

Every lightning flash produces thunder. In just a fraction of a second, a lightning flash can heat up the air to 50,000°F (28,000°C) — a temperature hotter than the surface of the sun. The burst of heat causes the air molecules around it to expand quickly away from the lightning's flash. As this hot air cools, it contracts. This quick expansion and contraction of air causes the air molecules to shake or vibrate, making sound waves that create the sound of thunder.

Thunder and lightning occur simultaneously, yet people will always see lightning before they hear thunder because light and sound travel at different speeds. Light travels at about 186,000 miles per second (299,800 kilometers per second). The speed of sound is only about 0.2 miles per second (0.3 kilometers per second). That means a person will see lightning almost instantly, but won't hear the thunder for several seconds. Knowing this allows any storm watcher to calculate the distance of the lightning strike. Count the number of seconds between the lightning and the thunder, and divide the number of seconds by 5 to calculate the miles distance; divide the number of seconds by 3 to calculate the kilometers distance.

### **EXPERIMENT: Separating Charges**

Lightning that is produced during a storm is simply a massive electric spark, which is called static electricity. Friction causes the particles to separate into positive and negative charges. These opposite charges attract one another, and when the electric charges are separated they look for a way to get back together. In a storm, the jump of numerous negative charges reaching out toward

the positive charges produces a bolt of lightning. A miniature version of static electricity will produce sparks and an attraction between charged objects.

In this experiment, you will explore what happens when you cause charges to separate. You will use friction to create electrical charges on a balloon, and observe how three different objects react to these charges. The three objects you will use are salt and pepper, water and another balloon.



Before you begin, make an educated guess about the outcome of this experiment based on your knowledge of lightning and charges. This educated guess, or prediction, is your hypothesis. A hypothesis should explain the topic of the experiment, the variable you will change, the variable you will measure and what you expect to happen.

### **What Are The Variables?**

Variables are anything that might affect the results of an experiment. Here are the main variables in this experiment: the object that is charged, the degree of friction, the material that produces the friction and the distance from the balloon to the objects.

In other words, the variables in this experiment are everything that might affect the charge of the balloon. If you change more than one variable at the same time, you will not be able to tell which variable had the most effect on the action of the charged particles.

A hypothesis should be brief, specific and measurable. It must be something you can test through further investigation. Your experiment will prove or disprove whether your hypothesis is correct. Here is one possible hypothesis for this experiment: "If enough charges are separated, the balloon will attract different objects and create electricity."

In this case, the variable you will change is the separation of the negative and positive charges on the balloon. The variable you will measure is how the balloon's charges are attracted to other objects. Having a control experiment will help you isolate each variable and measure the changes in the dependent variable. Only one variable will change between the control and the experimental setup, and that is the amount of charged particles. At the end of the experiment, you will compare the charged balloon with the neutrally charged balloon.

### **Materials Needed**

- 2 balloons
- Salt and pepper
- Access to sink
- Small plate
- Wool cloth or nylon (optional)
- Time: 30 minutes

## How To Experiment Safely

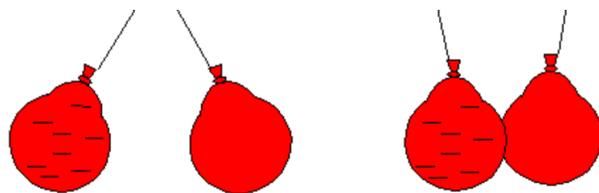
This project poses little hazard, but remember you are experimenting with electricity, however small. Do not conduct this experiment if there are any flammable vapors in the air, such as gasoline from an open container.

## Step-By-Step Instructions

1. Sprinkle some salt and pepper on a plate.
2. Inflate both balloons. For the control, do not rub one balloon. Place the balloon about 1 inch (2.5 centimeters) above the salt and pepper. Then place the balloon about 1 inch (2.5 centimeters) away from a trickle of water from the faucet. Note the results.
3. Rub the second balloon briskly against a piece of wool or your hair.
4. Hold this balloon about 1 inch (2.5 centimeters) above the salt and paper. Note what you see and hear.
5. Hold the balloon about 1 inch (2.5 centimeters) from a trickle of water. Note the results.
6. Darken the room. Rub both balloons against a cloth or your hair, and place them together. Note what you see and hear.
7. Place your hand gently over the section of the balloon that you rubbed. Again place the two balloons together and note the results.

## Summary Of Results

Create a data chart that describes the results of each trial. Compare the results to the control experiment. What did placing your hand over the balloon do to the charges in the balloon? Write a paragraph explaining your conclusions. Include how powerful bolts of lightning relate to this experiment.



## Change The Variables

You can change the variables in this experiment in several ways. You can use different types of material to create friction, and determine if this produces less or more attraction. You can also create charges on different objects, such as a comb. Try creating sparks or picking up different objects.

## Troubleshooter's Guide

Below is a problem that may arise during this experiment, a possible cause and a way to remedy the problem.

**Problem:** There was no difference between the control and the experimental balloon.

**Possible cause:** You may not have created enough friction, in which case not enough charges would separate. Try rubbing the balloon vigorously against your hair, and repeat the experiment.

# Sea turtles are natural ocean navigators

By Los Angeles Times, adapted by Newsela staff on 01.28.15

Word Count **800**

Level **1040L**



A sea turtle lies on the beach in Kailua, Hawaii, on Aug. 7, 2014. AP Photo/Chris Stewart

LOS ANGELES — It is a mystery that has stumped scientists for years: How do female sea turtles navigate back to the beach where they were born when it comes time to lay their own eggs? After all, sea turtles travel across thousands of miles of open ocean each year. Yet somehow the females find their way back to the spot where they were hatched.

Keep in mind that there are no visual guideposts in the open ocean where sea turtles spend most of their lives. Yet every two to three years, sea turtles dig their nests at the same location where they once crawled out of their own eggs.

## **Earth's Magnetic Force**

Since the 1990s, scientists have known that the turtles are somehow guided by the Earth's geomagnetic field.

Geomagnetism is an invisible but powerful force. The Earth's core is mostly solid iron. Electrical currents stream from it, creating a strong magnetic field. The force acts like an enormous magnet buried in the planet's center. One end of the magnet, or pole — the North Pole — is in the Arctic.

The other end — the South Pole — is in Antarctica. When travelers use a compass to find north, they rely on geomagnetism. The metal needle of a compass is attracted to the North Pole of the Earth, just as a pin is attracted to an ordinary magnet.

Scientists knew that sea turtles use magnetism to guide themselves in general directions. What they did not know was how turtles find the exact beach where they were born.

A study published on Thursday looks at loggerhead sea turtles that bury their eggs on the Florida coast. It shows that slight changes in the Earth's magnetic field affect where the eggs are buried.

### **Natural Field Of Magnets**

Once again, to understand how geomagnetism works, it helps to imagine that there is a giant bar magnet inside the Earth. Its two ends give off a powerful magnetic charge, which travels in a straight line through the Earth and up into the atmosphere. Because the bar shifts constantly, its angle relative to the Earth changes over time.

Also important to understand is that some objects are more magnetic than others. Everything on Earth reacts to geomagnetism in a different way, and the particular way each thing reacts is known as its magnetic signature. Imagine that you are pointing a magnet at two objects, and that one is pulled quickly toward the magnet, while the other is not. The difference in how they are attracted to the magnet is part of their magnetic signature.

However, an object's magnetic signature changes when the magnetic field shifts in strength and direction. The signature reflects how an object reacts to magnetism at a given time.

### **Pulled Back To The Beach**

Scientist J. Roger Brothers was involved in the new sea turtle study.

He said that over thousands of years, turtles developed a way to use the shifts in the geomagnetic field and the field's strength to guide themselves. It is almost as if they have a built-in GPS system similar to what is found in cellphones or cars.

Returning turtles are not just using geomagnetism to point themselves in the right general direction, however. Somehow, the turtles are also able to sense, remember and track their birth beach's magnetic signature.

But the magnetic signature of a particular stretch of beach changes over time. The change comes in response to changes in the strength and direction of the magnetic field itself.

### **The Sea Turtle Knows**

The scientists suspected that shifts in the geomagnetic field led to shifts in loggerhead turtle nesting sites.

In fact, that is exactly what they found. The team looked at 19 years' worth of records tracking loggerhead turtle nesting sites along Florida's Atlantic coast. They compared that information to the record of shifts in the geomagnetic field over the same period of time.

As the geomagnetic field shifted, the turtles went to different nesting sites. It proved that sea turtles can sense magnetic signatures.

However, there are still many more questions to be answered. For example, researchers do not know how the turtles sense the geomagnetic field, which can neither be seen nor heard.

“Most likely they have tiny magnetic particles in their brains or in their bodies that act like a compass,” Brothers said. The particles may be spread throughout the animals' bodies, which would make them hard to find.

Brothers also noted that loggerhead turtles do not only rely on geomagnetic fields when looking for a place to lay their eggs.

“We don’t expect that these turtles are coming to the magnetic signature regardless of what else is going on,” he said. “If a condo is built there, they will usually decide to go nest somewhere else.”

## Quiz

- 1 Select the sentence from the article that is LEAST important to be included in its summary.
- (A) The signature reflects how an object reacts to magnetism at a given time.
  - (B) Yet somehow the females find their way back to the spot where they were hatched.
  - (C) Scientists knew that sea turtles use magnetism to guide themselves in general directions.
  - (D) It is almost as if they have a built-in GPS system similar to what is found in cellphones or cars.
- 2 Select the sentence from the article that BEST supports its central idea.
- (A) After all, sea turtles travel across thousands of miles of open ocean each year.
  - (B) A study published on Thursday looks at loggerhead sea turtles that bury their eggs on the Florida coast.
  - (C) As the geomagnetic field shifted, the turtles went to different nesting sites. It proved that sea turtles can sense magnetic signatures.
  - (D) Returning turtles are not just using geomagnetism to point themselves in the right general direction, however.
- 3 What is the significance of the section "The Sea Turtle Knows" in the article?
- (A) It provides an account of the conflicting explanations about how sea turtles navigate their way to the same beach.
  - (B) It shows that sea turtles also rely on factors other than the magnetic signature of a beach.
  - (C) It shows that the magnetic signature of a beach influences the nesting sites of sea turtles.
  - (D) It provides information on where magnetic particles are located in sea turtles.

- 4 Read the sentence from the article.

*What they did not know was how turtles find the exact beach where they were born.*

Why did the author include the above sentence in the article?

- (A) to show that sea turtles prefer living near the beach where they were born
- (B) to show that scientists disagree on how sea turtles go back to the beach where they were born
- (C) to show that sea turtles have a complex magnetic sense that leads them back to the beach where they were born
- (D) to show that sea turtles have an exceptional memory that helps them find their way back to the beach where they were born

# Magnets and magnetism

By Encyclopaedia Britannica, adapted by Newsela staff on 08.21.19

Word Count **562**

Level **MAX**

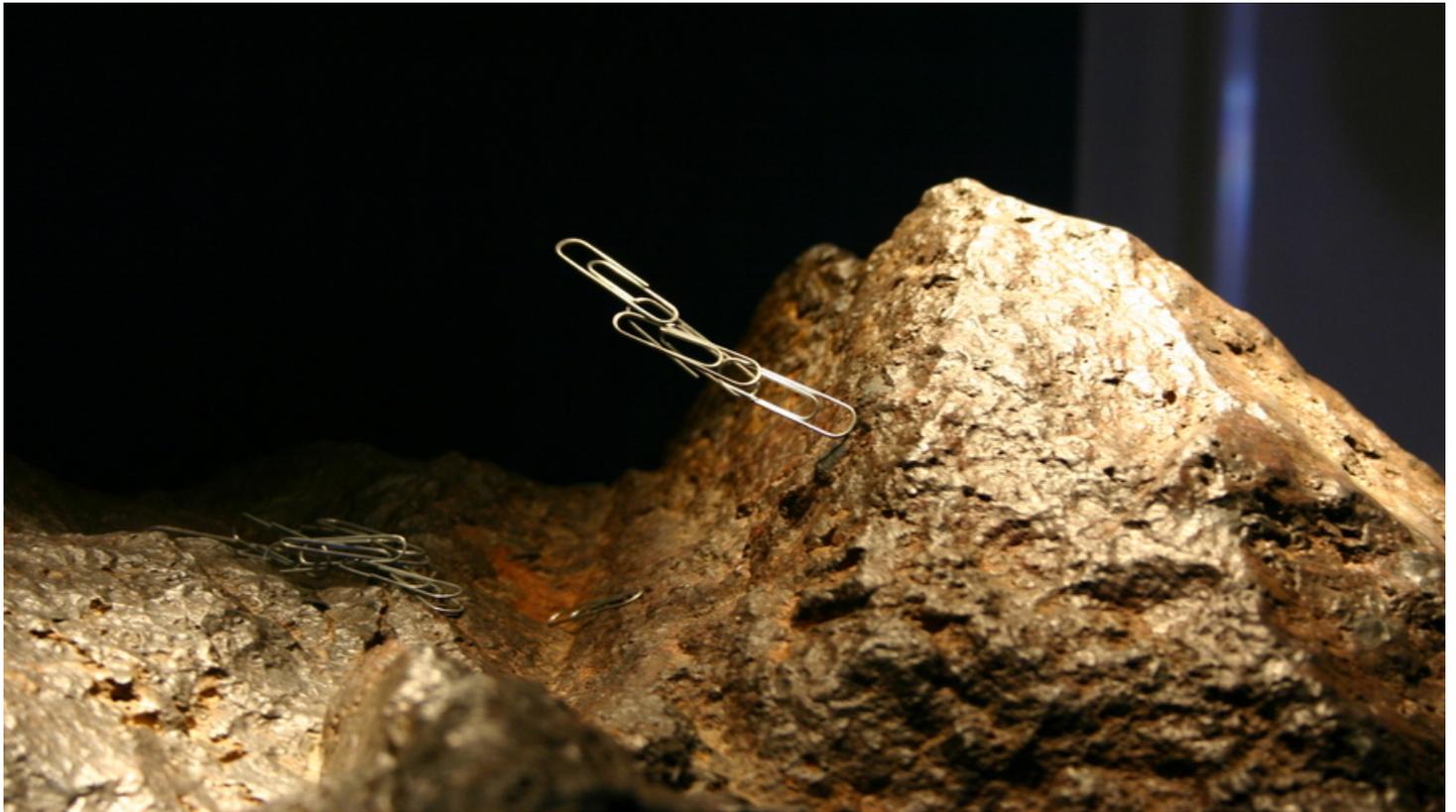


Image 1. Metal paperclips stick to a lodestone rock. Lodestone is a natural magnet. Photo by: Ryan Somma/Flickr

A magnet is a rock or a piece of metal that can pull certain types of metal toward itself. The force of magnets, called magnetism, is a basic force of nature, like electricity and gravity. Magnetism works over a distance, and this means that a magnet does not have to be touching an object to pull it.

## What Causes Magnetism?

People have known for a long time that a certain type of rock, called lodestone, is a natural magnet. When scientists learned why that is, they also learned how to make other metals into magnets.

Magnetism happens when tiny particles called electrons behave in a certain way. All objects in the universe are made up of units called atoms, which, in turn, are made up of electrons and other particles (neutrons and protons). The electrons spin around the atom's nucleus, which contains the other particles. The spinning electrons form tiny magnetic forces. Sometimes many of the electrons in an object spin in the same direction. In these cases, all the tiny magnetic forces from the electrons add up to make the object one big magnet.

It is possible to make a magnet by taking an existing magnet and rubbing another piece of metal with it. The new piece of metal must be rubbed continuously in the same direction, and this will make the electrons in that metal start to spin in the same direction.

Electricity can also create magnets. Electricity is a flow of electrons. As electrons move through a piece of wire they have the same effect as electrons spinning around the nucleus of an atom. This is called an electromagnet.

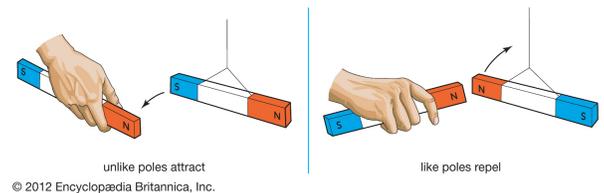
### Hard And Soft Magnets

Because of the way their electrons are arranged, the metals iron, steel, nickel and cobalt make good magnets. Once these metals become magnets, they can stay magnets forever. Then they are called hard magnets. But these metals and others can also act like magnets temporarily, after they have been near a hard magnet. Then they are called soft magnets. Most other materials — for example, water, air and wood — have very weak magnetic properties.

### Properties Of Magnets

Magnets strongly attract objects that contain iron, steel, nickel or cobalt. Magnets also attract or repel (push away) other hard magnets. This happens because every magnet has two opposite poles, or ends: a north pole and a south pole. North poles attract the south poles of other magnets, but they repel other north poles. Likewise, south poles attract north poles, but they repel other south poles.

The magnetic forces between the two poles of a magnet create a magnetic field. This is the area affected by the magnet. A magnetic field surrounds all magnets.



### Uses For Magnets

One of the earliest uses of magnets was in compasses, which are needle-shaped magnets that are free to turn around. The planet Earth is a giant magnet. Because the south pole of a compass is attracted to the north pole of Earth, the compass needle always points north.

Today magnets are found in many places. Magnets hold papers on refrigerator doors and they also hold the doors shut. Credit cards have a magnetic strip. Automatic doors, stereo speakers and many electric motors use electromagnets.

## Quiz

- 1 Which sentence from the article is BEST illustrated by Image 1?
- (A) Magnetism works over a distance, and this means that a magnet does not have to be touching an object to pull it.
  - (B) People have known for a long time that a certain type of rock, called lodestone, is a natural magnet.
  - (C) It is possible to make a magnet by taking an existing magnet and rubbing another piece of metal with it.
  - (D) Because of the way their electrons are arranged, the metals iron, steel, nickel and cobalt make good magnets.
- 2 What does Image 2 teach the reader about magnets?
- (A) that magnets must be painted red, white and blue
  - (B) that magnets in compasses point north
  - (C) that like poles of a magnet will attract
  - (D) that opposite poles of a magnet will attract
- 3 What materials will work as magnets? How do you know?
- (A) any metal  
A magnet is a rock or a piece of metal that can pull certain types of metal toward itself.
  - (B) iron, steel, nickel and cobalt  
Because of the way their electrons are arranged, the metals iron, steel, nickel and cobalt make good magnets.
  - (C) water, air and wood  
Most other materials — for example, water, air and wood — have very weak magnetic properties.
  - (D) any paper  
Magnets hold papers on refrigerator doors and they also hold the doors shut.
- 4 Read the section "What Causes Magnetism?"
- Select the paragraph that explains how magnets can be created from other magnets.
- (A) People have known for a long time that a certain type of rock, called lodestone, is a natural magnet. When scientists learned why that is, they also learned how to make other metals into magnets.
  - (B) Magnetism happens when tiny particles called electrons behave in a certain way. All objects in the universe are made up of units called atoms, which, in turn, are made up of electrons and other particles (neutrons and protons). The electrons spin around the atom's nucleus, which contains the other particles. The spinning electrons form tiny magnetic forces. Sometimes many of the electrons in an object spin in the same direction. In these cases, all the tiny magnetic forces from the electrons add up to make the object one big magnet.
  - (C) It is possible to make a magnet by taking an existing magnet and rubbing another piece of metal with it. The new piece of metal must be rubbed continuously in the same direction, and this will make the electrons in that metal start to spin in the same direction.
  - (D) Electricity can also create magnets. Electricity is a flow of electrons. As electrons move through a piece of wire they have the same effect as electrons spinning around the nucleus of an atom. This is called an electromagnet.

# What is a compass?

By Alison Ince Rodgers, National Geographic on 01.05.20

Word Count **1,069**

Level **MAX**



A reproduction of a compass from 1607. Photo by: Virginia State Parks staff/Wikimedia.

A compass is a device that indicates direction. It is one of the most important instruments for navigation.

Magnetic compasses are the most well-known type of compass. They have become so popular that the term "compass" almost always refers to a magnetic compass. While the design and construction of this type of compass have changed significantly over the centuries, the concept of how it works has remained the same. Magnetic compasses consist of a magnetized needle that is allowed to rotate so it lines up with the Earth's magnetic field. The ends point to what are known as magnetic north and magnetic south.

Scientists and historians don't know when the principles behind magnetic compasses were discovered. Ancient Greeks understood magnetism. As early as 2,000 years ago, Chinese scientists may have known that rubbing an iron bar (such as a needle) with a naturally occurring magnet, called a lodestone, would temporarily magnetize the needle so that it would point north and south.

Very early compasses were made of a magnetized needle attached to a piece of wood or cork that floated freely in a dish of water. As the needle would settle, the marked end would point toward

magnetic north.

As engineers and scientists learned more about magnetism, the compass needle was mounted and placed in the middle of a card that showed the cardinal directions — north, south, east and west. A spearhead and the letter T, which stood for the Latin name of the North Wind, Tramontana, signified north. This combination evolved into a fleur-de-lis design, which can still be seen today. All 32 points of direction were eventually added to the compass card.

Historians think China may have been the first civilization to develop a magnetic compass that could be used for navigation. Chinese scientists may have developed navigational compasses as early as the 11th or 12th century. Western Europeans soon followed at the end of the 12th century.

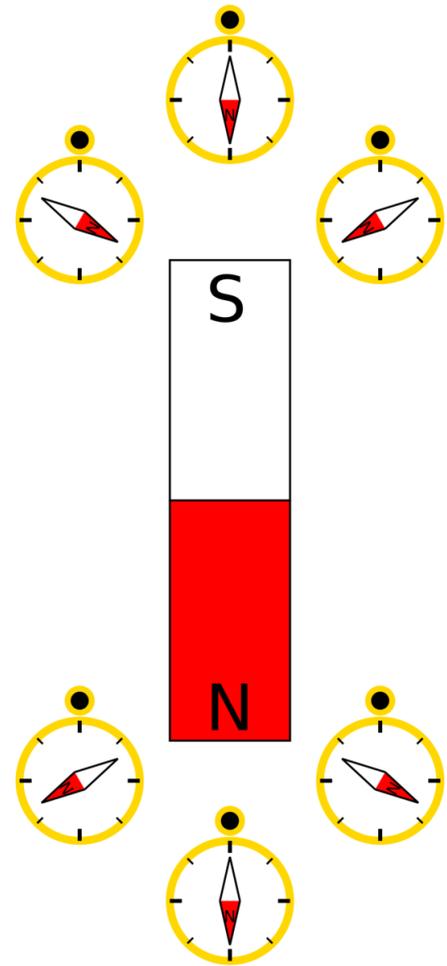
In their earliest use, compasses were likely used as backups for when the sun, stars or other landmarks could not be seen. Eventually, as compasses became more reliable and more explorers understood how to read them, the devices became a critical navigational tool.

### Adjustments And Adaptations

By the 15th century, explorers realized that the "north" indicated by a compass was not the same as Earth's true geographic north. This discrepancy between magnetic north and true north is called variation (by mariners or pilots) or magnetic declination (by land navigators) and varies depending on location. Variation is not significant when using magnetic compasses near the equator, but closer to the North and South Poles, the difference is much greater and can lead someone many kilometers off-course. Navigators must adjust their compass readings to account for variation.

Other adaptations have been made to magnetic compasses over time, especially for their use in marine navigation. When ships evolved from being made of wood to being made of iron and steel, the magnetism of the ship affected compass readings. This difference is called deviation. Adjustments such as placing soft iron balls (called Kelvin spheres) and bar magnets (called Flinders bars) near the compass helped increase the accuracy of the readings. Deviation must also be taken into account on aircraft using compasses, due to the metal in the construction of an airplane.

Magnetic compasses come in many forms. The most basic are portable compasses for use on casual hikes. Magnetic compasses can have additional features, such as magnifiers for use with maps, a prism or a mirror that allows you to see the landscape as you follow the compass reading, or markings in Braille for the visually impaired. The most complicated compasses are complex devices on ships or planes that can calculate and adjust for motion, variation and deviation.



## Other Types Of Compasses

Some



compasses do not use Earth's magnetism to indicate direction. The gyrocompass, invented in the early 20th century, uses a spinning gyroscope to follow Earth's axis of rotation to point to true north. Since magnetic north is not measured, variation is not an issue. Once the gyroscope begins spinning, motion will not disturb it. This type of compass is often used on ships and aircraft.

A solar compass uses the sun as a navigational tool. The most common method is to use a compass card and the angle of the shadow of the sun to indicate direction.

Even without a compass card, there are techniques that use the sun as a compass. One method is to make a shadow stick. A shadow stick is a stick placed upright in the ground. Pebbles placed around the stick, and a piece of string to track the shadow of the sun across the sky, help a navigator determine the directions of east and west.

Another type of solar compass is an old-fashioned analog (not digital) watch. Using the watch's hands and the position of the sun, it is possible to determine north or south. Simply hold the watch parallel to the ground (in your hand) and point the hour hand in the direction of the sun. Find the angle between the hour hand and the 12 o'clock mark. This is the north-south line. In the Southern Hemisphere, north will be the direction closer to the sun. In the Northern Hemisphere, north will be the direction further from the sun.



Receivers from the global positioning system (GPS) have begun to take the place of compasses. A GPS receiver coordinates with satellites orbiting the Earth and monitoring stations on Earth to pinpoint the receiver's location. GPS receivers can plot latitude, longitude and altitude on a map. Unless large objects block signals, readings are usually accurate to within about 15 meters (50 feet).

Despite advancements with GPS, the compass is still a valuable tool. Many airplanes and ships still use highly advanced compasses as navigational instruments. For casual observation — for

navigators on foot or in a small boat — a pocket compass or a basic compass mounted on a dashboard remains a practical and portable tool.

## Quiz

1 If a person got lost, in which situation would a magnetic compass be MOST useful?

- (A) lost in a car in the Arctic
- (B) lost at sea in an old, tall ship
- (C) lost in outer space in a space shuttle
- (D) lost underground in a metal tunnel maze

2 Read the paragraph from the article.

*In their earliest use, compasses were likely used as backups for when the sun, stars or other landmarks could not be seen. Eventually, as compasses became more reliable and more explorers understood how to read them, the devices became a critical navigational tool.*

The word "reliable" has a positive connotation. Which phrase from the paragraph BEST emphasizes that connotation?

- (A) used as backups
- (B) could not be seen
- (C) understood how to read
- (D) critical navigational tool

3 An explorer is traveling to Iceland with a lodestone, a needle, and a marked card. The explorer gets lost.

Which is the MOST likely explanation?

- (A) The needle had come loose from the card.
- (B) The needle did not indicate true north or south.
- (C) The needle was not magnetized by the lodestone.
- (D) The needle pointed to the north, but the explorer misread it.

4 Read the paragraph from the section "Adjustments And Adaptations."

*By the 15th century, explorers realized that the "north" indicated by a compass was not the same as Earth's true geographic north. This discrepancy between magnetic north and true north is called variation (by mariners or pilots) or magnetic declination (by land navigators) and varies depending on location. Variation is not significant when using magnetic compasses near the equator, but closer to the North and South Poles, the difference is much greater and can lead someone many kilometers off-course. Navigators must adjust their compass readings to account for variation.*

Which phrase from the paragraph BEST represents what the author means by "discrepancy"?

- (A) varies depending on location
- (B) is not significant
- (C) the difference is much greater
- (D) to account for variation

5 If Earth's magnetism were to disappear, which compasses might still function?

1. *gyroscope compass*
2. *lodestone compass*
3. *magnetic compass*
4. *solar clock compass*

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

6 How do the images in the article enhance your understanding of the evolution of the compass?

- (A) by showing the different types of compasses and their uses
- (B) by demonstrating how different compasses indicate direction
- (C) by showing examples of different compasses from various times
- (D) by demonstrating how a magnetic compass indicates direction

7 Which materials would be BEST for designing an accurate compass for a blind person to use while on a train?

- (A) paper maps and prisms
- (B) prisms and Braille marks
- (C) Braille marks and Flinders bars
- (D) Flinders bars and paper maps

8 Who would find the diagram from the introduction [paragraphs 1-7] MOST helpful, and why?

- (A) someone who is interested in using a magnetic compass, because this diagram illustrates how a magnetic compass shows direction
- (B) someone who is interested in designing their own magnetic compass, because this diagram shows how magnetic compasses are created
- (C) someone who is interested in learning about the original design of magnetic compasses, because this diagram demonstrates how the first compass worked
- (D) someone who is interested in how Earth's magnetic fields work, because this image illustrates how magnetic fields indicate direction

# How roller coasters work

By Tom Harris and Cherise Threewitt, How Stuff Works on 05.09.19

Word Count **598**

Level **MAX**



Image 1. A roller coaster in a loop-the-loop. To get through such an impressive loop, the roller coaster's cars need a lot of energy. Photo by: Hauke-Christian Dittrich/Getty Images

If you enjoy studying physics (and who doesn't), there are few more exhilarating classrooms than roller coasters. Roller coasters are driven almost entirely by basic inertial, gravitational and centripetal forces. All these are manipulated in the service of a great ride. Amusement parks keep upping the ante. They are building faster and more complex roller coasters. Still, the fundamental principles at work remain basically the same.

In this article, we'll examine the principles that keep coaster cars flying around on their tracks.

At first glance, a roller coaster is something like a passenger train. It consists of a series of connected cars that move on tracks. But unlike a passenger train, a roller coaster has no engine. It has no power source of its own. For most of the ride, the train is moved by gravity and momentum. To build up this momentum, the train has to get to the top of the first hill or get a powerful launch.

The purpose of the coaster's initial ascent is to build up a sort of reservoir of potential energy. The concept of potential energy is often referred to as energy of position. This concept is very simple: As the coaster gets higher in the air, gravity can pull it down a greater distance. You experience

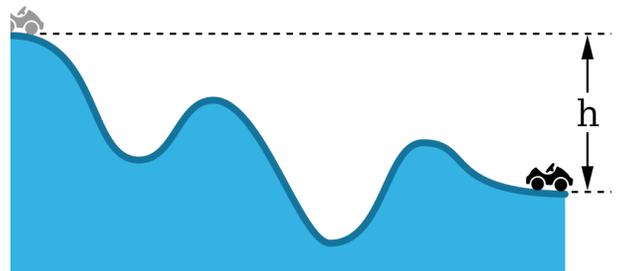
this phenomenon all the time. Think about driving your car, riding your bike or pulling your sled to the top of a big hill. The potential energy you build going up the hill can be released as kinetic energy — the energy of motion that takes you down the hill.

Once you start cruising down that first hill, gravity takes over. Then, all the built-up potential energy changes to kinetic energy. Gravity applies a constant downward force on the cars. The coaster tracks serve to channel this force — they control the way the coaster cars fall. If the tracks slope down, gravity pulls the front of the car toward the ground, so it accelerates. If the tracks tilt up, gravity applies a downward force on the back of the coaster, so it decelerates.

An object in motion tends to stay in motion. This is Newton's first law of motion. Because of this, the coaster car will maintain a forward velocity even when it is moving up the track, opposite the force of gravity. When the coaster ascends one of the smaller hills that follows the initial lift hill, its kinetic energy changes back to potential energy. In this way, the course of the track is constantly converting energy from kinetic to potential and back again.

This fluctuation in acceleration is what makes roller coasters so much fun. In most roller coasters, the hills decrease in height as the train moves along the track. This is necessary because the total energy reservoir built up in the lift hill is gradually lost to friction between the train and the track, as well as between the train and the air. When the train coasts to the end of the track, the energy reservoir is almost completely empty. At this point, the train either comes to a stop or is sent up the lift hill for another ride.

At its most basic level, this is all a roller coaster is — a machine that uses gravity and inertia to send a train along a winding track.



## Quiz

- 1 At which point does the roller coaster have the most potential energy?
- (A) at the bottom of a hill, before going up the hill
  - (B) at the beginning of the track, which is flat
  - (C) at the top of the hill
  - (D) at the end of the track, which is flat
- 2 Which sentence from the article BEST introduces to the reader how roller coasters work?
- (A) If you enjoy studying physics (and who doesn't), there are few more exhilarating classrooms than roller coasters.
  - (B) Roller coasters are driven almost entirely by basic inertial, gravitational and centripetal forces.
  - (C) They are building faster and more complex roller coasters.
  - (D) In this article, we'll examine the principles that keep coaster cars flying around on their tracks.
- 3 At which point does the roller coaster have the most kinetic energy?
- (A) at the bottom of a hill, before going up the hill
  - (B) at the bottom of a hill, after coming down the hill
  - (C) at the beginning of the track, which is flat
  - (D) at the end of the track, which is flat
- 4 What is MOST LIKELY the reason the author included a description of Newton's first law of motion?
- (A) to demonstrate a problem that can interfere with the roller coaster moving smoothly on the hills
  - (B) to show a type of energy that forces a car that is not moving at the top to start going down
  - (C) to describe the reason why a roller coaster car begins to slow down as it ascends up a hill
  - (D) to explain why the roller coaster car keeps moving up the hill despite gravity pulling it down
- 5 At which point does the roller coaster have very little kinetic energy and very little potential energy?
- (A) at the bottom of a hill, before going up the hill
  - (B) at the bottom of a hill, after coming down the hill
  - (C) at the top of the hill
  - (D) at the end of the track, which is flat

- 6 Read the following sentence from the article.

*This is necessary because the total energy reservoir built up in the lift hill is gradually lost to friction between the train and the track, as well as between the train and the air.*

Which of the following words, if it replaced the word "gradually" in the sentence above, would CHANGE the meaning of the sentence?

- (A) steadily
- (B) slowly
- (C) abruptly
- (D) progressively

- 7 What happens as a roller coaster car moves down a hill?
- (A) The car's potential energy turns into kinetic energy.
  - (B) The car's momentum turns into gravity.
  - (C) The car's kinetic energy turns into potential energy.
  - (D) The car's gravity turns into inertia.

- 8 Read the following selection from the article. Then, fill in the blank.

*The purpose of the coaster's initial ascent is to build up a sort of reservoir of potential energy. The concept of potential energy is often referred to as energy of position.*

The word "reservoir" in the selection above tells the reader that \_\_\_\_\_.

- (A) the initial ascent of the coaster has used up all of the potential energy
- (B) the initial ascent of the coaster is not as important as the other ascents on the ride
- (C) the initial ascent of the coaster has created a supply of potential energy
- (D) the initial ascent of the coaster works best when it is near a large body of water

# An explanation of the two types of energy: potential and kinetic

By Gale, Cengage Learning on 12.15.19

Word Count **543**

Level **MAX**



Billiards, often called pool, is a good example of how energy can be transferred between objects. When a ball is still, it has potential energy. When a ball moves, it has kinetic energy. When one ball hits another, kinetic energy is transferred to the second ball. Photo by PIRO4D/Pixabay

Energy is involved in nearly everything we do. It is defined as the ability to do work, to set an object in motion. There are several different kinds of energy. Kinetic energy is the energy an object has when it is in motion. Vibration, forward motion, turning and spinning are all examples of kinetic energy. Kinetic energy is directly proportional to the mass of an object. If two objects move at the same speed, and one has twice the mass of the other, the object with twice the mass will have twice the kinetic energy.

Potential energy is the energy an object has because of its position; it is energy waiting to be released. For example, a weight suspended above the ground has potential energy because it can be set in motion by gravity. Compressed or extended springs also have potential energy.

Thermal energy is the kinetic energy of atoms vibrating within matter. The faster the atoms move, the hotter the object becomes. Electrical energy is the kinetic energy resulting from the motion of

electrons within any object that conducts electricity. Chemical energy is the potential energy stored in molecules. Thermal, electrical and chemical energy are all forms of kinetic or potential energy.

### **What Laws Control Energy?**

One of the most fundamental laws of physics is that energy cannot be created or destroyed, only transformed from one form into another. For example, if a suspended weight falls, its potential energy becomes kinetic energy. When a car burns fuel, the fuel's chemical energy is transformed into thermal energy, which in turn, is transformed into kinetic energy by the engine to make the car move.

Energy can also be transferred from one object to another. Think about a game of pool. When a moving ball hits a still one, the moving ball stops or slows down, and the still one begins to move. The majority of the first ball's kinetic energy has been transferred to the second ball, while a small amount has been converted to thermal energy by the collision. If you could measure the temperature on the surface of each ball, you would find there was a slight rise in temperature at the point of contact. The total amount of energy involved — kinetic and thermal — remains the same. No energy was created or destroyed by the collision.

### **Who Wrote These Laws?**

The person who laid the groundwork for the study of energy was English mathematician and physicist Isaac Newton (1642–1727). Newton developed the laws of motion, which describe how objects are acted upon by forces. Newton's ideas formed the basis for much of physics, in fact. He studied at Cambridge University, where he excelled in mathematics and developed the field of calculus while he was still a student. Newton later became a professor at Cambridge, where he built the first reflecting telescope and studied optics.

He published his most important work in 1687, the *Principia Mathematica*. This book describes Newton's three laws of motion and the law of gravitation, which are a major part of the foundation of modern science. Newton also had an interesting life. He became Master of Mint in England, where he supervised the making of money, and later became the first scientist to be knighted.

## Quiz

- 1 How does reducing the mass of a moving object by half ( $1/2$ ) change its kinetic energy?
- (A) kinetic energy will be half of what it was before
  - (B) kinetic energy will be double of what it was before
  - (C) there is no relationship between mass and kinetic energy
  - (D) decreasing the mass will make the object go faster, increasing its kinetic energy
- 2 Which piece of evidence explains the cause of Newton's effect on physics?
- (A) The person who laid the groundwork for the study of energy was English mathematician and physicist Isaac Newton (1642–1727).
  - (B) Newton developed the laws of motion, which describe how objects are acted upon by forces.
  - (C) Newton later became a professor at Cambridge, where he built the first reflecting telescope and studied optics.
  - (D) He published his most important work in 1687, the "Principia Mathematica."
- 3 Why is heat or thermal energy considered a form of kinetic energy?
- (A) Heat or thermal energy is a measure of particle vibration, vibration is a type of motion.
  - (B) Heat or thermal energy increases the speed at which an object moves from place to place.
  - (C) Heat or thermal energy must always be stored in great quantities for an object to move.
  - (D) Heat or thermal energy is a form of stored energy.

- 4 Read the following selection from the introduction [paragraphs 1-3].

*Potential energy is the energy an object has because of its position; it is energy waiting to be released.*

What conclusion is BEST supported by the selection above?

- (A) All still objects have potential energy.
  - (B) Some objects have more energy than others.
  - (C) Most still objects do not have potential energy.
  - (D) Potential energy makes objects move.
- 5 Which choices are examples of an energy transformation?

1. *baking a cake*
2. *a tennis racket hitting a ball*
3. *a car speeding off from a stop sign*

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

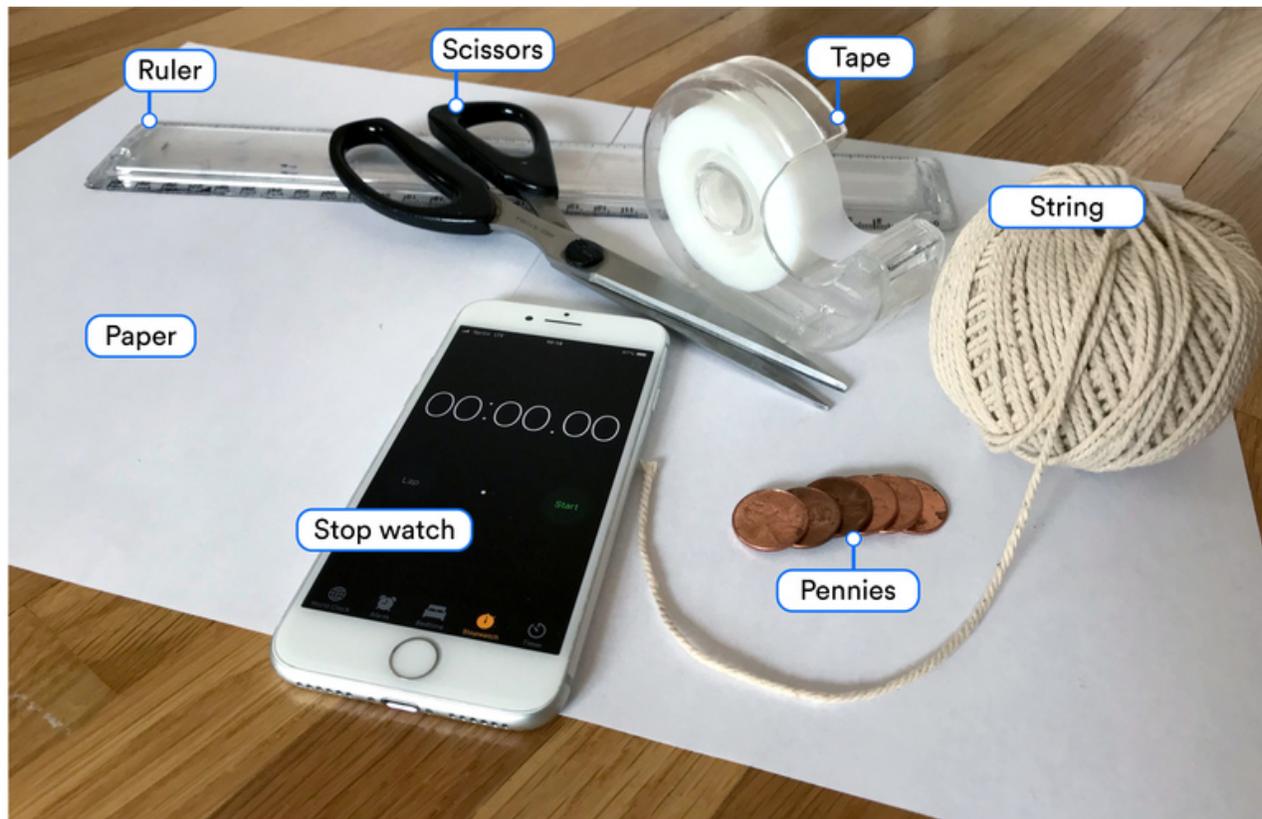
- 6 How are the sections organized to help to develop understanding?
- (A) by description; to help to introduce and give examples of several types of energies
  - (B) by scientific questions; to help readers to understand what they should be asking themselves
  - (C) by cause and effect; to demonstrate how different types of energies affect each other
  - (D) by guiding questions; to help readers to understand major concepts in energy
- 7 Why is Sir Isaac Newton an important person in the field of physics?
- (A) Sir Isaac Newton was the first person to calculate the shape and size of the solar system.
  - (B) Sir Isaac Newton developed many of the laws of physics we still use today.
  - (C) Sir Isaac Newton developed a mathematical formula to calculate the mass of any object.
  - (D) Sir Isaac Newton's laws of chemistry and biology changed the way we study science.
- 8 What is one reason why the author includes the information about what energies a car uses?
- (A) to explain how energy makes a car move
  - (B) to provide an example of chemical energy
  - (C) to provide an example of how energy can change
  - (D) to explain what thermal energy is

# Experiment: Swinging with a pendulum

By Scientific American/Science Buddies on 03.28.20

Word Count **666**

Level **MAX**



Use these items to learn more about how the motion of a pendulum is affected by gravity. Newsela staff

The back-and-forth motion of a playground swing is an example of a pendulum.

But pendulums can do more than provide fun at recess and help tell the time. Among other scientific applications, they can show that the Earth is huge! This is because the swinging motion of a pendulum is due to the force of gravity generated by the Earth's size. Other factors, including a pendulum's length, can also affect its motion. Do this activity to learn more.

## Materials

Two identical chairs

String or yarn

Ten metal washers of identical size or six pennies

Strong tape

Measuring stick

Scissors

Stopwatch accurate to 0.1 second

An assistant

### Preparation

1. Place the two chairs back-to-back. Space them about 1 meter (about 39 inches) apart. Lay the measuring stick on the backs of the two chairs, centered on the back of each.
2. Cut one piece of string to a length of 70 centimeters (about 28 inches). Cut a second piece of string to a length of 35 centimeters (about 14 inches). Tie one end of both strings to the measuring stick, toward the middle of the stick. Space the strings about 20 to 30 centimeters (about 8 to 12 inches) apart on the measuring stick.
3. Tie five metal washers to the free end of each string. Alternatively, if you are using pennies and tape, securely tape three pennies to the free end of each string. Tip: If the measuring stick does not seem to stably sit on the backs of the chairs, you can try to tape the ends of the stick to the chairs.

### Procedure

1. Pull the strings tight (by holding on to the washers or pennies at the ends) and position the strings at the same angle from the measuring stick.
2. Have an assistant ready with a stopwatch. Drop the longer pendulum and, at the same time, have the assistant start the stopwatch. Then have the assistant stop the stopwatch when the pendulum returns back to its original position. If the pendulum hit anything as it swung, such as the wall, readjust your setup and try timing the pendulum again. How long does it take the longer pendulum to swing back to its original position? This is the period of the pendulum.
3. Again, pull the strings tight and hold them at the same angle from the meter stick.
4. Have the assistant reset the stopwatch. Drop the shorter pendulum and, once more, have the assistant time the period of the pendulum. How long does it take the shorter pendulum to swing back to its original position?
5. Time the periods of the shorter and longer pendulums a few more times. Are the periods consistent for each pendulum, or do they vary a lot?
6. Is the period of the longer pendulum longer or shorter than the period of the shorter pendulum? How different are the two periods? Is this what you expected?

**Extra:** Instead of timing the period of the swing, you could time how long each pendulum swings before it comes to rest. What is the total time that each pendulum swings?

**Extra:** Instead of changing the length of the string, change the number of weights attached to the string or the initial angle of the string. Do mass or initial angle affect the period of the pendulum? Do they affect the pendulum's total time?

### Observations And Results

Did the longer pendulum have a longer period than the shorter pendulum? Was the longer pendulum's period not quite twice as long as the shorter pendulum's period?

A pendulum that is twice as long as another pendulum does not simply have a period that is also twice as long. The exact periods of your longer and shorter pendulums might be slightly less than 1.7 seconds and 1.2 seconds, respectively, because of friction and because their lengths were less than 70 centimeters (about 28 inches) and 35 centimeters (about 14 inches) because of strings being used to tie to attachments.

## Quiz

# A history of rockets

By NASA.gov on 11.16.16

Word Count **2,227**

Level **MAX**



TOP: A space shuttle blasts off piggybacking on a rocket. Pixabay. Graphics courtesy of NASA.

Today's rockets are remarkable collections of human ingenuity that have their roots in the science and technology of the past. They are natural outgrowths of literally thousands of years of experimentation and research on rockets and rocket propulsion.

One of the first devices to successfully employ the principles essential to rocket flight was a wooden bird. The writings of Aulus Gellius, a Roman, tell a story of a Greek named Archytas who lived in the city of Tarentum, now a part of southern Italy. Somewhere around the year 400 B.C., Archytas mystified and amused the citizens of Tarentum by flying a pigeon made of wood. Escaping steam propelled the bird suspended on wires. The pigeon used the action-reaction principle, which was not stated as a scientific law until the 17th century.

About 300 years after the pigeon, another Greek, Hero of Alexandria, invented a similar rocket-like device called an aeolipile. It, too, used steam as a propulsive gas.

Hero mounted a sphere on top of a water kettle. A fire below the kettle turned the water into steam, and the gas traveled through pipes to the sphere. Two L-shaped tubes on opposite sides of

the sphere allowed the gas to escape, and in doing so gave a thrust to the sphere that caused it to rotate.

Just when the first true rockets appeared is unclear. Stories of early rocket-like devices appear sporadically through the historical records of various cultures. Perhaps the first true rockets were accidents. In the first century A.D., the Chinese reportedly had a simple form of gunpowder made from saltpeter, sulfur and charcoal dust. To create explosions during religious festivals, they filled bamboo tubes with a mixture and tossed them into fires. Perhaps some of those tubes failed to explode and instead skittered out of the fires, propelled by the gases and sparks produced by the burning gunpowder.

The Chinese began experimenting with the gunpowder-filled tubes. At some point, they attached bamboo tubes to arrows and launched them with bows. Soon they discovered that these gunpowder tubes could launch themselves just by the power produced from the escaping gas. The true rocket was born.

The date reporting the first use of true rockets was in 1232. At this time, the Chinese and the Mongols were at war with each other. During the battle of Kai-Keng, the Chinese repelled the Mongol invaders by a barrage of "arrows of flying fire." These fire-arrows were a simple form of a solid-propellant rocket. A tube, capped at one end, contained gunpowder. The other end was left open and the tube was attached to a long stick. When the powder was ignited, the rapid burning of the powder produced fire, smoke and gas that escaped out the open end and produced a thrust. The stick acted as a simple guidance system that kept the rocket headed in one general direction as it flew through the air. It is not clear how effective these arrows of flying fire were as weapons of destruction, but their psychological effects on the Mongols must have been formidable.

Following the battle of Kai-Keng, the Mongols produced rockets of their own and may have been responsible for the spread of rockets to Europe. All through the 13th to the 15th centuries there were reports of many rocket experiments. In England, a monk named Roger Bacon worked on improved forms of gunpowder that greatly increased the range of rockets. In France, Jean Froissart found that more accurate flights could be achieved by launching rockets through tubes. Froissart's idea was the forerunner of the modern bazooka. Joanes de Fontana of Italy designed a surface-running, rocket-powered torpedo for setting enemy ships on fire.

By the 16th century rockets fell into a time of disuse as weapons of war, though they were still used for fireworks displays, and a German fireworks maker, Johann Schmidlap, invented the "step rocket," a multi-staged vehicle for lifting fireworks to higher altitudes. A large sky rocket (first stage) carried a smaller sky rocket (second stage). When the large rocket burned out, the smaller one continued to a higher altitude before showering the sky with glowing cinders. Schmidlap's idea is basic to all rockets today that go into outer space.

Nearly all uses of rockets up to this time were for warfare or fireworks, but there is an interesting old Chinese legend that reported the use of rockets as a means of transportation. With the help of many assistants, a lesser-known Chinese official named Wan-Hu assembled a rocket-powered flying chair. Attached to the chair were two large kites, and fixed to the kites were 47 fire-arrow rockets.

On the day of the flight, Wan-Hu sat himself on the chair and gave the command to light the rockets. Forty-seven rocket assistants, each armed with torches, rushed forward to light the fuses.

In a moment, there was a tremendous roar accompanied by billowing clouds of smoke. When the smoke cleared, Wan-Hu and his flying chair were gone. No one knows for sure what happened to Wan-Hu, but it is probable that if the event really did take place, Wan-Hu and his chair were blown to pieces. Fire-arrows were as apt to explode as to fly.

### **Rocketry Becomes A Science**

During the latter part of the 17th century, the scientific foundations for modern rocketry were laid by the great English scientist Sir Isaac Newton (1642-1727). Newton organized his understanding of physical motion into three scientific laws. The laws explain how rockets work and why they are able to work in the vacuum of outer space. Newton's laws soon began to have a practical impact on the design of rockets. About 1720, a Dutch professor, Willem Gravesande, built model cars propelled by jets of steam. Rocket experimenters in Germany and Russia began working with rockets with a mass of more than 45 kilograms. Some of these rockets were so powerful that their escaping exhaust flames bored deep holes in the ground even before liftoff.

During the end of the 18th century and early into the 19th, rockets experienced a brief revival as a weapon of war. The success of Indian rocket barrages against the British in 1792 and again in 1799 caught the interest of an artillery expert, Colonel William Congreve. Congreve set out to design rockets for use by the British military.

The Congreve rockets were highly successful in battle. Used by British ships to pound Fort Mchenry in the War of 1812, they inspired Francis Scott Key to write "the rockets' red glare," words in his poem that later became "The Star-Spangled Banner."

Even with Congreve's work, the accuracy of rockets still had not improved much from the early days. The devastating nature of war rockets was not their accuracy or power, but their numbers. During a typical siege, thousands of them might be fired at the enemy. All over the world, rocket researchers experimented with ways to improve accuracy. An Englishman, William Hale, developed a technique called spin stabilization. In this method, the escaping exhaust gases struck small vanes at the bottom of the rocket, causing it to spin much as a bullet does in flight. Variations of the principle are still used today.

Rockets continued to be used with success in battles all over the European continent. However, in a war with Prussia, the Austrian rocket brigades met their match against newly designed artillery pieces. Breech-loading cannons with rifled barrels and exploding warheads were far more effective weapons of war than the best rockets. Once again, rockets were relegated to peacetime uses.

### **Modern Rocketry Begins**

In 1898, a Russian schoolteacher, Konstantin Tsiolkovsky (1857-1935), proposed the idea of space exploration by rocket. In a report he published in 1903, Tsiolkovsky suggested the use of liquid propellants for rockets in order to achieve greater range. Tsiolkovsky stated that the speed and range of a rocket were limited only by the exhaust velocity of escaping gases. For his ideas, careful research and great vision, Tsiolkovsky has been called the father of modern astronautics. Early in the 20th century, an American, Robert H. Goddard (1882-1945), conducted practical experiments in rocketry. He had become interested in a way of achieving higher altitudes than were possible for lighter-than-air balloons. He published a pamphlet in 1919 titled "A Method of Reaching Extreme



States. These missiles would have had winged upper stages but very small payload capacities.

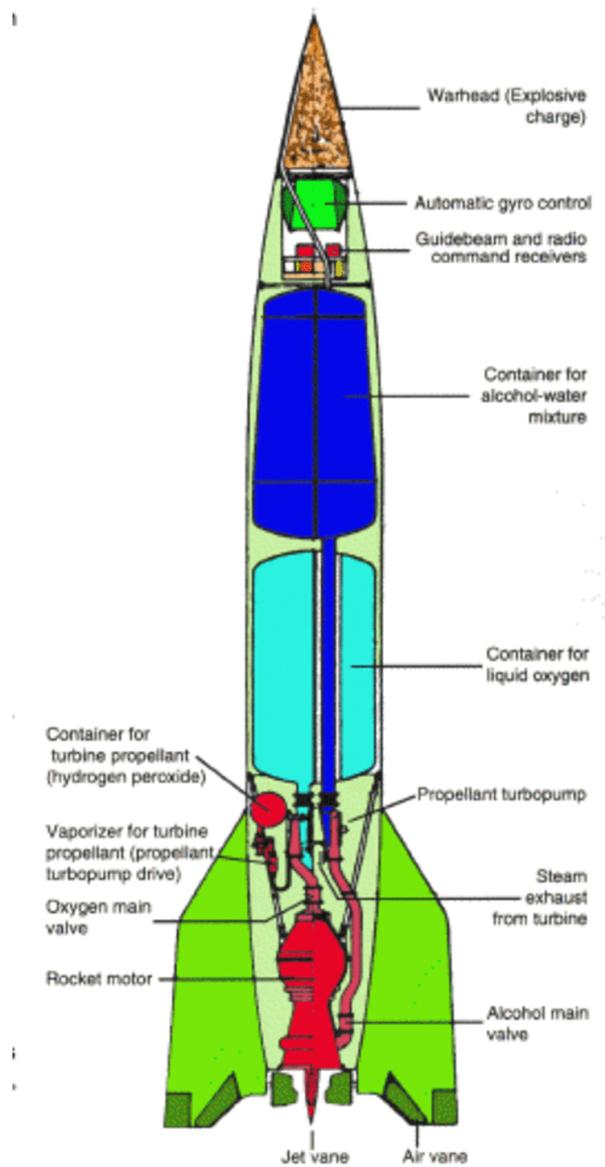
With the fall of Germany, many unused V-2 rockets and components were captured by the Allies. Many German rocket scientists came to the United States. Others went to the Soviet Union. The German scientists, including von Braun, were amazed at the progress Goddard had made.

Both the United States and the Soviet Union realized the potential of rocketry as a military weapon and began a variety of experimental programs. At first, the United States began a program with high-altitude atmospheric sounding rockets, one of Goddard's early ideas. Later, a variety of medium- and long-range intercontinental ballistic missiles were developed. These became the starting point of the U.S. space program. Missiles such as the Redstone, Atlas and Titan would eventually launch astronauts into space.

On October 4, 1957, the world was stunned by the news of an Earth-orbiting artificial satellite launched by the Soviet Union. Called Sputnik I, the satellite was the first successful entry in a race for space between the Soviet Union and United States. Less than a month later, the Soviets followed with the launch of a satellite carrying a dog named Laika on board. Laika survived in space for seven days before being put to sleep before the oxygen supply ran out. A few months after the first Sputnik, the United States followed the Soviet Union with a satellite of its own. Explorer I was launched by the U.S. Army on January 31, 1958. In October of that year, the United States formally organized its space program by creating the National Aeronautics and Space Administration (NASA). NASA became a civilian agency with the goal of peaceful exploration of space for the benefit of all humankind.

Soon, many people and machines were being launched into space. Astronauts orbited Earth and landed on the moon. Robot spacecraft traveled to the planets. Space was suddenly opened up to exploration and commercial exploitation. Satellites enabled scientists to investigate our world, forecast the weather and communicate instantaneously around the globe. As the demand for more and larger payloads increased, a wide array of powerful and versatile rockets had to be built.

Since the earliest days of discovery and experimentation, rockets have evolved from simple gunpowder devices into giant vehicles capable of traveling into outer space. Rockets have opened the universe to direct exploration by humankind.



German V-2 (A-4) Missile

## Quiz

- 1 Which of the following options BEST describes the structure of the article?
- (A) The article explains the diverse range of applications for modern rocketry.
  - (B) The article describes how the discovery of rocket technology has solved problems.
  - (C) The article chronologically describes advancements in rocket technology.
  - (D) The article presents and supports an argument in favor of continued rocket research.
- 2 Read the last two paragraphs of the article. Why does the author choose to conclude the article with these paragraphs?
- (A) to emphasize the impact of rocket advancements
  - (B) to summarize the importance of ancient rockets
  - (C) to convince the reader to research more about rockets
  - (D) to predict how rockets will be used in the future
- 3 Who would find the diagrams MOST helpful?
- (A) someone who wanted to build a rocket that can fly into space
  - (B) someone who wanted to understand early rocket design
  - (C) someone who wanted to know how each rocket part functioned
  - (D) someone who wanted to improve modern rocket technology
- 4 Which of the following topics is emphasized in the article, but not in the diagrams?
- (A) the use of liquid oxygen to power rockets
  - (B) the design of solid-propellant rockets
  - (C) the burning of alcohol to help fuel rockets
  - (D) the placement of the motor on the rocket

# How does gravity pull things down to Earth?

By Monica Grady, The Conversation on 01.16.20

Word Count **790**

Level **MAX**



Image 1. Everything in the universe has its own gravitational pull. When you throw an apple into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the apple is also pulling on the Earth. Image by: Westend61/Getty Images

Gravity is a force, which means that it pulls on things. But the Earth isn't the only thing which has gravity. In fact, everything in the universe, big or little, has its own pull because of gravity – even you.

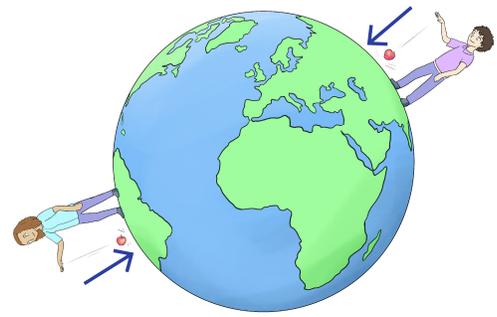
Isaac Newton was one of the first scientists to figure out the rules of how gravity behaves. The story goes, he was sitting under an apple tree when one of the fruits fell off. As he saw the apple fall down to the ground, he started to wonder why it didn't go up to the sky instead.

After lots of experiments, and some very clever thinking, he worked out that the force of gravity depends on how heavy objects are, and that the pull of gravity between objects gets smaller the farther apart they are. To see how gravity works in our universe, we're going to take a journey, with a few stops along the way.

First off, we'll go to the park and play a game of football. When you kick the football into the air, the Earth's gravity pulls it back down. But that's not the only thing that's happening: The gravity of the football is also pulling on the Earth. The thing is, the Earth is very heavy – much heavier than

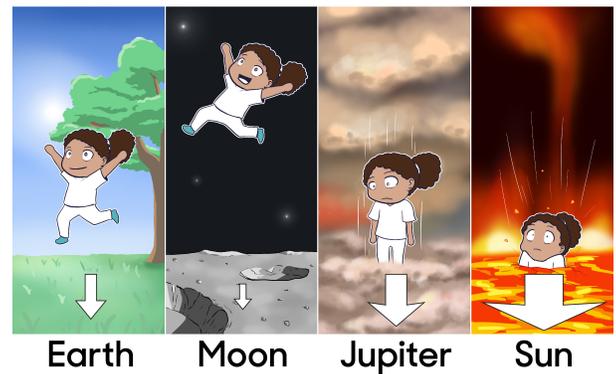
the football – so it's unaffected by the pull of the football, while the football itself is pulled back down to Earth.

Our next stop is the moon, and as we journey up into space, there's a good chance you'll see the sun. Now, the sun is much, much bigger than the Earth, which means its pull is very powerful indeed.



You might be wondering why the Earth (and all the other planets) don't just fall into the sun, the same way the football falls to Earth. The answer is that the planets are all moving, and the balance between the force of gravity and the speed of their movement (which comes from when they were first made, about 4.5 billion years ago) keeps them circling round the sun.

When we arrive on the moon, you'll see that the pull of gravity is not the same everywhere. It is related to how heavy – or how massive – an object is. If you jump on the moon, you'll be able to go much higher than you can on Earth. This is because the Earth is bigger than the moon, so the force between you and the Earth – which is what we call weight – is bigger than the force between you and the moon. On the moon, you seem to weigh less than on Earth, so you can jump higher.



Our final stop is the seaside. Sitting on the beach, you can see the sea gradually getting closer and closer to you – this is the tide coming in. After some time, the sea seems to get farther away – now, the tide is going out. But the sea is not actually moving in and out – it is moving up and down. As the sea level rises, the water gets closer to you, because the beach you are sitting on slopes upwards away from the sea. And as the sea level drops down, the water gets farther away from you.

This is also an effect of gravity, and it happens because the moon is close to the Earth. Unlike the football, the moon is heavy enough to have an effect – just a little one, because the Earth is still much heavier – but it's enough for us to notice when we watch the tides. As the water level rises, it is being pulled toward the moon, and the tide comes in. Then the tide goes out, and the water level drops, as the moon rotates around the Earth.

An interesting question is why we don't have enormous tides caused by the sun pulling on the Earth. We know that the sun is much bigger than the moon – so surely it ought to be able to pull water toward it? Actually, it does – but much less than the moon. This is because although the sun is much bigger than the moon, it is much, much farther away – and the pull of gravity gets weaker the bigger the distance between objects.

So, next time you're kicking a football around in the park, you'll know how gravity is bringing the football back down to Earth.

# Time travel may be possible for certain tiny particles, but probably not

By Scientific American, adapted by Newsela staff on 10.14.14

Word Count **1,462**

Level **1000L**



Visitors explore an imaginary time machine, part of the Philadelphia International Festival of the Arts, at the Kimmel Center for the Performing Arts, March 28, 2013, in Philadelphia. AP Photo/Matt Rourke

On June 28, 2009, the world-famous physicist Stephen Hawking threw a party, complete with balloons, appetizers and champagne. Everyone was invited but no one showed up. Hawking had expected that, because he only sent out invitations after his party had ended. It was, he said, "a welcome reception for future time travelers." It was a joke, but it was also an experiment to prove his belief that travel into the past is impossible.

But Hawking may be wrong. Recent experiments offer some support for time travel's possibility — at least in the world of math. The new study cuts to the core of our understanding of the universe. Proving that time travel is possible would have change classical physics as well as allow for super-fast types of computing that rely on quantum physics, also called quantum mechanics.

Briefly, classical physics deals with the big things, like the Sun and Moon. Quantum mechanics tells us that the things described in classical physics are affected by things even smaller than atoms. For instance, a ray of light is actually made up of tiny packets of energy.

## **Bending Space And Time**

Some think time travel is possible because physics says so. It should be possible based on Einstein's theory of general relativity. His famous theory describes gravity as the bending of space and time, which are one thing called "spacetime."

To understand that, imagine you and a friend stretch a blanket out between the two of you. That blanket is "spacetime." Space and time are part of the same fabric. Then someone drops a marble onto the blanket and it sinks a bit. The marble is like a planet, or anything with mass.

The mass of planets affects and bends both space and time, with big effects for time. Events that happen at the same time for one observer could happen at different times for another.

So, what does this mean for time travel? Instead of the marble bending spacetime, imagine a powerful gravitational field. One example would be a spinning black hole. It could make spacetime bend back on itself, creating a "closed timelike curve," or CTC. People could use this loop, or tube, to travel back in time.

### **Subatomic Time Travel?**

Hawking and many other physicists don't like the idea of CTCs. Anything traveling through one would create paradoxes. Even if you can go back in time, how can you come back to the future and have it be the same?

Think about science fiction movies. When someone travels back in time their actions change the future, and may even prevent themselves from being born. Cause and effect fall apart.

In 1991, physicist David Deutsch said he knew how to fix paradoxes caused by CTCs. He said the answer was at the tiniest quantum level. The key was fundamental particles, like quarks which are inside protons. Physicists believe fundamental particles are the smallest parts of matter. Now, they may be made of smaller parts or not, but we can't see that far. Deutsch came up with a theory to send these particles back in time.

"It's intriguing that you've got general relativity predicting these paradoxes, but then you consider them in quantum mechanical terms and the paradoxes go away," says University of Queensland physicist Tim Ralph. "It makes you wonder whether this is important in terms of formulating a theory that unifies general relativity with quantum mechanics." For years, physicists have searched for a theory to unite classical physics and quantum physics.

### **"The Grandfather Paradox"**

Recently Ralph and his PhD student Martin Ringbauer led a team that confirmed much of Deutsch's model of CTCs. Their findings are published in Nature Communications. They investigated how Deutsch's model deals with the "grandfather paradox." In the hypothetical scenario someone uses a CTC to travel back through time to murder her own grandfather. In turn, this prevents her own birth.

Deutsch's quantum solution to the grandfather paradox works like this:

Instead of a human taking a CTC back in time to kill her ancestor, imagine that a particle goes back in time to flip a switch on the particle-generating machine that created it. If the particle flips

the switch, the machine shoots a particle — the particle — back into the CTC. However, if the switch isn't flipped, the machine shoots out nothing.

In this scenario it is not certain the particle will be shot out. It's just a probability. Deutsch's big idea was that particles are steady and constant at the quantum level. He insists that any particle entering one end of a CTC must come out the other end exactly the same. Therefore, a particle shot out by the machine with a probability of one half would enter the CTC and come out the other end to flip the switch with a probability of one half.

By doing so it would give itself at birth a probability of one half of going back to flip the switch. If the particle were a person, she would be born with a one-half probability of killing her grandfather. In turn, that would give her grandfather a one-half probability of escaping death at her hands. That's good enough in terms of probability to escape the paradox. This strange solution agrees with the laws of quantum physics.

### **Mathematical Stunt Double**

Ralph and Ringbauer simulated Deutsch's model using pairs of polarized light particles (photons). They say it is mathematically the same as a photon passing through a CTC. "We encode their polarization so that the second one acts as kind of a past incarnation of the first," Ringbauer says. So instead of sending a person through a time loop, they created a stunt double of the person and ran him through a time-loop simulator. They wanted to see if the stunt double coming through a CTC exactly resembled the original person as he was in that moment in the past.

By measuring the polarization of the second photon after it interacted with the first, the team demonstrated Deutsch's theory. "Of course, we're not really sending anything back in time," Ralph says.

But the simulation, Ringbauer notes, would have remarkable effects for computing based on quantum mechanics. The quantum states of fundamental particles could be cloned. "If you can clone quantum states," he says, "you can violate the Heisenberg uncertainty principle." Heisenberg's uncertainty principle says certain pairs of things can't be measured accurately at the same time. Basically, the better you know the position of a particle, the less you know its momentum, and vice versa. "But if you clone that system, you can measure one quantity in the first and the other quantity in the second." This would allow for advances in quantum computing, such as quantum encryption.

CTCs would allow quantum mechanics to perform more powerful computing tasks than "classical or even normal quantum computers could do," says Todd Brun, a physicist at the University of Southern California. "But this experiment cannot test the Deutsch model itself." For that, an actual CTC would be necessary.

### **Guests From Future? Still Late**

Deutsch's model isn't the only one around, however. In 2011 Seth Lloyd, a physicist at Massachusetts Institute of Technology, tested simulations of a simpler model of CTCs. It resolves the grandfather paradox using quantum teleportation and post-selection. Quantum teleportation is a bit like the teleporter in Star Trek, when Scotty beams Spock up from other planets — but that's where the similarity ends. Quantum teleportation only beams around the tiniest bits of information.

Post-selection refers to discarding experimental runs where something you wanted to happen didn't happen.

Deutsch's theory destroys correlations, Lloyd says. "That is, a time traveler who emerges from a Deutschian CTC enters a universe that has nothing to do with the one she exited in the future." Post-selection preserves correlations, "so that the time traveler returns to the same universe that she remembers in the past."

Lloyd's model would make CTCs much less powerful for computing than Deutsch's. However, they would still be far superior to what computers could achieve in typical regions of spacetime. Typical computing stores information as 0's or 1's. Quantum computing can use 1 and 0 separately or at the same time. Lloyd's model could solve problems at the level of "finding needles in haystacks," Lloyd says. "But a computer in a Deutschian CTC could solve why haystacks exist in the first place."

Lloyd, though, admits how wild the idea of CTCs is. "I have no idea which model is really right. Probably both of them are wrong," he says. Of course, he adds, the other possibility is that Hawking is correct, "that CTCs simply don't and cannot exist." Time-travel party planners should save the champagne for themselves — no guests from the future seem likely to arrive.

## Quiz

- 1 Select the paragraph from the section "Subatomic Time Travel?" that describes in detail a potential paradox of time travel.
- 2 Which section from the article confirms that there are still philosophical issues with time travel?
- (A) "Bending Space And Time"
  - (B) "Subatomic Time Travel?"
  - (C) "The Grandfather Paradox"
  - (D) "Mathematical Stunt Double"
- 3 Which of the following sentences from the introduction [paragraphs 1-3] does NOT support the central idea of the text?
- (A) It was a joke, but it was also an experiment to prove his belief that travel into the past is impossible.
  - (B) Recent experiments offer some support for time travel's possibility — at least in the world of math.
  - (C) Proving that time travel is possible would have change classical physics as well as allow for super-fast types of computing that rely on quantum physics, also called quantum mechanics.
  - (D) Briefly, classical physics deals with the big things, like the Sun and Moon.
- 4 Below is a summary of the article.

*Currently, there exists debate about the possibility of time travel. Certain physicists believe that quantum mechanics makes time travel a theoretical possibility.*

Adding which of these details would help strengthen this summary of the article?

- (A) CTCs, or "closed timelike curves" are the result of spacetime bending back on itself.
- (B) Many physicists are concerned about the paradoxes inherent to time travel.
- (C) Albert Einstein's theory of relativity changed physics in numerous ways.
- (D) Stephen Hawking does not believe that time travel is a possibility.

# The sun, an engine of nuclear energy

By Christopher Crockett, Big History Project on 08.22.17

Word Count **1,047**

Level **MAX**



This image shows a view of all that remains of the oldest documented example of a supernova, called RCW 86. A supernova is one of the most dramatic events in the universe. All of the elements in the universe are created in supernova explosions. Photo by: NASA

The sun generates about 400 billion billion megawatts of power and it has done so for five billion years. Nuclear fusion – combining lighter atoms to make heavier ones – is what makes it possible. What energy source is capable of this sort of power? Remarkably, the engine of the mightiest stars is not something immense, but rather something very small: tiny building blocks of atoms smashing together at high speeds. With every collision, a spark of energy is released. Nuclear fusion, the blending of atomic nuclei to form new elements, is what drives entire galaxies of stars.

The nuclei of atoms are conceptually simple. They consist of only two types of particles: protons and neutrons. The number of protons determines the type of atom; it's what distinguishes helium, carbon and sulfur. The neutrons hold the positively charged protons together. Without the neutrons, the like charges would send the protons flying apart.

Heavier atoms, like neon, can be assembled by fusing together lighter atoms, like helium. When that happens, energy is released. How much energy? If you were to fuse all the hydrogen in a gallon of water into helium, you'd have enough energy to power New York City for three days.

Now imagine if you had an entire star's worth of hydrogen!

The trick to getting atoms to fuse is having extremely high temperature and density. Under the pressure of a few octillion tons of gas, the sun's center is heated to about 10 million degrees Celsius. At that temperature, the bare protons of a hydrogen nucleus are moving fast enough to overcome their mutual repulsion.

Through a series of collisions, the intense pressure at the sun's core continually fuses four protons together to form helium. With every fusion, energy is released into the stellar interior. Millions of these events occurring each second produce enough energy to push back against the force of gravity and keep the star in balance for billions of years. The released gamma rays follow a tortuous path higher and higher through the star until eventually emerging from the surface, millions of years later, in the form of visible light.

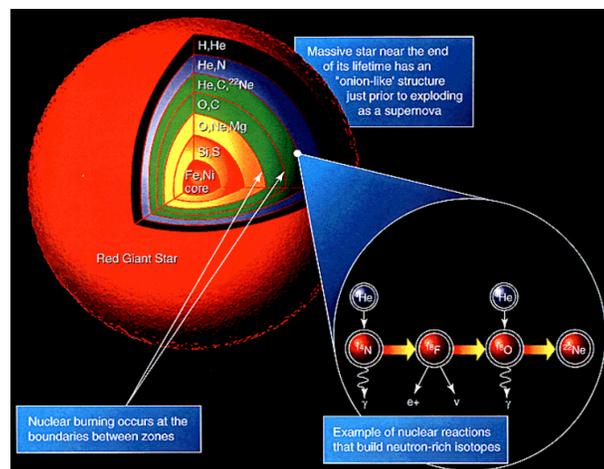
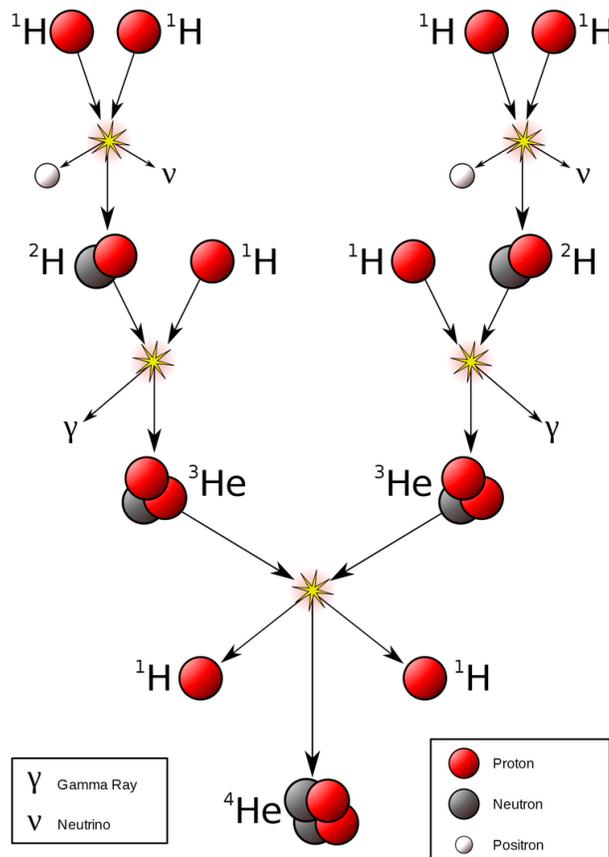
But this can't continue forever. Eventually, the hydrogen is depleted as an inert core of helium builds up. For the smallest stars, this is the end of the line. The engine turns off and the star quietly fades into the darkness.

A more massive star, like our sun, has other options. As the hydrogen fuel runs out, the core contracts. The contracting core heats up and releases energy. The star balloons into a "red giant." If the core can reach a high enough temperature — approximately 100 million degrees Celsius — the helium nuclei can begin fusing. The star enters a new phase of life as helium is transformed into carbon, oxygen and neon.

The star now enters a cycle where the nuclear fuel is depleted, the core contracts, and the star balloons. Each time, the core heating kicks off a new round of fusion.

How many times the star loops through these steps depends entirely on the mass of the star. More mass can produce more pressure and drive ever higher temperatures at the core. Most stars, like our sun, cease after producing carbon, oxygen and neon. The core becomes a white dwarf and the outer layers of the star are driven off into space.

But stars that are a couple of times more massive than the sun can keep going. After the helium is used up, the core contraction produces temperatures approaching 1 billion degrees. Now, the carbon and oxygen can start fusing to form even heavier elements: sodium, magnesium, silicon, phosphorous and sulfur. Beyond this, the most massive stars can heat their cores to several billion

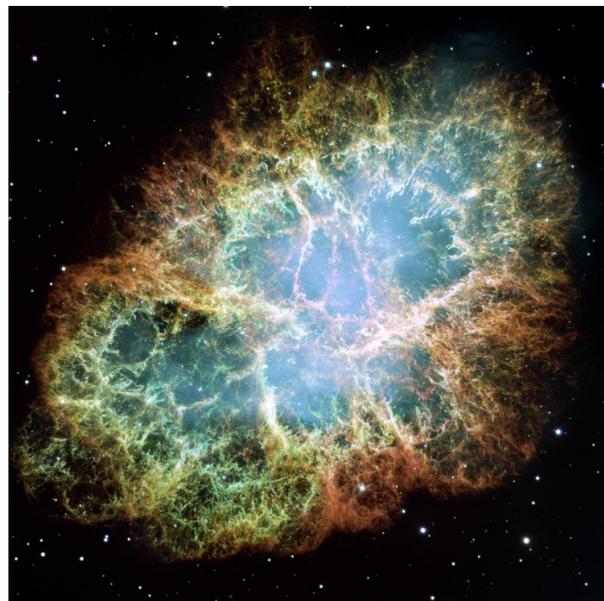


degrees. Here, a bewildering array of options is available as silicon fuses through a complex reaction chain to form metals like nickel and iron. Only a few stars get this far. It takes a star with the mass of more than eight suns to form iron.

Once a star produces a core of iron or nickel, however, there aren't any options left. At every stage along this journey, fusion has released energy into the stellar interior. To fuse with iron, on the other hand, robs energy from the star. At this point, the star has consumed all usable fuel. Without a nuclear energy source, the star collapses. All the layers of gas come crashing down to the center, which stiffens in response. An exotic neutron star is born in the core and the onrushing mass, with nowhere else to go, rebounds off the incompressible surface. Wildly out of balance, the star blows apart in a supernova — one of the most cataclysmic singular events in the universe.

In the chaos of the explosion, atomic nuclei begin capturing single protons and neutrons. Here, in the fires of a supernova, the rest of the elements in the universe are created. All the gold in all the wedding bands in the world can only have come from one place: a nearby supernova that ended one star's life and most likely triggered the formation of our solar system five billion years ago.

It is a remarkable fact that the largest of stars are fueled by the smallest of things. All the light and energy in our universe is the result of atoms being built in the cores of stars. The energy released every time two particles fuse together, combined with trillions of other ongoing reactions, is enough to power a single star for billions of years. And every time a star dies, those new atoms are released into interstellar space and carried along galactic streams, seeding the next generation of stars. Everything that we are is the result of thermonuclear fusion in the heart of a star. As Carl Sagan once famously quipped, we truly are star stuff.



## Quiz

1 The author infuses a tone of wonder and awe throughout the article.

Which selection from the article BEST reflects that tone?

- (A) The sun generates about 400 billion billion megawatts of power and it has done so for five billion years. Nuclear fusion – combining lighter atoms to make heavier ones – is what makes it possible. What energy source is capable of this sort of power? Remarkably, the engine of the mightiest stars is not something immense, but rather something very small: tiny building blocks of atoms smashing together at high speeds. With every collision, a spark of energy is released. Nuclear fusion, the blending of atomic nuclei to form new elements, is what drives entire galaxies of stars.
- (B) But stars that are a couple of times more massive than the sun can keep going. After the helium is used up, the core contraction produces temperatures approaching 1 billion degrees. Now, the carbon and oxygen can start fusing to form even heavier elements: sodium, magnesium, silicon, phosphorous and sulfur. Beyond this, the most massive stars can heat their cores to several billion degrees.
- (C) At every stage along this journey, fusion has released energy into the stellar interior. To fuse with iron, on the other hand, robs energy from the star. At this point, the star has consumed all usable fuel. Without a nuclear energy source, the star collapses. All the layers of gas come crashing down to the center, which stiffens in response. An exotic neutron star is born in the core and the onrushing mass, with nowhere else to go, rebounds off the incompressible surface.
- (D) It is a remarkable fact that the largest of stars are fueled by the smallest of things. All the light and energy in our universe is the result of atoms being built in the cores of stars. The energy released every time two particles fuse together, combined with trillions of other ongoing reactions, is enough to power a single star for billions of years. And every time a star dies, those new atoms are released into interstellar space and carried along galactic streams, seeding the next generation of stars. Everything that we are is the result of thermonuclear fusion in the heart of a star. As Carl Sagan once famously quipped, we truly are star stuff.

2 "Nuclear fusion" is central to understanding the article.

Which of the following paragraphs BEST illustrates the process of nuclear fusion for readers?

- (A) Heavier atoms, like neon, can be assembled by fusing together lighter atoms, like helium. When that happens, energy is released. How much energy? If you were to fuse all the hydrogen in a gallon of water into helium, you'd have enough energy to power New York City for three days.
- (B) Through a series of collisions, the intense pressure at the sun's core continually fuses four protons together to form helium. With every fusion, energy is released into the stellar interior. Millions of these events occurring each second produce enough energy to push back against the force of gravity and keep the star in balance for billions of years. The released gamma rays follow a tortuous path higher and higher through the star until eventually emerging from the surface, millions of years later, in the form of visible light.
- (C) A more massive star, like our sun, has other options. As the hydrogen fuel runs out, the core contracts. The contracting core heats up and releases energy. The star balloons into a "red giant." If the core can reach a high enough temperature — approximately 100 million degrees Celsius — the helium nuclei can begin fusing. The star enters a new phase of life as helium is transformed into carbon, oxygen and neon.
- (D) How many times the star loops through these steps depends entirely on the mass of the star. More mass can produce more pressure and drive ever higher temperatures at the core. Most stars, like our sun, cease after producing carbon, oxygen and neon. The core becomes a white dwarf and the outer layers of the star are driven off into space.

- 3 What is the BEST way to describe this article's organizational structure? What is the MOST LIKELY reason the author chose this organizational structure?
- (A) narrative description; to create a vivid image of nuclear fusion forming the stellar landscape
  - (B) chronology; to emphasize connections between stellar events driven by nuclear fusion
  - (C) compare and contrast; to show how stars of various types use nuclear fusion differently
  - (D) steps in a process; to explain the role of nuclear fusion in the life cycles of stars
- 4 How effectively does the final paragraph conclude the article for readers?
- (A) It effectively concludes the article by emphasizing the significance of nuclear fusion and how it relates to readers.
  - (B) It effectively concludes the article by expanding the definition of nuclear fusion to help readers grasp the concept fully.
  - (C) It ineffectively concludes the article by introducing new ideas about nuclear fusion without providing supporting information.
  - (D) It ineffectively concludes the article by simply restating points about nuclear fusion discussed previously in more detail.

# Explainer: the difference between radiation and radioactivity

By Martin Boland, The Conversation on 04.05.17

Word Count **1,319**

Level **MAX**



A nuclear power plant uses the heat generated from nuclear fission to convert water to steam, which powers generators to produce electricity. A potential danger from an accident at a nuclear power plant is exposure to radiation. Photo from Wikimedia Commons. SECOND IMAGE: The basic structure of an atom. LAST IMAGE: A chest x-ray. X-rays are a form of high-energy electromagnetic radiation. Photos from Wikimedia Commons.

Radioactivity and radiation are often used interchangeably, but they describe different (yet related) processes.

But before going into this difference, it's useful to understand what atoms are and a few concepts about how they behave.

An atom is the smallest particle that can be described as a chemical. Smaller particles aren't chemicals in the same way that wheels, windshields, and seats aren't cars – they are parts of them, but you need a few to make the whole.

At the center of each atom is a nucleus, containing a number of protons (positively charged particles). The number of protons determines what chemical the atom is. All carbon nuclei contain

six protons – it is what defines them as carbon nuclei. Five protons would be a boron atom, seven protons a nitrogen atom.

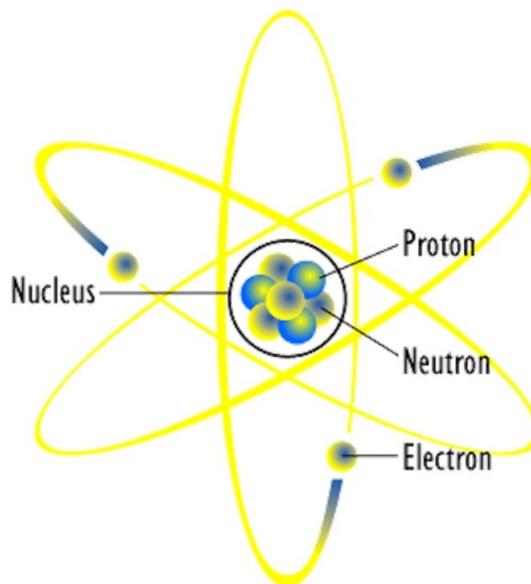
The nucleus also contains a number of neutrons (particle with no charge). Atoms of the same chemical can have different numbers of neutrons. Some 99 percent of carbon atoms have six neutrons, when added to the six protons this gives an atomic mass of 12.

Some carbon atoms have more or fewer neutrons – seven neutrons make carbon-13 and eight for carbon-14. The nuclei of carbon-12 and carbon-13 are stable, but carbon-14 is radioactive and is the basis of radiocarbon dating.

Atoms of the same chemical with different numbers of neutrons are known as isotopes.

Surrounding the nucleus are very small negatively charged particles called electrons. These are held in place (called orbitals) by their attraction to the positively charged nucleus. An atom contains as many electrons as protons.

Adding or removing an electron from the atom results in a charged particle, called an ion. Ions can react very differently to atoms. A chlorine atom is very reactive and dangerous; a chloride ion is part of table salt. This becomes important when talking about ionising radiation later.



### **What Is Radioactivity?**

Radioactivity is the term given to the breaking-up (decay) or rearrangement of an atom's nucleus. Decay occurs naturally and spontaneously to unstable nuclei. This instability is usually caused by a mismatch between the number of protons and neutrons.

Radioactive decay can occur in several ways, with the more common ones being: spontaneous fission, also known as "splitting the atom" as the nucleus breaks into two parts; neutron release: a neutron is ejected from the core of the atom; alpha decay: the nucleus releases an alpha particle (a helium-4 nucleus) consisting of two neutrons and two protons; beta decay: the nucleus ejects an electron or a positron (this is not the same as an electron being removed from orbitals around the nucleus); gamma decay: the protons and neutrons within the nucleus rearrange into a more stable form, and energy is emitted as a gamma ray.

Neutron release, alpha and beta decay are all accompanied by the release of a particle. It is the particle (or the gamma ray in gamma decay) that is the "radiation" associated with radioactivity.

### **What Is A "Half-Life"?**

Let's say we have 4,000 coins and we want to flip them all, which will take (for the sake of the argument) one minute. All of those that land heads are thrown away. By the law of averages, we should have 2,000 coins (half) remaining.

If we then take another minute to flip all of those coins and discard the heads, we will be left with 1,000 coins. And again, taking another minute to flip the 1,000 coins, we will be left with 500 coins.

You'll notice we take the same length of time to flip all the coins, no matter how many of them there are.

In the case of radioactivity, this time is not an artificial constraint, but a fundamental property of each nucleus – that in a given time, it has a 50-50 chance of spontaneously decaying. The name given to the length of time it takes for half the atoms in a sample to decay is called the "half-life."

The half-life of an isotope is the same for all nuclei of that type (all carbon-14 nuclei have a half-life of about 5,750 years and all carbon-15 nuclei have a half life of about 2.5 seconds).

If we perform the coin flip ten times we will be left with four coins – one-thousandth of the starting number. This is important because it is considered that after ten half-lives there is a negligible amount of material remaining.

If a material has a long half-life (such as uranium-238's 4.5 billion years half-life, about the age of the Earth), it is not very radioactive. A material with a short half-life (polonium-210's 138 days) is very radioactive.

### **What's The Difference Between Radioactivity And Radiation?**

As we have seen, radioactive decay is a property of a particular nucleus. In comparison, radiation is a possible consequence of many processes, not just radioactivity.

Radiation is the term given to a traveling particle or wave and can be split into three main types: 1. Non-ionizing radiation: essentially the low-energy parts of the electromagnetic spectrum. This includes all the light you see, radio waves (also known as microwaves, as in the oven) and infrared ("heat" radiation). Ultra violet falls into the high energy end of this category. 2. Ionizing radiation: radiation that can remove an electron from its orbital. 3. Neutrons: free neutron particles that can collide with other atoms.

Non-ionizing radiation is mostly damaging in obvious ways. Exposure to microwaves or infrared waves causes susceptible materials to heat up. Alternatively, ionizing radiation can be less obvious but, by changing an atom into a more reactive ion, can create longer-lasting damage.

Ionizing radiation falls into two main forms: 1. High-energy electromagnetic radiation, including X-ray and gamma rays; 2. Particle radiation, with alpha and beta particles.

These different forms of ionizing radiation differ in their capacity to do damage and their ability to penetrate materials.

### **Ionizing Electromagnetic Radiation**

X-rays and gamma rays are penetrating, and ionizing radiation is essentially the same thing. (The difference



in terminology is usually that gamma rays come from nuclear decay, while X-rays come from electron orbitals.)

These wavelengths of electromagnetic radiation contain enough energy to push an electron out of its orbit around the atom, yet again forming an ion. They are stopped by very dense materials such as lead or large amounts of earth or concrete.

### **Particle Radiation**

Particle radiation is potentially very harmful, but it is relatively easy to block.

Alpha particles, with two neutrons and two protons, are essentially helium ions. These can strip the electrons from another atom in order to become helium atoms. Beta particles are simply free electrons that can be captured by atoms just like any other electron.

Luckily, protection from these is reasonably easy. Alpha particles are blocked by a piece of paper, and beta particles by a few millimetres of metal or an equivalent amount of plastic.

Neutrons are more penetrating and so are potentially more dangerous. They cause damage by being captured by the nucleus of an atom. This can cause the atom to break in two (fission) or undergo another decay process (known as transmutation).

In either case, the original atom (say a nitrogen atom) is changed to become a different type of atom (in this case, carbon-14). The new atom will have different chemical properties and therefore could act as a poison, or, for building materials, change their physical properties.

Neutrons are either slowed down or captured safely by materials such as graphite or compounds containing lots of hydrogen (such as tap water).

All of these forms of radioactivity and radiation are naturally occurring. They make up what is known as background radiation. The web comic xkcd gives a good visual representation of what those numbers look like.

## Quiz

- 1 Which sentence from the introduction [paragraphs 1-9] shows that small particle changes can have drastic effects?
- (A) Atoms of the same chemical can have different numbers of neutrons.
  - (B) Surrounding the nucleus are very small negatively charged particles called electrons.
  - (C) Atoms of the same chemical with different numbers of neutrons are known as isotopes.
  - (D) A chlorine atom is very reactive and dangerous; a chloride ion is part of table salt.

- 2 Which selection from the article does NOT explain a part of the process of releasing radiation through radioactivity?
- (A) Atoms of the same chemical can have different numbers of neutrons. Some 99 percent of carbon atoms have six neutrons, when added to the six protons this gives an atomic mass of 12.
  - (B) Decay occurs naturally and spontaneously to unstable nuclei. This instability is usually caused by a mismatch between the number of protons and neutrons.
  - (C) Neutron release, alpha and beta decay are all accompanied by the release of a particle. It is the particle (or the gamma ray in gamma decay) that is the "radiation" associated with radioactivity.
  - (D) These wavelengths of electromagnetic radiation contain enough energy to push an electron out of its orbit around the atom, yet again forming an ion.

- 3 Read the paragraph from the section "What Is A Half-Life?"

*If we perform the coin flip ten times we will be left with four coins – one-thousandth of the starting number. This is important because it is considered that after ten half-lives there is a negligible amount of material remaining.*

What does the word "negligible" convey in the sentence?

- (A) the sense that the material remaining is unimportant
  - (B) the sense that it is hard to tell when half-lives conclude
  - (C) the sense that half-lives quickly break down materials
  - (D) the sense that the remaining materials are dangerous
- 4 Read the sentence from the section "Particle Radiation."

*Neutrons are more penetrating and so are potentially more dangerous.*

Which version of the sentence creates a more alarming tone by replacing the word "potentially"?

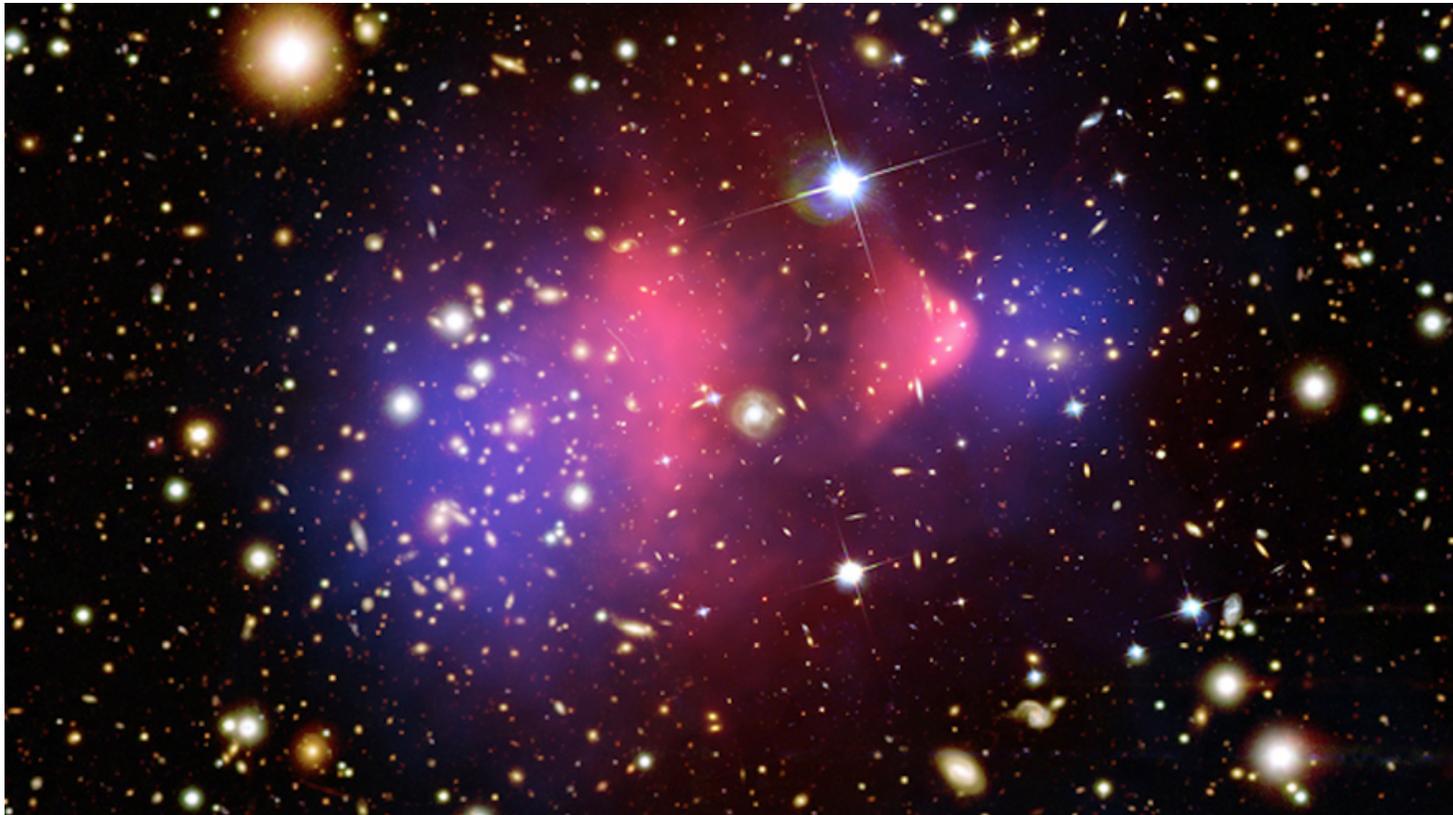
- (A) Neutrons are more penetrating and so are POSSIBLY more dangerous.
- (B) Neutrons are more penetrating and so are THEORETICALLY more dangerous.
- (C) Neutrons are more penetrating and so are CONCEIVABLY more dangerous.
- (D) Neutrons are more penetrating and so are UNDOUBTEDLY more dangerous.

# The nature of dark matter

By NASA.gov on 12.02.16

Word Count **448**

Level **MAX**



TOP: The Bullet Cluster of galaxies. Photo: NASA.

In general, astronomers learn about the universe by the electromagnetic radiation (or light) that we see from it. The light we see is in the form of radio waves, infrared, optical, ultraviolet, X-ray and gamma-ray emission. But what if there is material in the universe that does not glow? How will we ever know it is there? How can we tell how much of it there is? How do we know what it is?

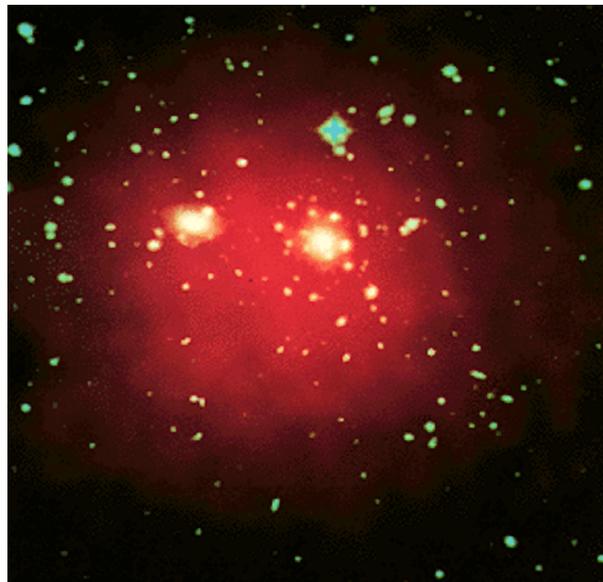
Such material is called "dark matter," and astronomers now believe that most of the material in the universe is made of this stuff. It is material that does not emit sufficient light for us to directly detect it, yet there are a variety of ways that we can indirectly detect it. The most common method involves the fact that dark matter has a gravitational pull on both the light and the sources of light that we can see. From the effects of "extra" gravity that we detect, we infer how much mass must be present.

The image at right shows one way this is done. Pictured here are two superimposed images of the Coma Cluster of galaxies. The red areas are X-ray light seen by the Einstein satellite; the blue is visible light from a Palomar Sky Survey optical image (made with ground-based telescopes at Caltech). Scientists have used these observations and others to determine the amount of gravity required to hold together all the mass detected in the image. Surprisingly, there is not nearly

enough mass observed to explain the inferred gravity - somehow, there is undetected "missing mass." What could this "missing mass" be?

The kinds of materials that we experience every day are made of atoms, which are composed of protons, neutrons and electrons. We refer to this type of matter as "baryonic." Is the dark matter in the universe made of the same stuff that we are familiar with? For example, is it baryonic? Or is it something strange ... some kind of exotic new material, which we could call non-baryonic?

So far, it looks like there are both baryonic and non-baryonic types of dark matter. Some dark matter may be composed of regular matter (i.e., baryonic), but simply not give off much light. Things like brown dwarf stars would be in this category. Other non-baryonic dark matter may be tiny, sub-atomic particles that aren't a part of "normal" matter at all. If these tiny particles have mass and are numerous, they could make up a large part of the dark matter we think exists. If true, then it's possible that most of the matter in the universe is of some mysterious form that we cannot yet even identify.



## Quiz

1 Read the following selection from the article.

*Scientists have used these observations and others to determine the amount of gravity required to hold together all the mass detected in the image. Surprisingly, there is not nearly enough mass observed to explain the inferred gravity - somehow, there is undetected "missing mass."*

Which of the following conclusions can be drawn from the selection above?

- (A) Due to high levels of gravity observed, scientists have inferred that the matter in the universe is shifting.
- (B) Due to low mass and high levels of gravity, scientists have inferred that dark matter is denser than previously thought.
- (C) Due to disproportionate amounts of mass and gravity, scientists have inferred that dark matter is present.
- (D) Due to areas of "missing mass," scientists have inferred that portions of the universe have likely disappeared.

2 Which of the following aspects of the article is NOT thoroughly discussed?

- (A) the methods scientists use to detect dark matter
- (B) the relationship between gravity and dark matter
- (C) the role that dark matter plays in the universe
- (D) the possible composition of dark matter

3 Read the sentence from the article.

*If true, then it's possible that most of the matter in the universe is of some mysterious form that we cannot yet even identify.*

Which version of this sentence creates a more bewildered tone by replacing the word "mysterious"?

- (A) If true, then it's possible that most of the matter in the universe is of some PERPLEXING form that we cannot yet even identify.
- (B) If true, then it's possible that most of the matter in the universe is of some NOTEWORTHY form that we cannot yet even identify.
- (C) If true, then it's possible that most of the matter in the universe is of some PECULIAR form that we cannot yet even identify.
- (D) If true, then it's possible that most of the matter in the universe is of some REMARKABLE form that we cannot yet even identify.

4 Read the sentence from the article.

*It is material that does not emit sufficient light for us to directly detect it, yet there are a variety of ways that we can indirectly detect it.*

Which two words could BEST replace "emit" and "sufficient" without changing the meaning of the sentence?

- (A) absorb; enough
- (B) radiate; adequate
- (C) emanate; excessive
- (D) vacate; ambiguous

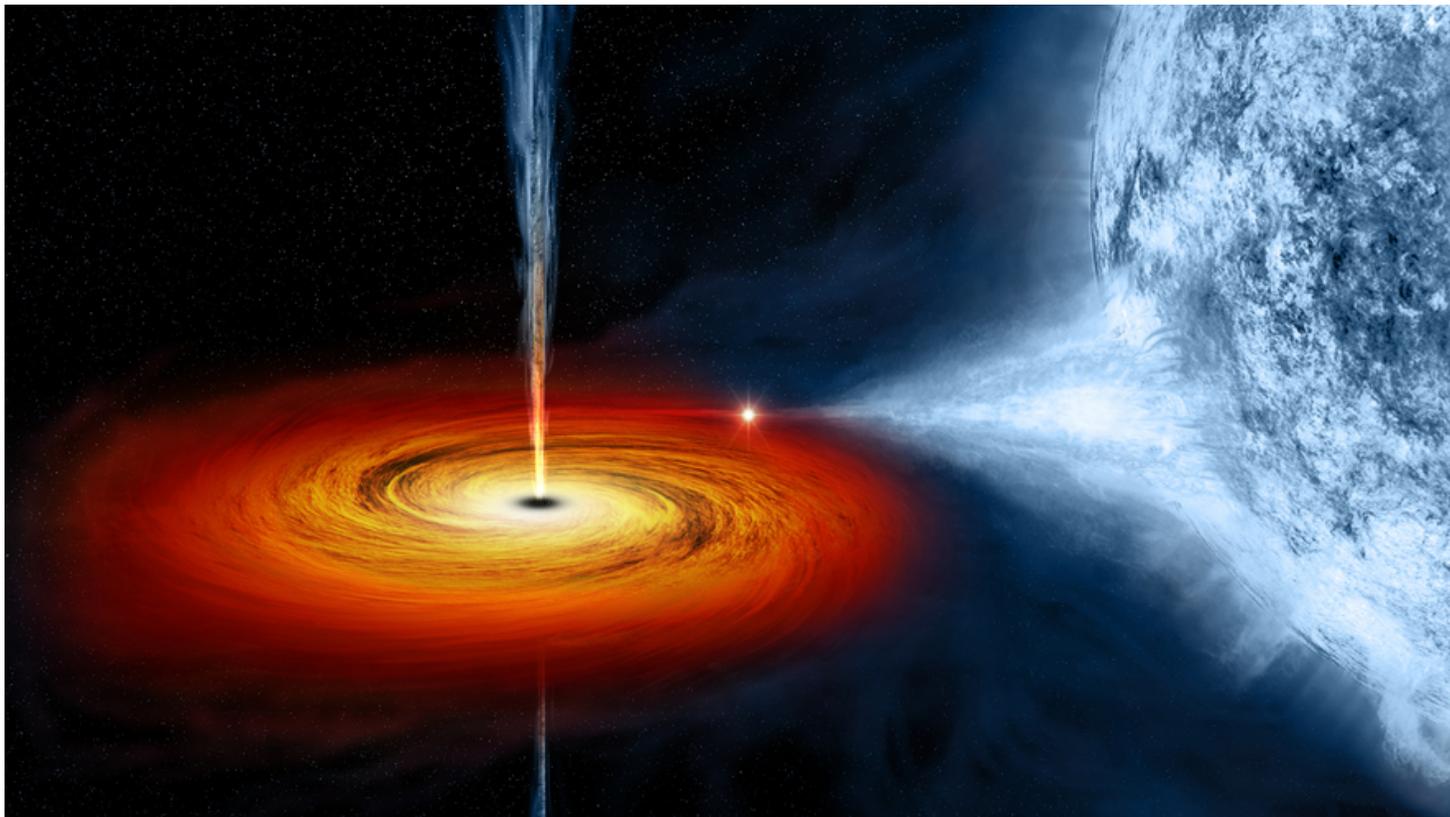


# What is a black hole?

By NASA.gov on 03.02.20

Word Count **841**

Level **MAX**



TOP: The black hole Cygnus X-1 formed when a large star caved in. This black hole pulls matter from the blue star beside it; NASA/CXC/M.Weiss. BOTTOM: An artist's drawing shows the current view of the Milky Way galaxy. Scientific evidence shows that in the center of the Milky Way is a supermassive black hole; NASA/JPL-Caltech.

A black hole is a region in space where the pulling force of gravity is so strong that light is not able to escape. The strong gravity occurs because matter has been pressed into a tiny space. This compression can take place at the end of a star's life. Some black holes are a result of dying stars.

Because no light can escape, black holes are invisible. However, space telescopes with special instruments can help find black holes. They can observe the behavior of material and stars that are very close to black holes.

## How Big Are Black Holes?

Black holes can come in a range of sizes, but there are three main types of black holes. The black hole's mass and size determine what kind it is.

The smallest ones are known as primordial black holes. Scientists believe this type of black hole is as small as a single atom but with the mass of a large mountain.

The most common type of medium-sized black holes is called "stellar." The mass of a stellar black hole can be up to 20 times greater than the mass of the sun and can fit inside a ball with a diameter of about 10 miles. Dozens of stellar mass black holes may exist within the Milky Way galaxy.

The largest black holes are called "supermassive." These black holes have masses greater than 1 million suns combined and would fit inside a ball with a diameter about the size of the solar system. Scientific evidence suggests that every large galaxy contains a supermassive black hole at its center. The supermassive black hole at the center of the Milky Way galaxy is called Sagittarius A. It has a mass equal to about 4 million suns and would fit inside a ball with a diameter about the size of the sun.

### **How Do Black Holes Form?**

Primordial black holes are thought to have formed in the early universe, soon after the big bang.

Stellar black holes form when the center of a very massive star collapses in upon itself. This collapse also causes a supernova, or an exploding star, that blasts part of the star into space.

Scientists think supermassive black holes formed at the same time as the galaxy they are in. The size of the supermassive black hole is related to the size and mass of the galaxy it is in.

### **If Black Holes Are "Black," How Do Scientists Know They Are There?**

A black hole cannot be seen because of the strong gravity that is pulling all of the light into the black hole's center. However, scientists can see the effects of its strong gravity on the stars and gases around it. If a star is orbiting a certain point in space, scientists can study the star's motion to find out if it is orbiting a black hole.

When a black hole and a star are orbiting close together, high-energy light is produced. Scientific instruments can see this high-energy light.

A black hole's gravity can sometimes be strong enough to pull off the outer gases of the star and grow a disk around itself called the accretion disk. As gas from the accretion disk spirals into the black hole, the gas heats to very high temperatures and releases X-ray light in all directions. NASA telescopes measure the X-ray light. Astronomers use this information to learn more about the properties of a black hole.

### **Could A Black Hole Destroy Earth?**

Black holes do not wander around the universe, randomly swallowing worlds. They follow the laws of gravity just like other objects in space. The orbit of a black hole would have to be very close to the solar system to affect Earth, which is not likely.



If a black hole with the same mass as the sun were to replace the sun, Earth would not fall in. The black hole with the same mass as the sun would keep the same gravity as the sun. The planets would still orbit the black hole as they orbit the sun now.

### **Will The Sun Ever Turn Into A Black Hole?**

The sun does not have enough mass to collapse into a black hole. In billions of years, when the sun is at the end of its life, it will become a red giant star. Then, when it has used the last of its fuel, it will throw off its outer layers and turn into a glowing ring of gas called a planetary nebula. Finally, all that will be left of the sun is a cooling white dwarf star.

### **How Is NASA Studying Black Holes?**

NASA is learning about black holes using spacecraft like the Chandra X-ray Observatory, the Swift satellite and the Fermi Gamma-ray Space Telescope. Fermi launched in 2008 and is observing gamma rays - the most energetic form of light - in search of supermassive black holes and other astronomical phenomena. Spacecraft like these help scientists answer questions about the origin, evolution and destiny of the universe.

## Quiz

- 1 Which of the following details from the article shows that scientists do not fully understand how black holes are created?
- (A) ...space telescopes with special instruments can help find black holes.
  - (B) Dozens of stellar mass black holes may exist within the Milky Way galaxy.
  - (C) A black hole cannot be seen because of the strong gravity that is pulling all of the light into the black hole's center.
  - (D) ...these help scientists answer questions about the origin, evolution and destiny of the universe.
- 2 The article suggests that each of the following plays an important role in scientists' current understanding of black holes EXCEPT:
- (A) the mass of individual black holes
  - (B) the holes' locations within different galaxies
  - (C) the force of gravity coming from the holes' center
  - (D) the location of the sun in relation to the nearest black hole
- 3 How does the article develop the idea that black holes have a significant effect on their surroundings?
- (A) by explaining how black holes use gravity to absorb matter
  - (B) by discussing scientists' belief that black holes exist at the center of every galaxy
  - (C) by detailing the sizes and masses of black holes that have been discovered
  - (D) by explaining the events that lead to the creation of black holes
- 4 Which of the following aspects of the article is NOT thoroughly discussed?
- (A) whether black holes are capable of changing sizes
  - (B) whether scientists are able to see black holes using telescopes
  - (C) the effect of black holes on other bodies in space
  - (D) the effect of black holes on the creation of galaxies

# Wanted: An orbiting garbage collector to clean up space

By Rachel Feltman, Washington Post, adapted by Newsela Staff on 05.17.18

Word Count **613**

Level **MAX**



Image 1. There are a lot of satellites floating around space with nowhere to go. Scientists are working on getting rid of the satellites that are no longer working in space. Image from NASA.

The night sky is full of stars, but it's also full of garbage.

Humans put lots of satellites up there. About 1,700 working spacecraft are in orbit around our planet today. And not every piece of machinery comes right back when its job is done. Many keep speeding through the sky long after scientists have lost touch. Those leftover space machines are liable to crash into one another and break into small pieces.

The National Aeronautics and Space Administration (NASA) estimates that there are about 23,000 pieces of space debris larger than 10 centimeters, or about four inches. They also estimate that there are about 500,000 pieces larger than one centimeter, and about 100,000,000 larger than one millimeter.

**Space Garbage Moves Fast!**

A piece of metal smaller than a sesame seed might not sound dangerous. Yet even these tiny bits can pose a big risk. The International Space Station navigates around the paths of the most dangerous hunks of junk. But tiny flakes of paint have managed to chip the craft's quadruple-thick windows. That's because space garbage moves fast.

"Because of the super-high impact speed — more than 10 times the speed of a bullet 250 miles up — even sub-millimeter debris could threaten astronauts when they conduct a spacewalk outside of the International Space Station," says J.D. Harrington. He is a NASA public affairs officer.

Small debris can punch a hole in a satellite. Meanwhile, larger debris can crush one entirely — creating even more wreckage.

"The threat from orbital debris is real," Harrington says. "Because of the ongoing space activities, the orbital debris problem is expected to worsen in the future and will present an even greater danger to future space missions."

It's becoming easier and cheaper for countries, private companies and research groups to send objects up. This has led to an increase in orbital traffic. And it means that our corner of space will have increasingly less space.

### **New Disposal Policy**

NASA doesn't have plans to clean up what's there. However, the agency is working to keep the problem from worsening. They are ensuring that each new mission includes clear arrangements to dispose of spacecraft that no longer work and any pieces they eject.



And there are potential solutions in the works from others: At the 2017 European Conference on Space Debris, presenters discussed ideas for disposing of space junk. Some scientists suggest pushing junk off into a higher orbit, while others vote for capturing it with nets and harpoons or magnets. In May, the International Space Station is expected to deploy a test project. It's called RemoveDEBRIS. It will capture several pieces of pretend garbage before burning itself up in Earth's atmosphere.

But while we wait for someone to design the ultimate space vacuum, are folks on Earth safe from the danger of falling debris? The short answer is yes. Junk falls down all the time: About 200 pieces of debris re-entered the atmosphere in 2016 alone. Most of that burns up and breaks down in the process. The pieces that remain are unlikely to cause harm. Most of the Earth is either covered in ocean or has plenty of open space, so chances are any hunks of junk will hit spots without humans there to get hurt.

### **Oh No! The Sky Is Falling!**

There's only one known case of a human getting hit with a piece of spacecraft — Lottie Williams in Tulsa, Oklahoma, in 1997. She didn't even get a bruise from the accident! You're way, way more likely to get struck by lightning.

## Quiz

- 1 Which statement is a MAIN idea of the article?
- (A) The increase in orbital traffic means there will be even more space junk and more problems for future space missions.
  - (B) Many spacecraft don't come back to Earth after they stop working but in fact keep traveling through the sky.
  - (C) Astronauts are afraid to go on spacewalks outside of the International Space Station because of large space debris.
  - (D) The 2017 European Conference on Space Debris has come up with more ideas than NASA has for cleaning up space debris.
- 2 Which sentence from the article would be MOST important to include in a summary of the article?
- (A) The International Space Station navigates around the paths of the most dangerous hunks of junk.
  - (B) It's becoming easier and cheaper for countries, private companies and research groups to send objects up.
  - (C) It will capture several pieces of pretend garbage before burning itself up in Earth's atmosphere.
  - (D) Most of the Earth is either covered in ocean or has plenty of open space, so chances are any hunks of junk will hit spots without humans there to get hurt.
- 3 What is MOST likely the reason the author included the information about the International Space Station's window getting chipped?
- (A) to describe some of the experiments the ISS is testing for the RemoveDEBRIS project that will get rid of space junk
  - (B) to show that the greatest danger to the ISS is the large pieces of debris orbiting around it
  - (C) to demonstrate that the damage done by small debris is actually worse than the damage done by large debris
  - (D) to highlight how even the smallest pieces of debris can cause damage to other spacecraft
- 4 Which answer choice accurately characterizes NASA's reaction to the space junk problem?
- (A) NASA is not addressing the problem of space debris that already exists but has rules to ensure that new missions plan how to get rid of their garbage.
  - (B) NASA is not addressing the problem of space debris that already exists and does not have any ideas to prevent more space debris from forming in the future.
  - (C) NASA is focusing primarily on the space debris that is already in space and has not addressed the debris that might be left by future missions.
  - (D) NASA is focusing primarily on the space debris that is already in space but also will attempt to solve the problem of future space garbage.

# Dream Job: Food chemist

By Peg Lopata, Cricket Media on 03.22.20

Word Count **617**

Level **MAX**



Uma Parasar is a senior research fellow with the research and development flavors team at International Flavors and Fragrances, Inc (IFF). She helps make sure the flavors her company makes are safe to eat and drink. Photo: Uma Parasar

Do you ever wonder what makes some packaged foods and drinks taste great? Well, a chemist such as Uma Parasar might be the one to thank. Parasar is a senior research fellow with the research and development flavors team at International Flavors and Fragrances, Inc (IFF). You can taste flavors her lab has created in all kinds of things — juices, yogurts, candy, potato chips and chocolate. Specifically, as a toxicologist, Parasar is responsible for making sure the flavors her company makes are safe to eat and drink.

## **Question: Why do you like chemistry?**

**Answer:** We humans are made up of chemicals and so is the natural world, as well as the materials-based world. Embracing chemistry helps us appreciate our amazing world and not fear it. I wanted to be a chemist to solve problems. My specialty, toxicology, helps create a safe world. Arguably, toxicology is the oldest scientific discipline, as the earliest humans had to recognize which plants were safe to eat.

## **Q: Do you have any favorite food chemicals?**

A: Yes, vanillin. It's the chemical responsible for the scent in vanilla — and one of the most widely used flavor in foods, including ice cream and cookies.

**Q: How do chemists create flavors in a lab?**

A: We use special equipment to trap odors to learn which chemical is responsible for which smell. Remember, taste is 90 percent smell. Then we recreate that smell by mixing the molecules of that chemical in a bottle. I am working on meat-free protein alternatives right now. We can create something that mimics the taste of meat using non-meat ingredients.

**Q: What are some other favorite projects you've worked on?**

A: I've worked on a plant extract that makes your mouth tingle and another that makes everything you taste after, even a sour lemon, taste sweet. Also, I've worked on alternative dairy products — especially interesting to me because I'm lactose intolerant. I've worked on soy milk to mask its harsh aftertaste.

**Q: What's a chemical you've studied that smells strange?**

A: Geosmin. It smells like earth, especially after it has rained.

**Q: Can flavorings solve problems?**

A: Yes. In the United States, oranges have recently been attacked with a fungal infection that is greatly affecting the crop and their quality. Juice from these oranges doesn't taste sweet enough. But by using molecules naturally occurring in oranges, then synthesizing them in the lab, we can make juice from poor-quality oranges have the sweetness and taste we are used to. We call these "nature identical," meaning we make in the lab what nature makes in the natural world.

We also have a new technology that can convert fresh produce (which may be farm waste) into powders that retain color, taste and nutrients. For example, we can make a strawberry powder that can be added to smoothies using berries that would otherwise be wasted. We can thus prevent waste and provide nutritious solutions.

**Q: What's new in the flavor world?**

A: The sit-down lunch and breakfast have been replaced by smoothies and protein bars. Natural offerings have increased significantly to meet customer demands.

Also, flavors have gone global because more people are traveling internationally. We eat something far from home and then want it in our grocery stores.

**Q: So chemists like you try to make those flavors. Could you possibly make a type of pepper that won't make us sneeze?**

A: It's possible! Piperine is the active component in pepper that makes us sneeze.

**Q: What's the long-term goal for your work?**

A: My goal is to continue to make products that are tasty, healthy, nutritious and better for the planet.

## Quiz

1 Read the following selection from the article.

*Embracing chemistry helps us appreciate our amazing world and not fear it. I wanted to be a chemist to solve problems. My specialty, toxicology, helps create a safe world. Arguably, toxicology is the oldest scientific discipline, as the earliest humans had to recognize which plants were safe to eat.*

What conclusion is BEST supported by the paragraph above?

- (A) The study of toxicology has not significantly changed throughout human history.
- (B) Toxicology is primarily the study of which plants are safe for human consumption.
- (C) People who study toxicology learn what food is safe by studying early humans.
- (D) Some understanding of toxicology has always been necessary for human survival.

2 Which sentence from the article BEST explains how the flavor world is responding to changes in how we eat today?

- (A) I've worked on a plant extract that makes your mouth tingle and another that makes everything you taste after, even a sour lemon, taste sweet.
- (B) We call these "nature identical," meaning we make in the lab what nature makes in the natural world.
- (C) Natural offerings have increased significantly to meet customer demands.
- (D) My goal is to continue to make products that are tasty, healthy, nutritious and better for the planet.

3 How did Uma Parasar affect the production of orange juice?

- (A) She created a cure for a fungal infection that affected the orange crop.
- (B) She invented a natural substitute for orange juice that can be synthesized in a lab.
- (C) She determined that oranges could be made into a powder for use in smoothies.
- (D) She ensured that poor-quality oranges could still be used to make flavorful juice.

4 Which of the following MOST influences a person's sense of taste?

- (A) the tingling sensation caused by food
- (B) the smell that is emitted by food
- (C) the overall sweetness of a food
- (D) the amount of vanillin in food

# Dream Jobs: Particle physicist

By Alexa Kurzius on 03.11.20

Word Count **857**

Level **MAX**



Scientist Jessica Esquivel stands in front of a giant electromagnet that she uses in her daily work studying very small particles that are in the universe. Photo by: Reidar Hahn/Fermilab

Most workdays, Jessica Esquivel searches for a tiny, pesky particle that is nearly impossible to observe. She and other scientists are using this particle to learn about new, undiscovered physics. Known as a muon, it's like an electron, but it's about 200 times more massive and much more elusive. "I can't look at it under a microscope and see what it looks like," she says.

Instead, she relies on a giant circular electromagnet 50 feet in diameter that shoots particles at nearly the speed of light. An electromagnet is a type of magnet in which the magnetic field is generated by an electric current. The hope is that this electromagnet — also known as a particle storage ring — at Fermilab in Batavia, Illinois, will teach physicists more about muons and how they behave in the universe.

## Studying Physics

Physics is the study of the nature and properties of energy and matter. Particle physicists, like Esquivel, focus on the tiny, subatomic particles that are smaller than an atom, such as electrons and muons. These particles, along with others like quarks and neutrinos, make up our universe.

but very little is known about most of them because they pop into and out of existence for very brief moments. "There are no answers to the questions we are asking," Esquivel says. And often, a new discovery leads to many more questions than answers.

Today, Esquivel is comfortable with a profession full of tough questions and uncertainty. But it wasn't always that way. Growing up in McAllen, Texas, Esquivel was fascinated by outer space. She loved watching science fiction movies with her aunt and attending math and science summer camps. Later, she went to specialized middle and high schools for science. And though she was often one of few Afrolatinx women in these environments (Esquivel is black and Mexican), it didn't affect her as much because she could identify with other groups in her Latino community.

That changed when she went off to college and graduate school. As an applied physics and electrical engineering major, Esquivel was often one of a few women in her college classes at St. Mary's University in San Antonio, Texas. When she got to graduate school, she was the only Afrolatinx, the only lesbian and practically the only woman in the physics department at Syracuse University in Syracuse, New York. "I had persistent feelings of not belonging," she says.

Though she struggled, she learned she was not alone in wanting more diverse representation in science. Her family, teachers and mentors encouraged her along the way. She especially credits her undergraduate physics professor, Richard Cardenas, who was recognized by President Obama for advocating underrepresented groups to pursue science. "If it weren't for him, I wouldn't be where I am today," she says.

This mentorship continued during her graduate studies, with some professors helping her stick with her studies when she wanted to quit. Ultimately, she stuck with her passion for physics and received her Ph.D. in 2018. She began working at Fermilab full-time soon after. "It just goes to show the importance of having good mentors," she says.

### **How National Labs Help Support Scientific Discovery**

National labs like Fermilab are instrumental in helping scientists conduct basic research, which aims to increase our knowledge and understanding of the world around us. Basic research is different from applied research, which uses scientific discovery to solve a particular problem.

During World War II, the U.S. government funded a lot of scientific research related to radar, telecommunications and atomic energy. This led to many advances in these fields, as well as others. National labs were created following World War II to build on this success, enable scientists to continue their research, and provide the highly technical, expensive equipment for use in ongoing research.

Today, there are 17 Department of Energy national labs nationwide. Scientists from around the world can visit the labs and conduct basic and applied research projects there. Fermilab, located 40 miles outside of Chicago, Illinois, focuses entirely on particle physics and related fields. The large experiment that Esquivel works on for her research is just one of many at the lab.

For the muon experiment, Esquivel collaborates with a team of scientists. They shoot muons into the particle storage ring. Then they watch for collisions between the muons and virtual particles that pop in and out of existence in the storage ring. Normally, muons spin like a top, though this spinning action changes when they collide with another subatomic particle. The team uses precise measurement tools, such as electromagnetic probes and calorimeters, to measure the magnetic

field and the energies of the muons. This is so they can see into what these collisions look like. It requires massive amounts of data from these collisions to interpret their observations precisely.

There are still so many things that scientists don't know about subatomic particles. But for now, Esquivel is excited to continue her work on them. "Everything around us is made from these fundamental building blocks," she says. Learning more about them "helps us understand how atoms interact with each other and how galaxies form," she says.

## Quiz

- 1 Which of the following would BEST describe Jessica Esquivel's reaction to working with muons?
- (A) She thinks it is boring work because she rather be studying electrons using circular electromagnets.
  - (B) She thinks it is exciting work because she loves studying subatomic particles under the microscope.
  - (C) She thinks it is frustrating work because very little is known about muons and it makes experiments seem pointless.
  - (D) She thinks it is interesting work and is enthusiastic about learning more about muons' role in the formation of galaxies.
- 2 Which of the following BEST explains how Jessica Esquivel interacted with Richard Cardenas?
- (A) Esquivel and Cardenas worked together to bring more diverse representation to Syracuse University.
  - (B) Esquivel and Cardenas worked together on the experiment that studied the effects of virtual particles on muons.
  - (C) Esquivel was encouraged by Cardenas to continue her physics studies despite feeling like an outsider in the physics department.
  - (D) Esquivel was the main reason why Cardenas was honored by President Obama for his work with underrepresented groups in science.
- 3 A reader of the article suggested that the author included the section "Studying Physics" to describe the work Esquivel does today.
- Is this a reasonable claim? Which selection from the article BEST supports your answer?
- (A) Yes; "Particle physicists, like Esquivel, focus on the tiny, subatomic particles that are smaller than an atom, such as electrons and muons."
  - (B) Yes; "'There are no answers to the questions we are asking,' Esquivel says. And often, a new discovery leads to many more questions than answers."
  - (C) No; "Today, Esquivel is comfortable with a profession full of tough questions and uncertainty. But it wasn't always that way."
  - (D) No.; "Growing up in McAllen, Texas, Esquivel was fascinated by outer space. She loved watching science fiction movies with her aunt and attending math and science summer camps."
- 4 Read the following paragraph from the Introduction [paragraphs 1-2].

*Instead, she relies on a giant circular electromagnet 50 feet in diameter that shoots particles at nearly the speed of light. An electromagnet is a type of magnet in which the magnetic field is generated by an electric current. The hope is that this electromagnet — also known as a particle storage ring — at Fermilab in Batavia, Illinois, will teach physicists more about muons and how they behave in the universe.*

What is the MAIN reason why the author includes this paragraph in the article?

- (A) It describes how Fermilab formed and why it is important.
- (B) It describes the experiment that Esquivel is working on at Fermilab.
- (C) It explains why Esquivel first got interested in particle physics.
- (D) It explains why Esquivel felt that she did not belong to her physics program.

# Dream Jobs: Doctor and researcher

By Alexa Kurzius on 04.07.20

Word Count **1,116**

Level **MAX**



Image 1. Russell Joseph Ledet is earning his medical degree and business degree at Tulane University in New Orleans, Louisiana. Ledet wants to focus on child and adolescent psychiatry so that he can help children in his community. Photo: NYU School of Medicine

When Russell Joseph Ledet and a group of black medical students visited a plantation museum, he knew the trip would make a big impact. Fifteen students from Tulane University stood in short white coats in front of what used to be the slave quarters of the Whitney Plantation. Today, it is a museum in Edgard, Louisiana. They took photos and shared them on Twitter, getting more than 88,000 views and 21,000 retweets. "We are truly our ancestors' wildest dreams," wrote his classmate Sydney Labat on Twitter.

You might say Ledet himself is his own wildest dream, choosing a career in medicine and scientific research when he never even thought he was smart enough to go to college. After serving in the U.S. Navy for almost 10 years, he completed an undergraduate degree in chemistry and biology and a Ph.D. in molecular oncology.

Now, he is earning his medical degree and business degree at Tulane University in New Orleans, Louisiana. And though the focus of his studies has changed throughout the years, his passion for science and helping people has remained constant. "I want to help my community through science and medical research," he said.

## Background And Interest In Science

Ledet grew up in Lake Charles, Louisiana, a small city about two hours east of Houston, Texas. The city is anchored by a chemical plant that many locals, such as Ledet's uncles, worked at. Ledet and his sister were raised by a single mom who worked as a nurse's aide. "There were times when we struggled to make ends meet," he said. High school was also tumultuous due to a rocky relationship with his mother's boyfriend. His classes, at the time, were an afterthought. "I didn't think college was an option," he said.



Ledet finished high school a year early instead and enlisted in the Navy, where he could get a steady paycheck and a nice place to live. After boot camp, the Navy relocated him to Washington, D.C., and later Pensacola, Florida, where he trained in cryptology. This is the study of coded messages or secure communication. It has real-life applications today with transmitting electronic data and information.

All service members and veterans of the armed forces can get tuition assistance for college or trade schools through the GI Bill. Signed into law by President Franklin D. Roosevelt in 1944, the GI Bill was created to provide education, loan, and unemployment benefits to help service members and veterans in their civilian lives. In Ledet's case, his wife, Mallory Alise convinced him to go to college on the GI Bill, telling him that he was smart enough to do so. Ledet began studying social work at Southern University and A&M College in Baton Rouge, Louisiana, but soon transitioned to a dual chemistry and biology major after taking an introductory class and getting encouragement from his professor. "I loved everything about chemistry," he said. "It just made sense to me."

Later, another professor encouraged him to apply for summer research positions, which are like internships but for scientific research careers. Students help conduct experiments in government, university and industry labs. In the summers between college classes, Ledet worked at Louisiana State University and Merck Pharmaceuticals in Boston, Massachusetts.

From these experiences, Ledet learned how much he loved the research process, which includes asking questions, conducting experiments and analyzing data to answer a scientific question. He applied and got into a doctorate (Ph.D.) program at New York University in New York City. Ledet studied oncology, or the study of cancer. Specifically, he studied molecular oncology, which combines chemistry with the study of cancer at the genetic level. He ended up in a lab studying prostate cancer, the most commonly diagnosed cancer in black men. His research was funded by the Ford Foundation and the Howard Hughes Medical Institute. "I wanted to study the things that might affect me or someone like me in my lifetime," he said.

During his Ph.D. studies, he met other black scientists who could identify with his experiences. Marcus Lambert, a dean at Weill Cornell Medical College and a researcher in educational and health equity, served as a mentor. Phillip Thomas, a Ph.D. student in pharmacology, or the study of medicines, was his close friend.

This was important, given that only about 2,200 black or African American students earn their Ph.D. each year, and less than 6 percent of full-time faculty at colleges and institutions are black.

"At times I felt like I didn't fit the mold," Ledet said. "I looked different and talked differently from those around me," he said. Having mentors and friends that "just understood me and my culture was really meaningful," he said.

### Looking Ahead

Ledet received his Ph.D. in 2018. Yet, he wanted to influence his community not just with scientific research, but medicine too. So Ledet decided to go to medical school. He chose Tulane University in New Orleans, Louisiana, because of its similarity to his community growing up and the support he received from a local church that he now attends. Later, he learned that he received a full scholarship.

With his medical degree, Ledet wants to focus on child and adolescent psychiatry so that he can help children who struggled like he did as a youth. "I know I am not the only one who went through tumultuous stuff," he said. He hopes to connect his Ph.D. studies to investigate the prevalence of mood and behavior disorders in minority communities.

Ledet acknowledges that he had a difficult journey to get to where he is today. Part of it he attributes to a socio-economic disparity that many people of color experience. "Growing up, I didn't have access to professional mentors who could steer me in the right direction," he said. But he made up for it by being curious and asking questions of everyone he met and admired as an adult. This led him to try a variety of career paths, and it ultimately led him to pursue the scientific career he has today. "Curiosity is the first sign that you love science," he said.

Though it might seem insurmountable, Ledet is confident that people of all backgrounds can pursue scientific careers. "Dare to be what you doubt you can be," he said. "It worked for me."



## Quiz

1 Read the following sentence from the Introduction [paragraphs 1-3].

*"I want to help my community through science and medical research," he said.*

Which answer choice BEST supports the idea that Russell Joseph Ledet plans to use his work to improve the lives of people with experiences similar to his?

- (A) You might say Ledet himself is his own wildest dream, choosing a career in medicine and scientific research when he never even thought he was smart enough to go to college. After serving in the U.S. Navy for almost 10 years, he completed an undergraduate degree in chemistry and biology and a Ph.D. in molecular oncology.
- (B) After boot camp, the Navy relocated him to Washington, D.C., and later Pensacola, Florida, where he trained in cryptology. This is the study of coded messages or secure communication. It has real-life applications today with transmitting electronic data and information.
- (C) He applied and got into a Ph.D. program at New York University in New York City. Ledet studied oncology, or the study of cancer. Specifically, he studied molecular oncology, which combines chemistry with the study of cancer at the genetic level.
- (D) With his medical degree, Ledet wants to focus on child and adolescent psychiatry so that he can help children who struggled like he did as a youth. "I know I am not the only one who went through tumultuous stuff," he said.

2 Read the following sentences from the article.

1. *Ledet and his sister were raised by a single mom who worked as a nurse's aide.*
2. *In Ledet's case, his wife, Mallory Alise convinced him to go to college on the GI Bill, telling him that he was smart enough to do so.*
3. *Ledet began studying social work at Southern University and A&M College in Baton Rouge, Louisiana, but soon transitioned to a dual chemistry and biology major after taking an introductory class and getting encouragement from his professor.*
4. *He chose Tulane University in New Orleans, Louisiana, because of its similarity to his community growing up and the support he received from a local church that he now attends.*

Which two sentences taken together provide the BEST evidence to support the idea that motivation provided by those around Ledet helped to change the course of his career?

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

3 Which of the following BEST explains how the information about photos of Ledet and other students at the Whitney Plantation interacts with the statistics about black and African American students earning their Ph.D. each year?

- (A) The information about the photos introduces the significance of Ledet's achievements, and the statistics further develop and support this idea.
- (B) The information about the photos introduces the difficulty of earning a college degree, and the statistics contrast and contradict this idea.
- (C) The information about the photos categorizes Ledet as a chemistry student, and the statistics highlight his skill in a different category of study.
- (D) The information about the photos categorizes Tulane University as a top medical school, and the statistics elaborate on its value for students.

- 4 Which of the following would BEST describe Ledet's reaction to his academic success?
- (A) Ledet wishes that he could have spent more of his academic career focused on psychiatry.
  - (B) Ledet feels thankful that he was able to train in cryptology while also serving in the Navy.
  - (C) Ledet believes it shows that anyone can overcome hardship with curiosity and hard work.
  - (D) Ledet understands that starting with a Ph.D. makes getting a medical degree much easier.

# Government and Economics

# Principles of economics: Demand and supply at work in labor markets

By Rice University on 09.12.19

Word Count 3,282

Level MAX



Image 1. A cashier in a grocery store. Photo by: SDI/Getty Images

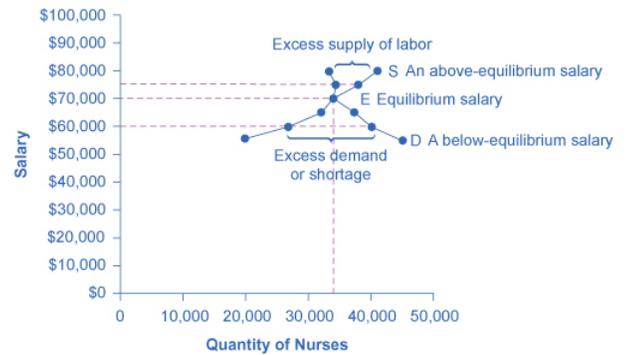
Markets for labor have demand and supply curves, just like markets for goods. The law of demand applies in labor markets this way: A higher salary or wage — that is, a higher price in the labor market — leads to a decrease in the quantity of labor demanded by employers, while a lower salary or wage leads to an increase in the quantity of labor demanded. The law of supply functions in labor markets, too: A higher price for labor leads to a higher quantity of labor supplied; a lower price leads to a lower quantity supplied.

## Equilibrium In The Labor Market

In 2013, about 34,000 registered nurses worked in the Minneapolis-St. Paul-Bloomington, Minnesota-Wisconsin metropolitan area, according to the U.S. Bureau of Labor Statistics (BLS). They worked for a variety of employers: hospitals, doctors' offices, schools, health clinics, and nursing homes. Image 2 illustrates how demand and supply determine equilibrium in this labor market. The demand and supply schedules in Table 1 list the quantity supplied and quantity demanded of nurses at different salaries.

The

Annual Salary	Quantity Demanded	Quantity Supplied
\$55,000	45,000	20,000
\$60,000	40,000	27,000
\$65,000	37,000	31,000
\$70,000	34,000	34,000
\$75,000	33,000	38,000
\$80,000	32,000	41,000



horizontal axis shows the quantity of nurses hired. In this example, labor is measured by number of workers, but another common way to measure the quantity of labor is by the number of hours worked.

The vertical axis shows the price for nurses' labor — that is, how much they are paid. In the real world, this "price" would be total labor compensation: salary plus benefits. It is not obvious, but benefits are a significant part (as high as 30 percent) of labor compensation. In this example, the price of labor is measured by salary on an annual basis, although in other cases the price of labor could be measured by monthly or weekly pay, or even the wage paid per hour. As the salary for nurses rises, the quantity demanded will fall. Some hospitals and nursing homes may cut back on the number of nurses they hire, or they may lay off some of their existing nurses, rather than pay them higher salaries. Employers who face higher nurses' salaries may also try to replace some nursing functions by investing in physical equipment, like computer monitoring and diagnostic systems to monitor patients, or by using lower-paid health care aides to reduce the number of nurses they need.

As the salary for nurses rises, the quantity supplied will rise. If nurses' salaries in Minneapolis-St. Paul-Bloomington are higher than in other cities, more nurses will move to Minneapolis-St. Paul-Bloomington to find jobs, more people will be willing to train as nurses, and those currently trained as nurses will be more likely to pursue nursing as a full-time job. In other words, there will be more nurses looking for jobs in the area.

At equilibrium, the quantity supplied and the quantity demanded are equal. Thus, every employer who wants to hire a nurse at this equilibrium wage can find a willing worker, and every nurse who wants to work at this equilibrium salary can find a job. In Image 2, the supply curve (S) and demand curve (D) intersect at the equilibrium point (E). The equilibrium quantity of nurses in the Minneapolis-St. Paul-Bloomington area is 34,000, and the equilibrium salary is \$70,000 per year. This example simplifies the nursing market by focusing on the "average" nurse. In reality, of course, the market for nurses is actually made up of many smaller markets, like markets for nurses with varying degrees of experience and credentials. Many markets contain closely related products that differ in quality; for instance, even a simple product like gasoline comes in regular, premium, and super-premium, each with a different price. Even in such cases, discussing the average price of gasoline, like the average salary for nurses, can still be useful because it reflects what is happening in most of the submarkets.

When the price of labor is not at the equilibrium, economic incentives tend to move salaries toward the equilibrium. For example, if salaries for nurses in Minneapolis-St. Paul-Bloomington were above the equilibrium at \$75,000 per year, then 38,000 people want to work as nurses, but employers want to hire only 33,000 nurses. At that above-equilibrium salary, excess supply or a surplus results. In a situation of excess supply in the labor market, with many applicants for every job opening, employers will have an incentive to offer lower wages than they otherwise would have. Nurses' salary will move down toward equilibrium.

In contrast, if the salary is below the equilibrium at, say, \$60,000 per year, then a situation of excess demand or a shortage arises. In this case, employers encouraged by the relatively lower wage want to hire 40,000 nurses, but only 27,000 individuals want to work as nurses at that salary in Minneapolis-St. Paul-Bloomington. In response to the shortage, some employers will offer higher pay to attract the nurses. Other employers will have to match the higher pay to keep their own employees. The higher salaries will encourage more nurses to train or work in Minneapolis-St. Paul-Bloomington. Again, price and quantity in the labor market will move toward equilibrium.

### **Shifts In Labor Demand**

The demand curve for labor shows the quantity of labor employers wish to hire at any given salary or wage rate, under the *ceteris paribus* assumption. A change in the wage or salary will result in a change in the quantity demanded of labor. If the wage rate increases, employers will want to hire fewer employees. The quantity of labor demanded will decrease, and there will be a movement upward along the demand curve. If the wages and salaries decrease, employers are more likely to hire a greater number of workers. The quantity of labor demanded will increase, resulting in a downward movement along the demand curve.

Shifts in the demand curve for labor occur for many reasons. One key reason is that the demand for labor is based on the demand for the good or service that is being produced. For example, the more new automobiles consumers demand, the greater the number of workers automakers will need to hire. Therefore, the demand for labor is called a "derived demand." Here are some examples of derived demand for labor:

- The demand for chefs is dependent on the demand for restaurant meals.
- The demand for pharmacists is dependent on the demand for prescription drugs.
- The demand for attorneys is dependent on the demand for legal services.

As the demand for the goods and services increases, the demand for labor will increase, or shift to the right, to meet employers' production requirements. As the demand for the goods and services decreases, the demand for labor will decrease, or shift to the left. Table 2 shows that in addition to the derived demand for labor, demand can also increase or decrease (shift) in response to several factors.

### **Shifts In Labor Supply**

The supply of labor is upward-sloping and adheres to the law of supply: The higher the price, the greater the quantity supplied and the lower the price, the less quantity supplied. The supply curve models the trade-off between supplying labor into the market or using time in leisure activities at every given price level. The higher the wage, the more labor is willing to work and forego leisure activities. Table 3 lists some of the factors that will cause the supply to increase or decrease.

A change in salary will lead to a movement along labor demand or labor supply curves, but it will not shift those curves. However, other events like those outlined here will cause either the demand or the supply of labor to shift, and thus will move the labor market to a new equilibrium salary and quantity.

### **Technology And Wage Inequality: The Four-Step Process**

# Economic events can change the

Factors	Results
Number of Workers	An increased number of workers will cause the supply curve to shift to the right. An increased number of workers can be due to several factors, such as immigration, increasing population, an aging population, and changing demographics. Policies that encourage immigration will increase the supply of labor, and vice versa. Population grows when birth rates exceed death rates; this eventually increases supply of labor when the former reach working age. An aging and therefore retiring population will decrease the supply of labor. Another example of changing demographics is more women working outside of the home, which increases the supply of labor.
Required Education	The more required education, the lower the supply. There is a lower supply of PhD mathematicians than of high school mathematics teachers; there is a lower supply of cardiologists than of primary care physicians; and there is a lower supply of physicians than of nurses.
Government Policies	Government policies can also affect the supply of labor for jobs. On the one hand, the government may support rules that set high qualifications for certain jobs: academic training, certificates or licenses, or experience. When these qualifications are made tougher, the number of qualified workers will decrease at any given wage. On the other hand, the government may also subsidize training or even reduce the required level of qualifications. For example, government might offer subsidies for nursing schools or nursing students. Such provisions would shift the supply curve of nurses to the right. In addition, government policies that change the relative desirability of working versus not working also affect the labor supply. These include unemployment benefits, maternity leave, child care benefits and welfare policy. For example, child care benefits may increase the labor supply of working mothers. Long term unemployment benefits may discourage job searching for unemployed workers. All these policies must therefore be carefully designed to minimize any negative labor supply effects.

Factors	Results
Demand for Output	When the demand for the good produced (output) increases, both the output price and profitability increase. As a result, producers demand more labor to ramp up production.
Education and Training	A well-trained and educated workforce causes an increase in the demand for that labor by employers. Increased levels of productivity within the workforce will cause the demand for labor to shift to the right. If the workforce is not well-trained or educated, employers will not hire from within that labor pool, since they will need to spend a significant amount of time and money training that workforce. Demand for such will shift to the left.
Technology	Technology changes can act as either substitutes for or complements to labor. When technology acts as a substitute, it replaces the need for the number of workers an employer needs to hire. For example, word processing decreased the number of typists needed in the workplace. This shifted the demand curve for typists left. An increase in the availability of certain technologies may increase the demand for labor. Technology that acts as a complement to labor will increase the demand for certain types of labor, resulting in a rightward shift of the demand curve. For example, the increased use of word processing and other software has increased the demand for information technology professionals who can resolve software and hardware issues related to a firm's network. More and better technology will increase demand for skilled workers who know how to use technology to enhance workplace productivity. Those workers who do not adapt to changes in technology will experience a decrease in demand.
Number of Companies	An increase in the number of companies producing a given product will increase the demand for labor resulting in a shift to the right. A decrease in the number of companies producing a given product will decrease the demand for labor resulting in a shift to the left.
Government Regulations	Complying with government regulations can increase or decrease the demand for labor at any given wage. In the healthcare industry, government rules may require that nurses be hired to carry out certain medical procedures. This will increase the demand for nurses. Less-trained healthcare workers would be prohibited from carrying out these procedures, and the demand for these workers will shift to the left.
Price and Availability of Other Inputs	Labor is not the only input into the production process. For example, a salesperson at a call center needs a telephone and a computer terminal to enter data and record sales. The demand for salespersons at the call center will increase if the number of telephones and computer terminals available increases. This will cause a rightward shift of the demand curve. As the amount of inputs increases, the demand for labor will increase. If the terminal or the telephones malfunction, then the demand for that labor force will decrease. As the quantity of other inputs decreases, the demand for labor will decrease. Similarly, if prices of other inputs fall, production will become more profitable and suppliers will demand more labor to increase production. The opposite is also true. Higher input prices lower demand for labor.

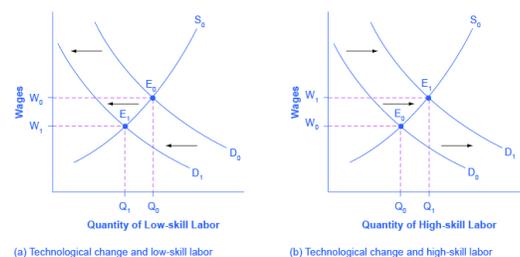
equilibrium salary (or wage) and quantity of labor. Consider how the wave of new information technologies, like computer and telecommunications networks, has affected low-skill and high-skill workers in the U.S. economy. From the perspective of

employers who demand labor, these new technologies are often a substitute for low-skill laborers like file clerks, who used to keep file cabinets full of paper records of transactions. However, the same new technologies are a complement to high-skill workers like managers, who benefit from the technological advances by being able to monitor more information, communicate more easily, and juggle a wider array of responsibilities. So, how will the new technologies affect the wages of high-skill and low-skill workers? For this question, the four-step process of analyzing how shifts in supply or demand affect a market (introduced in Demand and Supply) works in this way:

**Step 1.** What did the markets for low-skill labor and high-skill labor look like before the arrival of the new technologies? In Image 3 (a) and Image 3 (b),  $S_0$  is the original supply curve for labor and  $D_0$  is the original demand curve for labor in each market. In each graph, the original point of equilibrium,  $E_0$ , occurs at the price  $W_0$  and the quantity  $Q_0$ .

**Step 2.** Does the new technology affect the supply of labor from households or the demand for labor from firms? The technology change described here affects demand for labor by firms that hire workers.

**Step 3.** Will the new technology increase or decrease demand? Based on the description earlier, as the substitute for low-skill labor becomes available, demand for low-skill labor will shift to the left, from  $D_0$  to  $D_1$ . As the technology complement for high-skill labor becomes cheaper, demand for high-skill labor will shift to the right, from  $D_0$  to  $D_1$ .



**Step 4.** The new equilibrium for low-skill labor, shown as point  $E_1$  with price  $W_1$  and quantity  $Q_1$ , has a lower wage and quantity hired than the original equilibrium,  $E_0$ . The new equilibrium for high-skill labor, shown as point  $E_1$  with price  $W_1$  and quantity  $Q_1$ , has a higher wage and quantity hired than the original equilibrium ( $E_0$ ).

So, the demand and supply model predicts that the new computer and communications technologies will raise the pay of high-skill workers, but reduce the pay of low-skill workers. Indeed, from the 1970s to the mid-2000s, the wage gap widened between high-skill and low-skill

labor. According to the National Center for Education Statistics, in 1980, for example, a college graduate earned about 30 percent more than a high school graduate with comparable job experience, but by 2012, a college graduate earned about 60 percent more than an otherwise comparable high school graduate. Many economists believe that the trend toward greater wage inequality across the U.S. economy was primarily caused by the new technologies.

### **Price Floors In Labor Market: Living Wages, Minimum Wages**

In contrast to goods and services markets, price ceilings are rare in labor markets, because rules that prevent people from earning income are not politically popular. There is one exception: sometimes limits are proposed on the high incomes of top business executives.

The labor market, however, presents some prominent examples of price floors, which are often used as an attempt to increase the wages of low-paid workers. The U.S. government sets a minimum wage, a price floor that makes it illegal for an employer to pay employees less than a certain hourly rate. In mid-2009, the U.S. minimum wage was raised to \$7.25 per hour. Local political movements in a number of U.S. cities have pushed for a higher minimum wage, which they call a living wage. Promoters of living wage laws maintain that the minimum wage is too low to ensure a reasonable standard of living. They base this conclusion on the calculation that, if you work 40 hours a week at a minimum wage of \$7.25 per hour for 50 weeks a year, your annual income is \$14,500, which is less than the official U.S. government definition of what it means for a family to be in poverty. (A family with two adults earning minimum wage and two young children will find it more cost efficient for one parent to provide child care while the other works for income. So the family income would be \$14,500, which is significantly lower than the federal poverty line for a family of four, which was \$23,850 in 2014.)

Supporters of the living wage argue that full-time workers should be assured a high enough wage so that they can afford the essentials of life: food, clothing, shelter, and health care. Since Baltimore passed the first living wage law in 1994, several dozen cities enacted similar laws in the late 1990s and the 2000s. The living wage ordinances do not apply to all employers, but they have specified that all employees of the city or employees of firms that are hired by the city be paid at least a certain wage that is usually a few dollars per hour above the U.S. minimum wage.

Image 4 illustrates the situation of a city considering a living wage law. For simplicity, we assume that there is no federal minimum wage. The wage appears on the vertical axis, because the wage is the price in the labor market. Before the passage of the living wage law, the equilibrium wage is \$10 per hour and the city hires 1,200 workers at this wage. However, a group of concerned citizens persuades the city council to enact a living wage law requiring employers to pay no less than \$12 per hour. In response to the higher wage, 1,600 workers look for jobs with the city. At this higher wage, the city, as an employer, is willing to hire only 700 workers. At the price floor, the quantity supplied exceeds the quantity demanded, and a surplus of labor exists in this market. For workers who continue to have a job at a higher salary, life has improved. For those who were willing to work at the old wage rate but lost their jobs with the wage increase, life has not improved. Table 4 shows the differences in supply and demand at different wages.

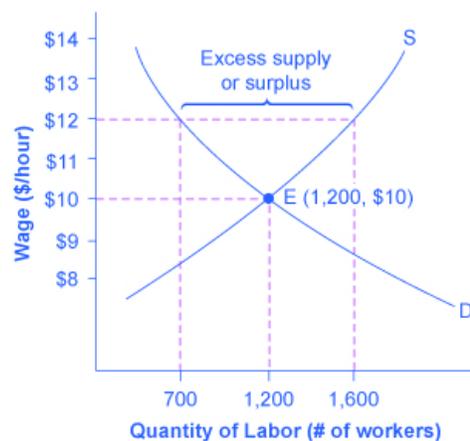
### **The Minimum Wage As An Example Of A Price Floor**

The U.S. minimum wage is a price floor that is set either very close to the equilibrium wage or even slightly below it. About 1 percent of American workers are actually paid the minimum wage. In

other words, the vast majority of the U.S. labor force has

Wage	Quantity Labor Demanded	Quantity Labor Supplied
\$8/hr	1,900	500
\$9/hr	1,500	900
\$10/hr	1,200	1,200
\$11/hr	900	1,400
\$12/hr	700	1,600
\$13/hr	500	1,800
\$14/hr	400	1,900

its wages determined in the labor market, not as a result of the government price floor. But for workers with low skills and little experience, like those without a high school diploma or teenagers, the minimum wage is quite important. In many cities, the federal minimum wage is apparently below the market price for unskilled labor, because employers offer more than the minimum wage to checkout clerks and other low-skill workers without any government prodding.



Economists have attempted to estimate how much the minimum wage reduces the quantity demanded of low-skill labor. A typical result of such studies is that a 10 percent increase in the minimum wage would decrease the hiring of unskilled workers by 1 to 2 percent, which seems a relatively small reduction. In fact, some studies have even found no effect of a higher minimum wage on employment at certain times and places — although these studies are controversial.

Let's suppose that the minimum wage lies just slightly below the equilibrium wage level. Wages could fluctuate according to market forces above this price floor, but they would not be allowed to move beneath the floor. In this situation, the price floor minimum wage is said to be nonbinding — that is, the price floor is not determining the market outcome. Even if the minimum wage moves just a little higher, it will still have no effect on the quantity of employment in the economy, as long as it remains below the equilibrium wage. Even if the minimum wage is increased by enough so that it rises slightly above the equilibrium wage and becomes binding, there will be only a small excess supply gap between the quantity demanded and quantity supplied.

These insights help to explain why U.S. minimum wage laws have historically had only a small impact on employment. Since the minimum wage has typically been set close to the equilibrium wage for low-skill labor and sometimes even below it, it has not had a large effect in creating an excess supply of labor. However, if the minimum wage were increased dramatically — say, if it were doubled to match the living wages that some U.S. cities have considered — then its impact on reducing the quantity demanded of employment would be far greater.

### Key Concepts And Summary

In the labor market, households are on the supply side of the market and firms are on the demand side. In the market for financial capital, households and firms can be on either side of the market: they are suppliers of financial capital when they save or make financial investments, and demanders of financial capital when they borrow or receive financial investments.

In the demand and supply analysis of labor markets, the price can be measured by the annual salary or hourly wage received. The quantity of labor can be measured in various ways, like number of workers or the number of hours worked.

Factors that can shift the demand curve for labor include: a change in the quantity demanded of the product that the labor produces; a change in the production process that uses more or less labor; and a change in government policy that affects the quantity of labor that firms wish to hire at a given wage. Demand can also increase or decrease (shift) in response to: workers' level of education and training, technology, the number of companies, and availability and price of other inputs.

The main factors that can shift the supply curve for labor are: how desirable a job appears to workers relative to the alternatives, government policy that either restricts or encourages the quantity of workers trained for the job, the number of workers in the economy, and required education.

## Quiz

- 1 The author creates a thoughtful tone.  
How does this tone help the author to achieve his or her purpose in writing?
- (A) It allows the author to trace specific changes in the labor market over time in response to the introduction of new technology.
  - (B) It allows the author to reflect upon the problems that individuals and employers face during the hiring process.
  - (C) It allows the author to consider several different scenarios in which various aspects of the labor market would fluctuate.
  - (D) It allows the author to analyze the ideas of several different economists and convey that information clearly to the reader.
- 2 Read the following sentence from the section "Equilibrium In The Labor Market."
- Image 2 illustrates how demand and supply determine equilibrium in this labor market.*
- Which sentence from the article BEST emphasizes what the author means by "equilibrium"?
- (A) At equilibrium, the quantity supplied and the quantity demanded are equal.
  - (B) When the price of labor is not at the equilibrium, economic incentives tend to move salaries toward the equilibrium.
  - (C) At that above-equilibrium salary, excess supply or a surplus results.
  - (D) Again, price and quantity in the labor market will move toward equilibrium.
- 3 How do the graphics enhance the reader's understanding of supply and demand in labor markets beyond what the article offers?
- (A) They reveal the effects of U.S. minimum wage laws on employment in different sectors.
  - (B) They pinpoint which types of technology most affected demand for low-skill labor in the workplace.
  - (C) They provide an in-depth analysis of nurses' salaries in different areas as well as demand for nurses.
  - (D) They illustrate how quantity of labor supplied is directly correlated to wages offered.
- 4 Which images included in the article BEST depict the idea that regulations and requirements can affect supply and demand in labor markets?
- (A) Table 1 and Table 4
  - (B) Image 1 and Image 3
  - (C) Table 2 and Table 3
  - (D) Image 2 and Image 4

# The definition and importance of the supply and demand model

By ThoughtCo.com, adapted by Newsela staff on 07.03.19

Word Count 709

Level 1020L

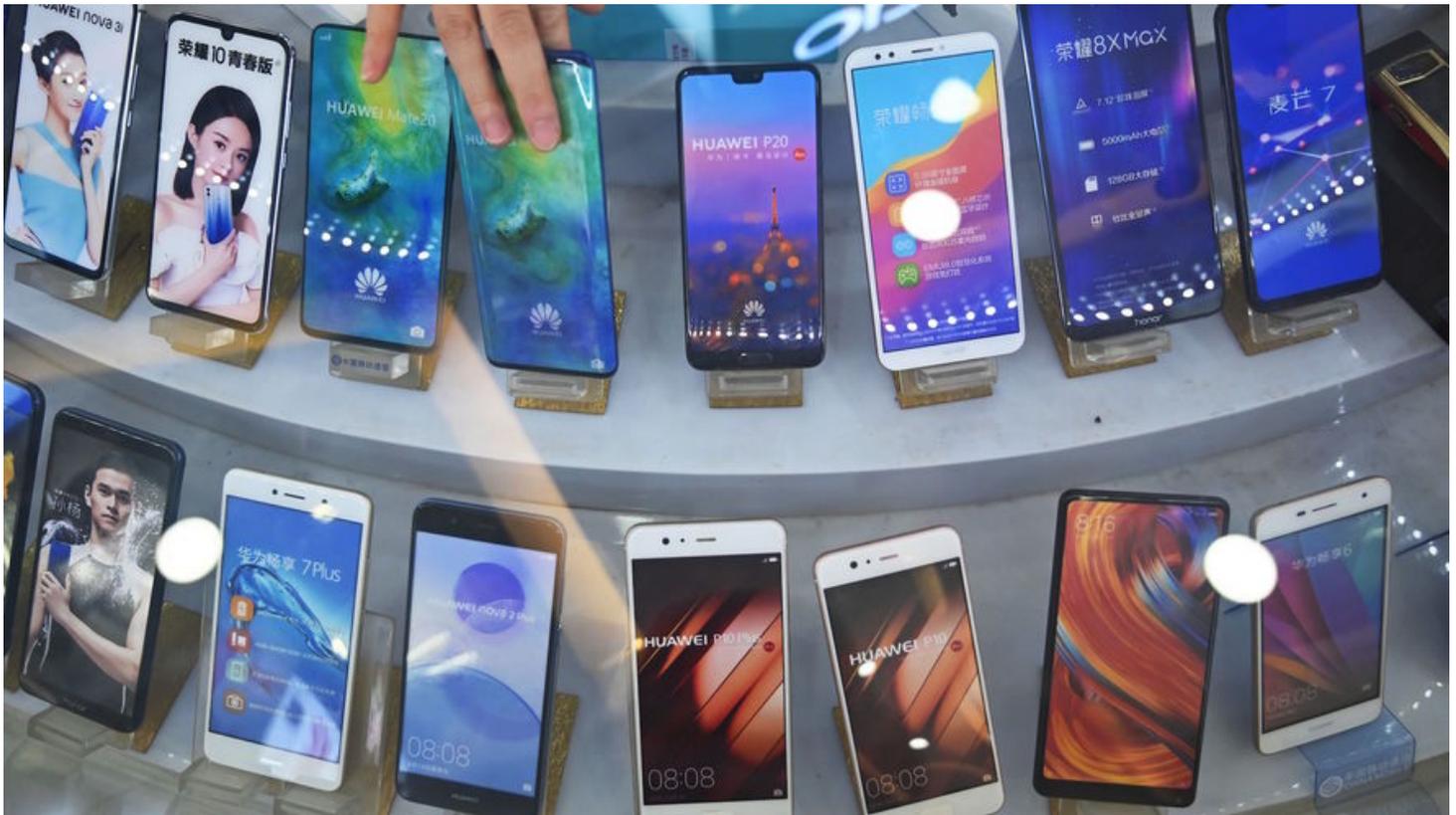


Image 1. Huawei smartphones on display at a store in Shanghai, China, May 27, 2019. Understanding supply and demand can help us make sense of markets for such items as smartphones. Photo by: Hector Retamal/AFP/Getty Images

The supply and demand model forms the basis for introductory concepts of economics. The model refers to the combination of buyers' preferences comprising the demand and sellers' preferences comprising the supply.

Together, buyers' preferences with sellers' preferences determine the market prices and product quantities in any given market. In a capitalistic society, prices are not determined by a central authority. Rather they are the result of buyers and sellers interacting in these markets. Unlike a physical market, however, buyers and sellers don't have to all be in the same place. They just have to be looking to carry out the same economic transaction.

It's important to keep in mind that prices and quantities are what comes out of the supply and demand model. They are not what goes into it. That is to say, supply and demand determine the quantities of a product that are available and at what prices. It's also important to keep in mind that the supply and demand model only applies to competitive markets. Those are markets where

there are many buyers and sellers all looking to buy and sell similar products. Markets that don't satisfy these criteria have different models that apply to them instead.

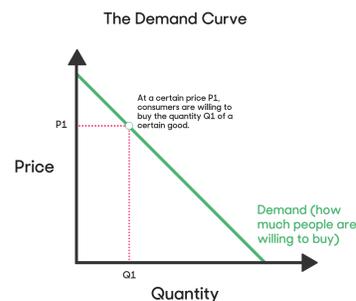
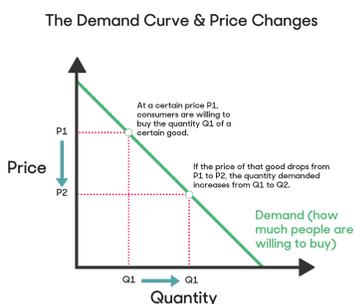
## The Law Of Supply And The Law Of Demand

The supply and demand model can be broken into two parts: the law of demand and the law of supply.

In the law of demand, the higher a supplier's price, the lower the quantity of demand for that product becomes.

The law itself states, "all else being equal, as the price of a product increases, quantity demanded falls; likewise, as the price of a product decreases, quantity demanded increases." This corresponds largely to the opportunity cost of buying more expensive items.

The

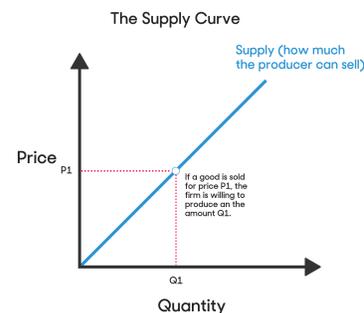
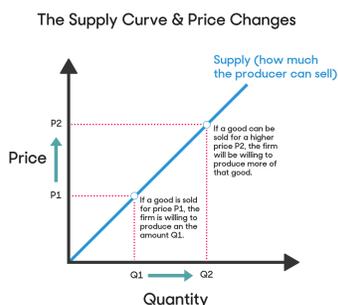


expectation is that if the buyer must give up consumption of something they value more in order to buy the more expensive product, they will likely want to buy it less.

Similarly, the law of supply corresponds to the quantities that will be sold at certain price points.

Essentially the law of supply is the converse of the law of demand. The supply model demonstrates that the higher the price of an item, the higher the quantity of that item will be available. This is because businesses want to increase their revenue. More sales at higher prices does that.

The



relationship between supply and demand relies heavily on maintaining a balance between the two. This balance is the point at which there is never more or less supply than demand in a marketplace. This point is called market equilibrium.

## Application In Modern Economics

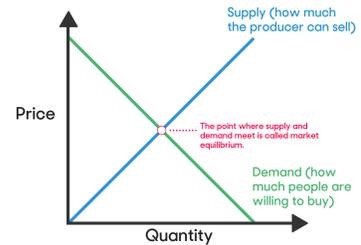
To think of supply and demand in concrete terms, take the example of a new XYZ smartphone being sold for \$300. The smartphone company is offering it at \$300 because the market analysis has shown them that consumers will not pay more for this product.

The company releases 1,000 XYZ smartphones at this price. It can't offer more XYZ smartphones, since the opportunity cost of production is too high for the demand. However, if the demand rises, sellers will raise the price. With a higher price, the smartphone company can afford to offer more XYZ smartphones. This will result in higher quantity of supply. On the other hand, if 1,000 smartphones are released, what happens if the demand at this price is only for 500 of them? The price will fall to attempt to sell the remaining 500 copies that the market no longer demands.

These concepts in the supply and demand model are essential. They provide a backbone for modern economics discussions. This is especially true as we consider capitalist societies. Without a basic understanding of this model, it is almost impossible to understand the complex world of economic theory.

*Jodi Beggs is an economist and instructor at Harvard University and runs a website called "Economists Do It With Models."*

Supply and Demand: Market Equilibrium



## Quiz

1 Read the paragraph from the section "The Law Of Supply And The Law Of Demand."

*Essentially the law of supply is the converse of the law of demand. The supply model demonstrates that the higher the price of an item, the higher the quantity of that item will be available. This is because businesses want to increase their revenue. More sales at higher prices does that.*

Which word from the paragraph helps you understand that the law of demand is the flip side of the law of supply?

- (A) essentially
- (B) converse
- (C) available
- (D) revenue

2 Read the selection from the introduction [paragraphs 1-3]

*That is to say, supply and demand determine the quantities of a product that are available and at what prices. It's also important to keep in mind that the supply and demand model only applies to competitive markets. Those are markets where there are many buyers and sellers all looking to buy and sell similar products. Markets that don't satisfy these criteria have different models that apply to them instead.*

Which two words would BEST replace "determine" and "satisfy" in the selection above?

- (A) assess; fulfil
- (B) regulate; indulge
- (C) control; meet
- (D) decide; quench

3 Which sentence from the article is BEST supported by Image 2?

- (A) The supply and demand model can be broken into two parts: the law of demand and the law of supply.
- (B) In the law of demand, the higher a supplier's price, the lower the quantity of demand for that product becomes.
- (C) The relationship between supply and demand relies heavily on maintaining a balance between the two.
- (D) This balance is the point at which there is never more or less supply than demand in a marketplace.

4 Examine image 6.

How does this image contribute to the reader's understanding of the supply and demand model?

- (A) It highlights the idea that the supply curve is more complex than the demand curve.
- (B) It highlights the fact that supply will always be greater than demand.
- (C) It shows that market equilibrium is impossible in real life economics.
- (D) It shows the point where there is a balance between supply and demand.

# Factors of production

By Encyclopaedia Britannica, adapted by Newsela staff on 08.12.19

Word Count **514**

Level **1060L**



Workers assemble cars at Ford's plant in Chicago, Illinois, June 24, 2019. Photo by: Jim Young/AFP/Getty Images

**Factors of production** is a term used by economists to mean economic resources. These refer to both human resources and other kinds of resources, which, if properly utilized, will bring about a flow or output of goods and services.

Factors of production are the **inputs** necessary to obtain an **output**. However, not all necessary inputs are considered factors of production. Some of these inputs in a normal situation are free, such as air. Although air (or a substitute for it) must be present to enable production to proceed, it is not counted among the factors since it is available in most situations in practically unlimited quantities. As such, there is no cost for its use. However, if air has to be piped into a deep mine, for example, or underwater for production to proceed, then air would be a factor of production.

## The Cost Of Using A Resource

A cost is involved in using a resource if, as a result of its use, the production of something else is hampered. For example, part of the cost to the economy for using a farm's land to produce corn, is that the land isn't used to produce wheat. Thus, if the input (land) is scarce in relation to the need for it, it is regarded as a factor of production. There are two ways needed inputs may be considered

scarce. The first way is if the inputs represent something that cannot be increased or produced, such as land. The second way is if it would be costly to enlarge the supply of the input, such as a factory.

The productive factors are commonly classified into three groups: land, labor and capital. The first, **land**, represents resources whose supply is low in relation to demand and cannot be increased as the result of production. The income that comes from the ownership of this factor is known as **economic rent**.

The factor of **labor** represents all those productive resources that can be applied only at the cost of human effort. Wage or salary is the form of payment for the use of this factor. The effort which the economist regards as qualifying may be either manual or mental.

The final category, **capital**, is a more complex one. It refers to all the produced instruments of production, such as the factories, their equipment, their stocks of raw materials and finished goods, houses, trade facilities and so on. The owners of capital receive their income in various possible forms; profits and interest are the usual ones.

### **The Effect Of Factors Of Production**

Economists believe that the level of an economy's output depends upon how much input there is. That is to say, a country's economy depends on how many and how much of its factors of production are in use. These are the questions economists consider. To what degree are those factors of production being used? To what end or aim are the factors of production being utilized? What rewards are there for using these factors of production? Much of economics involves the study of questions like these.

# What is human capital?

By ThoughtCo., adapted by Newsela staff on 08.13.19

Word Count **893**

Level **1070L**



Image 1. Human capital refers to the people who contribute to economic activities. It is the sum of knowledge, skills, experience and social qualities that contribute to a person's ability to perform work in a manner that produces economic value.

The people who do or are able to work for an organization are called the "workforce." One way to describe this group of people is by using human capital, a measure of the quality of labor. Human capital theory is based on the conditions needed to create a suitable supply of labor for economic growth. This theory is crucial to the economic and social health of countries around the world.

## Human Capital Definition

Capital is an economic term that refers to all the assets needed for a business to function properly. This can include land, machinery and equipment, buildings and offices. Workers contribute to a business in the form of human capital.

Human capital is not restricted to the physical labor of employees, however. It also includes non-physical qualities of the workforce, like education, skill, experience and health. Both employees and employers can invest in the development of human capital, and when they do so, all members of a society benefit. For instance, well-educated countries outperform undereducated societies in the global economy.

Employers invest in human capital by providing training, support for education and health benefits. Employees can invest in human capital by obtaining a good education. These investments do not always pay off, however. Sometimes well-educated workers struggle to find jobs and other times employers spend resources training employees only for them to leave to work for another company.

The greater the investment in human capital, the better the health of the economy and country as a whole.

### **Human Capital Theory**

According to human capital theory, enough investment in human capital can grow the national economy. For example, some countries invest highly in education. In these countries a better educated population earns more money, stimulating the economy. In business administration, this theory is applied in human resources management.

Adam Smith, called the "founding father of economics," is given credit for the idea of human capital theory. In 1776, he called human capital "the acquired and useful abilities of all the inhabitants or members of the society." Smith also stated that the level of wages workers were paid was in relation to the skills needed for the job.

### **Marxist Theory**

In 1859, Karl Marx, a German philosopher, called human capital "labor power." According to Marx, people sell their labor power in return for income. Unlike other economists like Smith, Marx saw "two disagreeably frustrating facts" with human capital.

Firstly, the ability to do a job is not enough to earn income, workers have to actively work to be paid. This means that workers cannot sell human capital like physical goods. Workers and employers have to enter into contracts wherein employees use their skills to earn income.

Marx also asserted that for this contract to work, employers have to make a profit. Therefore, workers have to work hard enough for their employers to make money. If a worker is being paid more than they produce, the human capital contract fails.

Marx also distinguished between human capital and slavery. Unlike free workers, slaves do not earn income. In fact, their capacity for work is what is bought and sold.

### **Modern Theory**

Human capital is broken down into categories such as cultural, social and intellectual capital.

The knowledge and skills that allow a person to increase their social standing or do work is called cultural capital. This can involve advanced education, worker training and natural ability. Cultural capital can be developed in order to earn higher wages.

Strong relationships that benefit a business or person are called social capital. This can include brand-name recognition or a positive public image. It can gain a good image through branding, social networks, social media or word of mouth. An individual's fame or charm is not included under social capital because it cannot be taught or transferred like other skills and knowledge

The value of everything every worker in a business knows that gives the business an advantage is called intellectual capital. This is typically in the form of intellectual property or workers' ideas, like inventions. Unlike other human capital assets, intellectual capital is usually protected by copyright laws and non-disclosure agreements. Intellectual capital stays with a company even when workers leave.

### **Human Capital In Today's World Economy**

Increasing human capital is a common way to increase economic growth, which is an important part of raising a country's standard of living. This is particularly true in impoverished and developing countries.

Factors of human capital also support economic growth, especially health and education. Countries with lower access to health and educational resources also tend to suffer from lower economic growth.

The countries with the strongest economies usually invest in higher education. For many developing countries, investing in health and education is the first step toward improving the economy. Following the end of World War II, Japan, South Korea and China invested in human capital in this way. They have been successful in decreasing poverty and increasing their economic power.

In order to show the effect of human capital, the World Bank publishes a yearly Human Capital Index Map. The map illustrates how access to education and health care affects different countries.

President of the World Bank, Jim Yong Kim, made a warning. According to Kim, countries with lower investment in human capital will be much less productive than they could be with proper education and health care.

## Quiz

- 1 The sentence below from the section "Human Capital Definition" helps prove the claim that investments can be beneficial for a society.

*Both employees and employers can invest in the development of human capital, and when they do so, all members of a society benefit.*

Which sentence from the section provides further support for the claim?

- (A) It also includes non-physical qualities of the workforce, like education, skill, experience and health.
- (B) Employers invest in human capital by providing training, support for education and health benefits.
- (C) Sometimes well-educated workers struggle to find jobs and other times employers spend resources training employees only for them to leave to work for another company.
- (D) The greater the investment in human capital, the better the health of the economy and country as a whole.

- 2 Select the paragraph from the section "Marxist Theory" that explains what occurs when the income of the worker outweighs what they are able to provide.

- (A) In 1859, Karl Marx, a German philosopher, called human capital "labor power." According to Marx, people sell their labor power in return for income. Unlike other economists like Smith, Marx saw "two disagreeably frustrating facts" with human capital.
- (B) Firstly, the ability to do a job is not enough to earn income, workers have to actively work to be paid. This means that workers cannot sell human capital like physical goods. Workers and employers have to enter into contracts wherein employees use their skills to earn income.
- (C) Marx also asserted that for this contract to work, employers have to make a profit. Therefore, workers have to work hard enough for their employers to make money. If a worker is being paid more than they produce, the human capital contract fails.
- (D) Marx also distinguished between human capital and slavery. Unlike free workers, slaves do not earn income. In fact, their capacity for work is what is bought and sold.

- 3 Read the first paragraph of the article.

*The people who do or are able to work for an organization are called the "workforce." One way to describe this group of people is by using human capital, a measure of the quality of labor. Human capital theory is based on the conditions needed to create a suitable supply of labor for economic growth. This theory is crucial to the economic and social health of countries around the world.*

Why did the author use the word "crucial"?

- (A) to convey a sense of how difficult the concept of human capital theory is for people to understand
- (B) to convey a sense of how essential the human capital theory is to the study of economics
- (C) to convey a sense of how urgent it is to invest in human capital to help impoverished countries
- (D) to convey a sense of how interesting it is to learn about the effects of human capital

Read the paragraph from the section "Human Capital In Today's World Economy."

*Factors of human capital also support economic growth, especially health and education. Countries with lower access to health and educational resources also tend to suffer from lower economic growth.*

Which option is the BEST definition of the word "access" as used in the paragraph?

- (A) the biggest problem a country has
- (B) the way to obtain something stored
- (C) the act of approaching something
- (D) the right to make use of something

# Profile of an entrepreneur

By Council for Economic Education, adapted by Newsela staff on 08.23.19

Word Count 292

Level 1130L



Steve Jobs with room full of computers in 1984. Jobs, who created Apple, is one of the most recognizable entrepreneurs in modern history. Photo by: Michael L Abramson/Getty Images

An entrepreneur is someone who creates his or her own job by providing a new or improved good or service. Rather than accepting the way something works or doesn't work, entrepreneurs try out new approaches, sometimes shaking up entire industries. In addition to the potential for making money, many entrepreneurs enjoy the challenge of starting up their own businesses and making their own jobs.

## Common Characteristics

Entrepreneurs have been key figures in the development of American business. Their economic activity has introduced new products to the market, offered us more choices and created millions of jobs. By examining entrepreneurs of the past, we can understand how their contributions have improved our standard of living and recognize the skills and traits that make entrepreneurs successful.

Most people are employees, working somewhere along a chain of supervision, but this arrangement is not for everyone. Some individuals prefer the challenge of starting their own

businesses and working for themselves.

Research suggests that these individuals share certain characteristics. They tend to be willing to take risks and are very independent. They tend to be leaders and enjoy being recognized. They also tend to be confident, hard-working and well-organized self-starters.

### **Risk And Reward**

For an entrepreneur, a steady income depends almost completely on the success of the business. Entrepreneurs tend to work very long hours, though they get to organize their schedules themselves. Entrepreneurs often take little salary in the beginning so that most income can be put back into the business. So, an entrepreneur's earnings depend on the success of their business.

Being an entrepreneur can be very rewarding, but it is also demanding. Bookkeeping, selling, cleaning, painting and producing items are likely to be included in their job responsibilities, at least early on.

## Quiz

1 Read the list of sentences from the article.

1. *Rather than accepting the way something works or doesn't work, entrepreneurs try out new approaches, sometimes shaking up entire industries.*
2. *Their economic activity has introduced new products to the market, offered us more choices and created millions of jobs.*
3. *They also tend to be confident, hard-working and well-organized self-starters.*
4. *Bookkeeping, selling, cleaning, painting and producing items are likely to be included in their job responsibilities, at least early on.*

Which two sentences taken together provide the BEST evidence to support the idea that entrepreneurs can cause big changes?

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

2 Read the sentence from the section "Risk And Reward."

*Being an entrepreneur can be very rewarding, but it is also demanding.*

Which of the following options BEST supports the idea that being an entrepreneur can be demanding?

- (A) For an entrepreneur, a steady income depends almost completely on the success of the business.
- (B) Entrepreneurs tend to work very long hours, though they get to organize their schedules themselves.
- (C) Entrepreneurs often take little salary in the beginning so that most income can be put back into the business.
- (D) So, an entrepreneur's earnings depend on the success of their business.

3 Read the sentence from the section "Common Characteristics."

*By examining entrepreneurs of the past, we can understand how their contributions have improved our standard of living and recognize the skills and traits that make entrepreneurs successful.*

Which sentence from the section helps explain what the word "traits" is referring to?

- (A) Entrepreneurs have been key figures in the development of American business.
- (B) Most people are employees, working somewhere along a chain of supervision, but this arrangement is not for everyone.
- (C) Some individuals prefer the challenge of starting their own businesses and working for themselves.
- (D) They also tend to be confident, hard-working and well-organized self-starters.

Read the sentence from the introduction [paragraph 1].

*In addition to the potential for making money, many entrepreneurs enjoy the challenge of starting up their own businesses and making their own jobs.*

The author uses the word "potential" to mean:

- (A) capacity
- (B) danger
- (C) availability
- (D) impossibility

# Influencers: The modern entrepreneur

By National Geographic Society, adapted by Newsela staff on 06.05.19

Word Count **930**

Level **1020L**



Image 1. Influencers Ethan and Grayson Dolan, known as the Dolan twins, at MTV Studios in New York City, November 30, 2017. Photo by: MTV/TRL/Getty Images

Social media influencers use social media to build their own personal brand or influence their followers to act. They may tell their followers to buy products, support a brand or visit a certain place. They can share about anything from clothes and beauty products to make-at-home slime with their followers.

While it might seem like it's just for fun, some influencers are making significant amounts of money from their connection to their fans. Not every social media influencer is an entrepreneur. However, the ones who have started their own businesses have much in common with traditional entrepreneurs.

## Are Influencers Entrepreneurs?

Entrepreneurs are people who organize, manage, and take on the risks of a business. They often start a new business in response to a need for a product or service. An influencer, on the other hand, is someone who has the power to affect or change people and their behavior through social



media. Influencers who start their own business are definitely entrepreneurs, since they manage their business, but are they fulfilling a need? Many say yes. Companies can target specific groups of people through employing an influencer. These groups might be missed by traditional advertising. And because influencers form a more personal relationship with their followers, the followers seem more likely to buy what the influencer suggests.

### **Getting Started**

Starting a business is one area where entrepreneurs and influencers differ the most. Nearly all traditional businesses have startup costs for buying materials for material or equipment to manufacture items or provide a service. But entrepreneurs do not always have to put their own savings into a business. They can raise venture capital, which is money to start or grow a business, from outside investors. Often the funders get part of the business in exchange. Influencers, on the other hand, have much lower startup costs, though it can vary. Beauty and fashion influencers may have to get new clothes, for instance, buy the latest makeup, or hire a professional photographer. Other influencers, on the other hand, only need their social media accounts and a smartphone. Additionally, influencers usually don't have to spend money on renting office space, since many of them work from their own home.

### **Building A Brand**

Building a brand is critical for both influencers and entrepreneurs, but they do it in different ways. Entrepreneurs build their brands slowly over time as they create their business. First, they determine what sets their brand apart from others. Then they need to figure out how to communicate that to consumers. A lot of brand-building happens when the business is in its start-up phase. Some of it happens when the product or service hits the marketplace and gets feedback from the consumers. For entrepreneurs, the product or service usually comes first, and the brand comes second. Influencers also develop their brand over time. But because their brand is their personality, it has to be perfected and be appealing to followers before the influencer is able to make money. Influencers know how their personalities are different from other influencers. They develop a message to reach and gain followers, then monetize it through partnering with brands. For them, their personal brand comes first, and the service of reaching followers comes second.



### **Making Money**

Most entrepreneurs make money from their businesses in a straightforward way. Most businesses sell a product or service for more than it costs to make them, which is their profit. Influencers have a less clear path. After building up an audience of followers, influencers enter partnerships with companies or advertisers. The companies pay them to post about a product or service. With social media channels, like YouTube or Instagram, influencers can add advertisements to their page, creating another way of making money. Most influencers earn money through a combination of

advertisements, company-sponsored posts, and sometimes creating their own brand of products. And of course, they advertise these products on their own social media channels.

## Driving The Economy

Entrepreneurship is a major driver of economic growth. As influencers have grown in number and become more and more popular, it has become clear that they are helping to boost the economy, as well. Entrepreneurs drive economic growth in many ways. By fulfilling a need for a good or service, entrepreneurs create new markets and also create competition. For example, Uber was created to fulfill the need of more taxis.

Soon, a number of ride-sharing companies sprang up in this new category. As new companies grow, they can create employment opportunities by hiring more people. Entrepreneurs also encourage innovation, which is clear from the vast number of startups that introduce new technology to the world.

Influencers can drive the economy in similar ways. They have created a new market on social media. Their need for professional help in creating content can create employment opportunities, and competition becomes stronger as more people become influencers. Influencers also get followers to join new social media platforms to get access to their content and provide marketing opportunities for companies. As entrepreneurs themselves, influencers create businesses and add a few unique features that continue to boost the economy in a socially connected world.



# What is credit?

By Council for Economic Education, adapted by Newsela staff on 09.25.19

Word Count **626**

Level **1060L**



Image 1. Photo from: Getty Images/Francesco Carta fotografo.

Credit allows people to obtain and use money they do not have. To receive credit, a prospective borrower must convince a lender to provide a loan.

The borrower promises to pay the money back, plus an additional charge called interest. People obtain loans to buy many different items. Loans help pay for cars, homes, home repairs, major appliances and post-secondary education.

## **Decision-Making**

Credit decisions can be difficult. Like all difficult decisions, credit decisions involve examining the advantages and disadvantages. People must decide whether the advantages of using credit outweigh the disadvantages.

There are many advantages to using credit. Credit can help people acquire assets, which are goods or services that usually retain or increase their value. Ordinarily, a home or post-secondary education is considered an asset. Credit can also help people lead happier lives by enabling them

to obtain the goods and services they wish to have now while paying for them in the future. This can be very helpful during emergencies.

There are also disadvantages to using credit, though, as some people make the mistake of using far more credit than they're able to pay back. They may then take on heavy burdens of debt that are difficult to repay.

Many new college graduates, for example, spend a lot of the income from their first jobs repaying large credit card debts they have taken on while in college. They spend a great deal of their current income paying for previous purchases. This means they're left with less money to buy things they would like to have in the present. These new graduates might even miss payments or become unable to repay loans altogether. If this happens, they face serious consequences, such as being unable to get credit in the future.

### **Types Of Lenders**

Commercial banks, savings and loans, credit unions and consumer finance companies are all examples of financial institutions. They hold money that they, in turn, lend out to others. The owners of financial institutions expect to be paid interest for providing a loan. Interest is the price a borrower pays to a lender for use of the credit provided by the lender. Both sides in a credit transaction expect to benefit. Borrowers are able to purchase something that is of value to them today or in the future. Lenders are repaid the money they lent, plus interest.

There are several important factors in determining the rate of interest charged. One is the amount of confidence the lender has that the loan will be repaid in the agreed-upon time. Higher-risk loans, which are loans where it is uncertain the borrower can repay, usually result in higher interest rates. Lower-risk loans, which are loans where it seems evident that the borrower can repay, usually result in lower interest rates.

What the loan is used for also determines the interest rate. For example, a loan for a vacation likely has higher interest than a loan for a home. Loans for material items, such as homes, tend to come with lower interest rates.

### **Secured And Unsecured Loans**

Secured loans usually have lower interest rates than unsecured loans. Secured loans are backed by an asset, such as a home or car, which is called collateral. Collateral is something the borrower promises to give the lender if they can't repay the loan. A car loan is an example of a secured loan. In this loan, the car is the collateral. If a borrower fails to repay the loan, the lender can take back the car and sell it to pay off the loan. If there is still a balance owed after the sale of the collateral, the borrower has to pay this remaining balance.

## Quiz

- 1 Which sentence from the article is BEST supported by Image 2?
- (A) Like all difficult decisions, credit decisions involve examining the advantages and disadvantages.
  - (B) They spend a great deal of their current income paying for previous purchases.
  - (C) There are several important factors in determining the rate of interest charged.
  - (D) If there is still a balance owed after the sale of the collateral, the borrower has to pay this remaining balance.
- 2 Which conclusion is BEST supported by both Image 2 and the information in the article?
- (A) Unsecured loans typically have lower interest rates than secured loans.
  - (B) Personal loans usually have lower interest rates than mortgages.
  - (C) Home loans often have fairly low interest rates.
  - (D) Credit cards tend to have somewhat low interest rates.
- 3 Select the paragraph from the section "Decision-Making" that highlights benefits of using credit.
- (A) Credit decisions can be difficult. Like all difficult decisions, credit decisions involve examining the advantages and disadvantages. People must decide whether the advantages of using credit outweigh the disadvantages.
  - (B) There are many advantages to using credit. Credit can help people acquire assets, which are goods or services that usually retain or increase their value. Ordinarily, a home or post-secondary education is considered an asset. Credit can also help people lead happier lives by enabling them to obtain the goods and services they wish to have now while paying for them in the future. This can be very helpful during emergencies.
  - (C) There are also disadvantages to using credit, though, as some people make the mistake of using far more credit than they're able to pay back. They may then take on heavy burdens of debt that are difficult to repay.
  - (D) Many new college graduates, for example, spend a lot of the income from their first jobs repaying large credit card debts they have taken on while in college. They spend a great deal of their current income paying for previous purchases. This means they're left with less money to buy things they would like to have in the present. These new graduates might even miss payments or become unable to repay loans altogether. If this happens, they face serious consequences, such as being unable to get credit in the future.
- 4 Which section from the article BEST explains how interest rates are established?
- (A) Introduction [paragraph 1]
  - (B) "Decision-Making"
  - (C) "Types Of Lenders"
  - (D) "Secured And Unsecured Loans"

# How do taxes work in the U.S. government?

By U.S Treasury, adapted by Newsela staff on 05.24.17

Word Count **808**

Level **930L**



An individual U.S. income tax return form called a 1040. Photo from <http://401kcalculator.org>.

Every organized society has some form of government. In free societies, the goals of government are to protect individual freedoms and to promote the health and happiness of society.

To meet expenses, the government has to spend trillions of dollars each year. It raises this money through taxes. In the United States, there are several different types of taxes on individuals and businesses.

The American economy is based on the system of free enterprise. This means that people are free to decide how to spend their money. The goal of companies is to make profits by selling what people want.

However, the free-enterprise system does not produce all the services needed by society. Some services are more efficiently provided when government agencies run them. Two good examples are national defense, such as the military, and police departments. Everyone benefits from these services and they are paid for with tax money.

## Taxes Pay For Government Services

For public protection, government agencies create regulations. There are regulations to make sure products are of high quality and are safe. These might apply to home construction, vehicles and appliances. There are also regulations for financial services, like banks. Another important form of consumer protection is the use of licenses to prevent unqualified people from working in certain jobs, such as medicine or construction.

Public schools are also paid for by taxes.

Since the 1930s, the federal government has been providing services, often called a "safety net," for people in need. Major programs include health services for the elderly, called Medicare, and financial aid for the disabled and unemployed. These programs are funded by taxes.

Governments pay for these services by taxing three economic bases: income, consumption (purchases), and wealth.

The federal government gets most of its money through income taxes. It taxes the earnings of both individuals and corporations.

It also taxes a portion of the pay people earn from their jobs. These "payroll taxes" go toward Medicare, Social Security (which provides people with money when they retire), and unemployment protection if people lose their jobs. Both employers and employees pay these. The tax is taken from the employee's paycheck and sent to the government.

### **Sales Tax On Things We Buy**

State governments depend on both income and sales taxes. Sales taxes usually get paid on such things as cars, household items and movie tickets. The tax rate and the list of goods that might be taxed are different in each state. A few states do not even charge sales tax.

Some items get taxed to discourage their use. This applies to taxes on alcohol, tobacco and gambling — and sometimes unhealthy food, like soda or candy.

### **Taxes On Property And Wealth**

Cities and states get most of their money through property taxes. Most towns and cities tax homes, land and business property based on the property's value.

Some state and local governments also impose taxes on certain types of "personal" property. This includes cars, boats, recreational vehicles and livestock.

A basic principle of the income tax laws of the United States is that people should be taxed according to their "ability to pay." Taxpayers with the same income might not have the same ability to pay. For example, people with high medical bills have less money to spend on taxes. They can subtract the cost of their medical bills from their income. This reduces the amount of money the government can tax — called taxable income.

Those with high taxable incomes pay a larger percentage of their income in taxes. This percentage is the "tax rate." Those with higher taxable incomes pay a higher percentage, called a "progressive" tax.

Sales taxes are considered "regressive." This means that everyone pays the same taxes on the same goods. It causes people with lower incomes to pay a larger percentage of their income in sales

taxes than rich people. Some people think this is unfair.

### **Tax Money Is Spent Every Which Way**

Federal taxes are spent on many programs. Among the largest are Social Security and Medicare. Another large portion of federal spending is for national defense.

Veterans also receive benefits from the federal government. They receive medical services and education training. Veterans also get a pension that pays them money when they get older and cannot work, and life insurance, which pays money to someone's family when they die.

Transportation is another thing the government spends money on. Transportation spending helps to build highways, train and subway systems and airports. Also included in transportation spending are the costs of running the U.S. Coast Guard, regulation of the airways and assistance to railroads and shipping.

There are many other federal government services. They include protection of natural resources and the environment, and maintaining national parks. In addition, there is assistance to foreign countries, disaster relief, space exploration and community development.

## Quiz

- 1 Which paragraph in the section "Taxes Pay For Government Services" BEST explains HOW people with jobs pay taxes to the government?
- 2 Which of these sentences from the article would be MOST important to include in a summary of the article?
- (A) The American economy is based on the system of free enterprise.
  - (B) Some services are more efficiently provided when government agencies run them.
  - (C) Another important form of consumer protection is the use of licenses to prevent unqualified people from working in certain jobs, such as medicine or construction.
  - (D) A basic principle of the income tax laws of the United States is that people should be taxed according to their "ability to pay."

- 3 Read the paragraph from the section "Sales Tax On Things We Buy."

*State governments depend on both income and sales taxes. Sales taxes usually get paid on such things as cars, household items and movie tickets. The tax rate and the list of goods that might be taxed are different in each state. A few states do not even charge sales tax.*

Which conclusion is BEST supported by the paragraph?

- (A) It is difficult for states to charge sales tax.
  - (B) States have the right to decide which items they will tax.
  - (C) Many states would like to get rid of the sales tax.
  - (D) State tax rates are usually the highest for cars.
- 4 Which detail BEST supports the article's CENTRAL idea that governments raise money through taxes in various ways?
- (A) There are also regulations for financial services, like banks.
  - (B) Public schools are also paid for by taxes.
  - (C) It taxes the earnings of both individuals and corporations.
  - (D) This means that everyone pays the same taxes on the same goods.

# Rights and responsibilities of U.S. citizens

By U.S. Citizenship and Immigration Services on 06.01.17

Word Count 1,247

Level MAX



Members of the armed services recite the pledge of allegiance during a naturalization ceremony at the USS Midway Museum, in May 2009 in San Diego, California. (U.S. Navy photo by Legalman 1st Class Jennifer L. Bailey/Released)

People in the United States have the basic freedoms and protections outlined in our founding documents, the Declaration of Independence and the Constitution. For more than 200 years, we have been bound by the ideals expressed in these documents. Because of these ideals, our society has prospered. The U.S. government, as established in the Constitution, protects the rights of each individual, without regard to background, culture, or religion. To keep our system of representative democracy and individual freedom, you should strive to become an active participant in American civic life.

Upon taking the Oath of Allegiance, you promise your loyalty and allegiance to the United States of America. U.S. citizens have important rights and responsibilities. These include the right to vote in federal elections and the ability to serve on a jury. Citizenship is a privilege that offers the extraordinary opportunity to be a part of the governing process. Former Supreme Court Justice Louis Brandeis once said, "The only title in our democracy superior to that of President [is] the title of citizen." In the United States, the power of government comes directly from the people.

**Freedom to express yourself.** "Freedom of expression" includes several individual rights. It includes freedom of speech, freedom to peaceably assemble, and the freedom to petition the government for a redress of grievances. In a representative democracy, individual beliefs and opinions are important to our national dialogue and necessary to maintain a responsible citizenry. Americans can speak and act as they wish as long as it does not endanger others or obstruct another's freedom of expression in the process.

**Freedom to worship as you wish.** In the United States, the freedom to hold any religious belief, or none at all, is considered a basic, or unalienable right. The government cannot violate this right. Religious intolerance is unacceptable in a society where everyone has individual freedom. In cases where religious practices hurt the common good or endanger the health of others, the Supreme Court has imposed minor limitations of the way some religious practices are performed.

**Right to a prompt, fair trial by jury.** People accused of a crime have the right to a speedy and fair trial by a jury of peers. In a free society, those accused of a crime are assumed innocent until proven guilty in a court of law. The American system of justice treats all people fairly, ensuring the rights of the individual are maintained.

**Right to keep and bear arms.** The Constitution protects the rights of individuals to have firearms for personal defense. This privilege is subject to reasonable restrictions designed to prevent unfit persons, or those with the intent to criminally misuse guns or other firearms, from obtaining such items.

**Right to vote in elections for public officials.** By voting in federal, state, and local elections, citizens choose their government leaders. The right to vote is one of the most important liberties granted to American citizens. It is the foundation of a free society.

**Right to apply for federal employment.** Public service is a worthy endeavor and can lead to an extremely rewarding career working for the American people. Many federal government jobs require applicants to have U.S. citizenship. U.S. citizens can apply for federal employment within a government agency or department.

**Right to run for elected office.** U.S. citizenship is required for many elected offices in this country. Naturalized U.S. citizens can run for any elected office they choose with the exception of President and Vice President of the United States, which require candidates to be native-born citizens.

**Freedom to pursue "life, liberty, and the pursuit of happiness."** As a society based on individual freedom, it is the inherent right of all Americans to pursue "life, liberty and the pursuit



of happiness." The United States is a land of opportunity. People are able to choose their own path in life based on personal goals and objectives. Americans can make their own decisions and pursue their own interests as long as it does not interfere with the rights of others.

## **Responsibilities Of A Citizen**

**Support and defend the Constitution against all enemies, foreign and domestic.** The Constitution establishes the U.S. system of representative democracy and outlines the inherent principles of freedom, liberty and opportunity to which all citizens are entitled. The continuity of this Nation's unique freedoms depends on the support of its citizens. When the Constitution and its ideals are challenged, citizens must defend these principles against all adversaries.

**Stay informed on the issues affecting your community.** U.S. citizens should learn about the issues and candidates running for office before casting a vote in an election. Staying informed allows citizens the opportunity to keep the candidates and laws responsive to the needs of the local community.

**Participate in the democratic process.** Voting in the federal, state and local elections is the most important responsibility of any citizen. Voting ensures that our system of government is maintained and individual voices are clearly heard by officials.

### **Respect and obey federal, state and local laws.**

Laws are rules of conduct that are established by an authority and followed by the community to maintain order in a free society. Every person living in the United States must follow laws established through federal, state and local authorities.

### **Respect the rights, beliefs and opinions of others.**

Though the United States is a nation of diverse backgrounds and cultures, our common civic values united us as one nation. Tolerance, through courtesy and respect for the beliefs and opinions of others, is the hallmark of a civilized society and ensures the continuity of liberty and freedom for future generations.



**Participate in your local community.** Being a responsible member of one's local community is important to the success of representative democracy. Community engagement through volunteerism, participation in town hall meetings and public hearings, joining a local parent-teacher association, and running for public office are ways individuals can actively contribute to the well-being of the community.

### **Pay income and other taxes honestly, and on time, to federal, state, and local**

**authorities.** Taxes pay for government services for the people of the United States. Some of these services include: educating children and adults, keeping our country safe and secure, and providing medical services to the elderly and less fortunate. Paying taxes on time and in full ensures that these services continue for all Americans.

**Serve on a jury when called upon.** For U.S. citizens, serving on a jury is a very important service to the community. The Constitution guarantees that all persons accused of a crime have the right to a "speedy and public trial by an impartial jury." Jury service gives U.S. citizens the

opportunity to participate in the vital task of achieving just, fair results in matters that come before the court.

**Defend the country if the need should arise.**

The Armed Forces of the United States, the military, is currently an all-volunteer force. However, should the need arise in time of war, it is important that all citizens join together and assist the Nation where they are able. This support could include defending the Nation through the military, noncombatant or civilian service.



## Quiz

- 1 Which two sentences taken together develop the idea that citizens' rights depend on other citizens carrying out their responsibilities?
1. *In a representative democracy, individual beliefs and opinions are important to our national dialogue and necessary to maintain a responsible citizenry.*
  2. *In a free society, those accused of a crime are assumed innocent until proven guilty in a court of law.*
  3. *Though the United States is a nation of diverse backgrounds and cultures, our common civic values unite us as one nation.*
  4. *Jury service gives U.S. citizens the opportunity to participate in the vital task of achieving just, fair results in matters that come before the court.*
- (A) 1 and 3  
(B) 1 and 4  
(C) 2 and 3  
(D) 2 and 4
- 2 Which of the following ideas did the author develop LEAST in this article?
- (A) Citizens must defend the Constitution.  
(B) Citizens must participate in government.  
(C) Citizens must respect one another's rights.  
(D) Citizens must volunteer in the community.
- 3 HOW do the images included with the article enhance your understanding of rights and responsibilities of citizens BEYOND what the article offers?
- (A) by demonstrating that there are different ways for citizens to participate in democracy  
(B) by demonstrating that many citizens do actively participate in their democracy  
(C) by demonstrating that citizens of different races and religions participate in democracy  
(D) by demonstrating that citizens can participate in democracy individually or in groups
- 4 Which image included with the article BEST depicts the idea that all citizens, without regard to culture or background, have both a right and a responsibility to defend and participate in government?
- (A) top image  
(B) second image  
(C) third image  
(D) bottom image



Article of the Constitution.

### **Amendment I**

Congress shall make no law setting up one national or state religion or stopping anyone from being part of a religion. No law can stop or get in the way of freedom of speech, or freedom of the press to write and print. No law can stop the right of the people to peacefully meet and talk, and of the right to send complaints to the government.

### **Amendment II**

A well-organized small army, being needed for the safety of a free State and the right of the people to own, carry and use weapons and guns, shall not be limited or taken away.

### **Amendment III**

No soldier shall, in time of peace live, eat or sleep in any house, without the approval of the owner, nor in time of war, unless this is changed by law.

### **Amendment IV**

The right of the people to protect their persons, houses, papers and things they own, from unfair searches and unfair taking of their things, shall not be ignored. No permission shall be given to do this, unless there is a good reason. The permission will also only be given to search only a specific place, and only take specific, named people or things.

### **Amendment V**

No person shall be put in jail for crimes of murder, crimes against the government, stealing a lot of money or badly hurting someone unless given a written copy describing the crime and unless people have looked at the evidence that supports the arrest, except when soldiers and/or sailors of our country are at war or the people of the United States are in danger. No person can be arrested and go to trial more than once for the same crime. Never shall the person on trial be forced to be a witness against himself. No person shall lose his life, freedom, money or property, without a chance to have a judge or jury decide the result. Property cannot be taken to be used by the public, without fair payment of money to the person who owns the land or things.

### **Amendment VI**

In all criminal trials, the person on trial shall have the right to a speedy and public trial, by a fair jury of the State and place where the crime happened. The person has to be told the reasons for being on trial. The person can face and listen to the witnesses against him. The person can have his own witnesses to help him, have witnesses to explain the facts and have a lawyer to help him defend himself.

### **Amendment VII**

In civil court, when a person is sued for more than 20 dollars, the right of trial by jury is still the person's right. But this can happen only one time and there is no way to change the final result according to the rules of the common law.

### **Amendment VIII**

People have a right to pay a fair amount of money to stay out of jail before and at the time of the trial. If the person is found guilty, he must pay a fair amount of money for a fine. Other punishments cannot be too cruel.

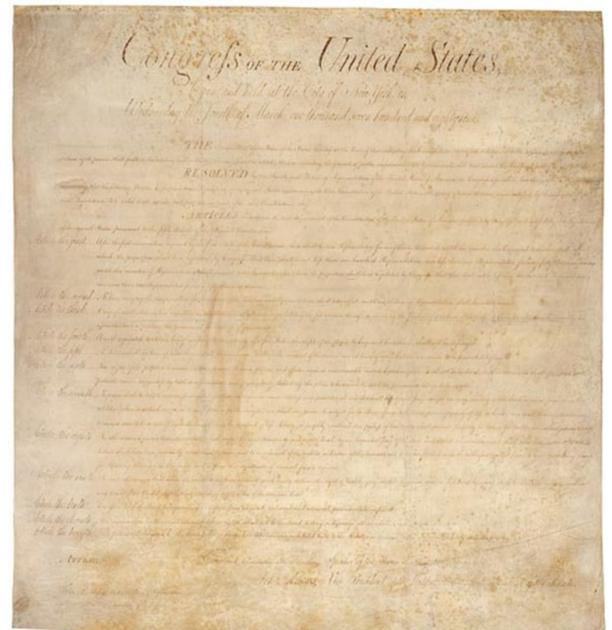
**Amendment IX**

Certain rights in the Constitution shall not be seen to be the only rights. There are more rights that are given to and held by the people.

**Amendment X**

The powers not given to the United States by the Constitution are given to each of the States and to the people.

*Editor's Note: Above are the first 10 amendments to the Constitution, as adapted by Newsela. These amendments were ratified Dec. 15, 1791, and are known as the "Bill of Rights." Roman numerals were used to number the amendments.*



## Quiz

1 What did Congress hope to achieve by writing the Bill of Rights?

1. Encourage more states to follow the rules of the Constitution.
2. Help citizens understand what the government could and could not tell them to do.
3. Create a Senate and a House of Representatives for the new country.

- (A) 1 only
- (B) 2 only
- (C) 2 and 3
- (D) 1, 2, and 3

2 Read Amendment IV.

*The right of the people to protect their persons, houses, papers and things they own, from unfair searches and unfair taking of their things, shall not be ignored. No permission shall be given to do this, unless there is a good reason. The permission will also only be given to search only a specific place, and only take specific, named people or things.*

Which of the following can be concluded from the selection above?

- (A) The government can look at a person's private papers only if that person is a criminal.
- (B) The government can take someone's personal property if it has special permission.
- (C) The government must get permission from the person to search his or her house.
- (D) The government can search a person's personal property with permission, but it cannot take that property.

3 Read these facts about the Constitution:

1. To be adopted, nine of the 13 states had to ratify, or approve, the Constitution.
2. Several states agreed to ratify the Constitution only under the condition that a Bill of Rights would be added.
3. The Introduction [paragraphs 1-4] to the Bill of Rights outline the process for approval.

What conclusion can you draw about how Congress felt about state approval of the Constitution?

- (A) Congress felt that it was important for all of the states in the nation to agree to and ratify the Constitution and the Bill of Rights.
- (B) Congress felt that the opinions of the larger states were more important than the opinions of the smaller states. They thought it was wise for the Bill of Rights to address the rights in those large states.
- (C) Congress valued the ratification process and wanted to ensure that all people in the United States understood the process for ideas to become laws.
- (D) Congress valued the idea that the nation should make a decision together. It also believed that people need to understand how their government works and the rights bestowed upon them.

4 Which idea is BEST supported by the text in Amendment V?

- (A) There may be different rules about arrests and trials during times of war.
- (B) The government can require a person to give evidence against him- or herself.
- (C) Certain crimes are so severe that a trial is not required to send someone to prison.
- (D) A jury is made up of people who are trained to act fairly and make judgments without bias.

5 Which group of amendments MOST helped shape the legal system of the United States?

- (A) Amendments I, II, and III
- (B) Amendments III, VI, and V
- (C) Amendments V, VI, VII, and VIII
- (D) Amendments VII, VIII, IX, and X

6 Read the paragraph from the introduction [paragraphs 1-4].

*It has been decided by the Senate and House of Representatives of the United States of America, by two-thirds of both Houses agreeing, that the following new parts be offered to the Legislatures of the States. They are amendments or changes to the Constitution of the United States. All, or any of the new parts must be approved by three-fourths of the said Legislature. Then they will become part of the said Constitution, so it is named.*

What is meant by the word "said" as used in the last two sentences above?

- (A) spoken
- (B) written down
- (C) mentioned previously
- (D) carefully remembered

7 King George III was the head of the Church of England. Which excerpt from the Bill of Rights draws on the opinions of Congress about the separation between church and state?

- (A) They wanted the people to trust the government.
- (B) Congress shall not set up one national or state religion.
- (C) No law can stop people from meeting and talking.
- (D) Certain rights in the Constitution shall not be seen to be the only rights.

8 What is the meaning of the phrase "national or state religion" as used in the following sentence from Amendment I?

*Congress shall make no law setting up one national or state religion or stopping anyone from being part of a religion.*

- (A) a religion that the government provides funding for
- (B) a religion that has not already been established
- (C) a religion that people can freely choose to follow
- (D) a religion that everyone in the area must belong to

# How Government Works: What is citizenship?

By Encyclopaedia Britannica, adapted by Newsela staff on 02.24.17

Word Count **662**

Level **MAX**



Citizens in California vote during the 2008 presidential election. Choosing a leader of the government, like the president, is a right citizens have. Photo from: Associated Press.

Citizenship is everything that has to do with being a citizen, or full member, of a country. Citizens have rights that are given by the country's government. For example, citizens have the right to be protected by a country's laws. In return, citizens have duties that they owe to the country. One of the most important duties is being loyal to the country.

Citizenship is different than nationality. A person's nationality tells which country that person (called a national) is from. But nationals from a certain country are not always citizens of that country. They may have gained citizenship in another country, or they may have lost their citizenship. People who live in a country but are not citizens or nationals of that country are called aliens.

## **Becoming A Citizen**

Every country has its own rules about who is a citizen and how to become one. Many countries have set up four basic ways to become a citizen. First, anyone who is born in the country is a citizen of that country. Second, anyone whose mother or father is a citizen of the country is also a

citizen. Third, anyone who is married to a citizen becomes a citizen. Fourth, a person who goes through a process called naturalization becomes a citizen.

Naturalization is a method for people who are born in one country to become citizens of another country. Laws on naturalization are different from country to country. Usually, people who want to be naturalized must have lived in the new country for several years and must speak the country's language. They may have to pass a test about the country's laws and history and often they must take an oath, or swear to be loyal to the country.



### **Rights And Responsibilities**

Citizens have certain rights, and some countries give their citizens more or different rights than other countries. Citizens usually have the right to vote and the right to be elected to government jobs, as well. Other rights of citizens may include the right to follow any religion and the right to speak freely.

Citizens also have duties, or responsibilities. Voting is a responsibility as well as a right. Citizens must vote to make sure that their government works for the good of its citizens. Citizens also may have the duty to serve on a jury during a trial in court. Some countries make serving in the military a duty of all citizens.

Aliens may have some of the same rights as citizens but they usually cannot vote or serve in the government. Aliens also have some of the same responsibilities as citizens. They must obey the country's laws and they often must pay taxes as well.

### **Losing Citizenship**

People cannot lose their citizenship except in very special cases. A government may take away the citizenship of someone who becomes a naturalized citizen of another country. A government also may take away the citizenship of people who show allegiance to another country. Examples of this include voting in a foreign election and serving in a foreign military. Trying to overthrow the government by force is a serious crime that can result in loss of citizenship. Naturalized citizens who commit serious crimes may lose their citizenship as well.



People who have lost their citizenship can end up as citizens of no country, in which case they are called stateless persons.

## Quiz

- 1 Read the summary below. Choose the answer that BEST fits into the blank to complete the summary.
- Citizenship refers to being a full member of a country. \_\_\_\_\_. They also have duties, like serving on a jury or serving in the military. Every country has different rules for who is considered a citizen, how to become a citizen and how to stay a citizen.
- (A) Citizens have rights that are protected by the government, such as freedom of religion and speech.
  - (B) Citizens have responsibilities to their countries, like paying taxes and voting in elections.
  - (C) Naturalization is a process that people can go through to become citizens of a different country.
  - (D) Sometimes people's nationality (where they are from) is different from their citizenship (where they are citizens).
- 2 What is the MOST likely reason the author included the example about voting in a foreign election?
- (A) The author wanted to give information on how naturalized citizens are different from other citizens.
  - (B) The author wanted to show that it is possible for people to have their rights as citizens taken away.
  - (C) The author wanted to explain part of the process for becoming a citizen in a foreign country.
  - (D) The author wanted to highlight the rare cases in which aliens become stateless persons instead of citizens.
- 3 Read the sentence from the introduction [paragraphs 1-2].
- One of the most important duties is being loyal to the country.*
- Which selection from the article describes a consequence for not following through with this duty?
- (A) They may have to pass a test about the country's laws and history and often they must take an oath, or swear to be loyal to the country.
  - (B) Citizens also may have the duty to serve on a jury during a trial in court. Some countries make serving in the military a duty of all citizens.
  - (C) Aliens may have some of the same rights as citizens but they usually cannot vote or serve in the government.
  - (D) Trying to overthrow the government by force is a serious crime that can result in loss of citizenship.
- 4 Which piece of evidence from the article BEST shows how becoming a citizen of another country is a complex process?
- (A) But nationals from a certain country are not always citizens of that country. They may have gained citizenship in another country, or they may have lost their citizenship.
  - (B) First, anyone who is born in the country is a citizen of that country. Second, anyone whose mother or father is a citizen of the country is also a citizen. Third, anyone who is married to a citizen becomes a citizen.
  - (C) Naturalization is a way for people who are born in one country to become citizens of another country. Laws on naturalization are different from country to country.
  - (D) Usually, people who want to be naturalized must have lived in the new country for several years and must speak the country's language. They may have to pass a test about the country's laws and history and often they must take an oath, or swear to be loyal to the country.

# Our system of checks and balances

By Whitehouse.gov and USA.gov, adapted by Newsela staff on 12.07.16

Word Count **933**

Level **1040L**



Scales of Justice. Image by DonkeyHotey, Wikimedia.

When the Founding Fathers wrote the U.S. Constitution, they had an important goal in mind. They wanted to form a government that did not allow any one person to have too much control. To accomplish this, they created three branches of government, all with separate powers. Each branch has its own responsibilities, but each also works together to make the country run smoothly and to assure that the rights of citizens are not ignored or disallowed. This is done through a system called checks and balances. One branch may use its powers to check the powers of the other two in order to maintain a balance of power among the three branches of government.

The Constitution of the United States divides the federal government into three branches to ensure a central government in which no individual or group gains too much control. These branches are:

Legislative — Makes laws (Congress)

Executive — Carries out laws (president, vice-president, Cabinet)

Judicial — Evaluates laws (Supreme Court and other courts)

Each branch of government can change acts of the other branches. For example:

The president can veto laws passed by Congress.

Congress confirms or rejects the president's appointments and can remove the president from office in exceptional situations.

The justices of the Supreme Court can overturn unconstitutional laws. They are appointed by the president and confirmed by the Senate.

The U.S. federal government seeks to act in the best interests of its citizens through this system of checks and balances.

### Legislative Branch

The legislative branch enacts legislation, confirms or rejects presidential appointments and has the authority to declare war.

This branch includes Congress, which is made up of the Senate and House of Representatives. It also includes several agencies that provide support services to Congress. American citizens have the right to vote for senators and representatives through free, confidential ballots.

Senate — There are two elected senators per state, totaling 100 senators. A senate term is six years, and there's no limit to the number of terms an individual can serve.

House of Representatives — There are 435 elected representatives, which are divided among the 50 states in proportion to their total population. States with more people get more representatives. A representative serves a two-year term, and there's no limit to the number of terms an individual can serve.

In order to pass legislation and send it to the president for his signature, both the House and the Senate must pass the same bill. In order for the bill to pass and become law, a majority of the senators and representatives must vote in favor of it.

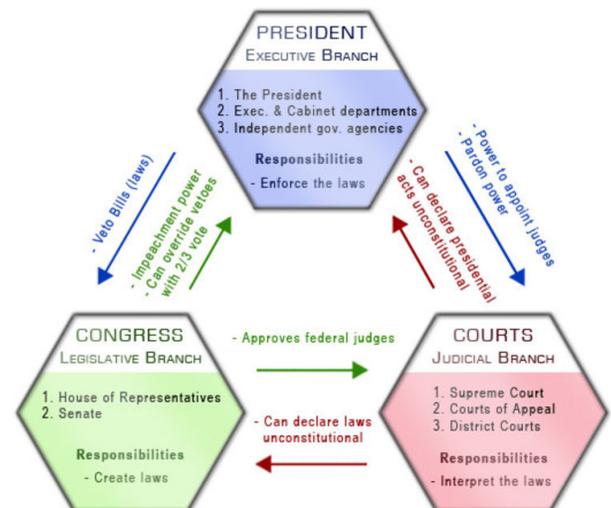
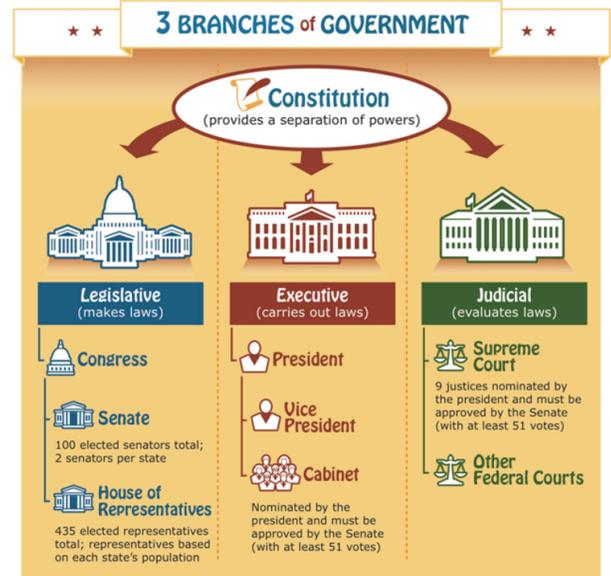
### Executive Branch

The executive branch carries out and enforces laws. It includes the president; vice-president; the Cabinet; executive departments; independent agencies; and other boards, commissions and committees.

American citizens have the right to vote for the president and vice-president through confidential ballots.

Key roles of the executive branch include:

President — The president leads the country. He or she is the head of state, leader of the federal



government and commander-in-chief of the U.S. Armed Forces. The president serves a four-year term and can be elected no more than two times. The president has the power either to sign legislation into law or to veto bills enacted by Congress, although Congress may override a veto with a two-thirds vote of both houses. The executive branch conducts diplomacy with other nations, and the president has the power to negotiate and sign treaties. However, those must also be ratified by two-thirds of the Senate. The president can issue executive orders, which direct executive officers or clarify and further existing laws. The president also has unlimited power to extend pardons for federal crimes, except in cases of impeachment.

With these powers come several responsibilities, including a constitutional requirement to "from time to time give to the Congress Information of the State of the Union, and recommend to their Consideration such Measures as he shall judge necessary and expedient." Although the president may fulfill this requirement in any way he or she chooses, presidents have traditionally done it through a State of the Union address. This is a speech given to both the House of Representatives and the Senate in January outlining the agenda for the coming year.

Vice president — The vice president supports the president. If the president is unable to serve, the vice president becomes president. He or she can serve an unlimited number of four-year terms. The vice president also serves as the president of the U.S. Senate, where he or she casts the deciding vote in the case of a tie.

The Cabinet — Cabinet members serve as advisers to the president. They include the vice president and the heads of executive departments. Cabinet members are nominated by the president and must be approved by the Senate (with at least 51 votes).

## **Judicial Branch**

The judicial branch interprets the meaning of laws, applies laws to individual cases and decides if laws violate the Constitution.

The judicial branch is made up of the Supreme Court and other federal courts.

Supreme Court — The Supreme Court is the highest court in the United States. The justices of the Supreme Court are nominated by the president and must be approved by the Senate (with at least 51 votes). Congress decides the number of justices. Currently, there are nine. There is no fixed term for justices. They serve until their death, retirement or removal in exceptional circumstances if they're unfit to serve.

Other federal courts — The Constitution grants Congress the authority to establish other federal courts.

## Quiz

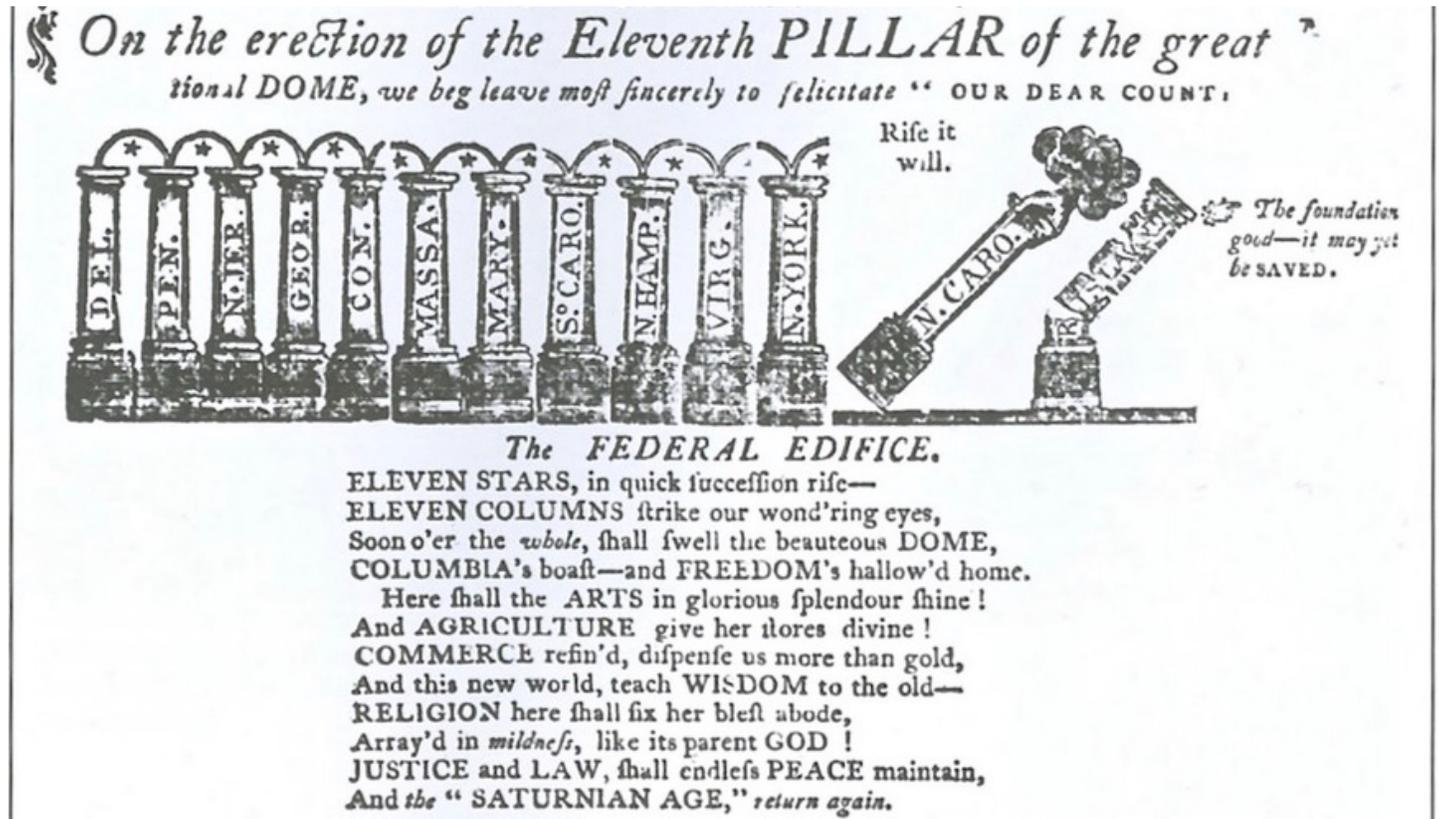
- 1 Which of these options BEST describes an interaction that reflects the system of checks and balances developed by the Founding Fathers?
- (A) Although both the Senate and the House of Representatives have different numbers of members, all of the members are elected by U.S. citizens.
  - (B) After the Senate and the House of Representatives passes a bill, it goes to the president, who either approves it or vetoes it.
  - (C) Each state of the U.S. has members in the Senate and in the House of Representatives, but the number of members is not determined in the same way.
  - (D) The president is required by the Constitution to periodically give information to the Senate and the House of Representatives about the State of the Union.
- 2 Which statement describes a connection between the legislative branch and the judicial branch?
- (A) The judicial branch enforces laws passed by the legislative branch.
  - (B) The legislative branch nominates justices for the judicial branch.
  - (C) Before the legislative branch passes a bill, the judicial branch must review and evaluate it.
  - (D) Except for the Supreme Court, the legislative branch has the power to establish federal courts.
- 3 Look at the graphic that comes at the end of the section "Legislative Branch."  
Which statement BEST explains why the graphic is included with the article?
- (A) to indicate that the president has more power than either Congress or the courts
  - (B) to illustrate that Congress and the courts are equal in the power they have
  - (C) to reinforce the idea that each of the three branches of government has different roles and responsibilities
  - (D) to give examples of how the system of checks and balances operates among the branches of government
- 4 Look at the chart titled "3 Branches of Government."  
Based on the article, which option BEST explains why the line from the Executive box goes directly to the President symbol but not to the Vice President and Cabinet symbols?
- (A) because the vice president and Cabinet function to support the president
  - (B) because the president is the only key role of the executive branch
  - (C) because the vice president and Cabinet have a role only if the president is unable to serve
  - (D) because the vice president is part of the Cabinet

# Primary Sources: James Madison's Federalist Papers No. 51

By Original document from the public domain, adapted by Newsela staff on 06.22.16

Word Count 771

Level 1030L



This image is part of a series of prints published over several months in 1788. They show columns, each labeled after a state, being placed upright by a hand extending from a cloud. Library of Congress

*Editor's Note: The Federalist Papers were 85 essays written by Alexander Hamilton, John Jay and James Madison between October 1787 and May 1788. The essays were published anonymously, under the pen name "Publius." They were primarily printed in two New York state newspapers of the time: The New York Packet and The Independent Journal. They were written to urge citizens of New York to support the approval of the proposed U.S. Constitution.*

*The essays explain sections of the Constitution in detail. Hamilton and Madison were members of the Constitutional Convention, which was responsible for writing the proposed Constitution. For these reasons, the Federalist Papers are often used today to help understand the intentions of the writers of the Constitution. Federalist Number 51, written by Madison, emphasized the importance of checks and balances within a government. It was published Feb. 6, 1788.*

To the People of the State of New York:

How shall we maintain the necessary separation of power among the several departments of government? The only answer that can be given is that the departments themselves keep each other in their proper places.

The separate and distinct exercise of different departments of government is essential to preserving liberty. As such, each department should have a will of its own. The members of each should have as little power as possible in appointing the members of the others. Ideally, this would be achieved by having voters independently elect members of each department.

Such a plan would be difficult to carry out, however. Therefore, we must allow certain members of government to be appointed by other means. In particular, it would be useful to allow judges to be appointed by other government officials. Judges require special qualifications, so it is important that they be elected in a way that ensures that only qualified candidates are chosen. Also, because judges are appointed to the courts for life, they are unlikely to be improperly influenced by the men who appoint them.

It is evident, too, that the members of each department should be minimally dependent on other departments for their salaries. Were the president, or the judges, dependent upon lawmakers for their salaries, they would not be able to act independently.

### **"Power Is Divided"**

Furthermore, members of each government department should be able to keep other departments from overtaking their authority. The system should encourage individuals to defend their department's powers.

In a perfect world, we would not need such safeguards. If angels were to govern men, no controls on government would be necessary. In framing a government that is to be administered by men over men, however, it must control itself. This can be done by dividing and arranging the several offices of government in such a manner that each acts as a check on the others.

It is not possible to give to each department an equal power of self-defense, however. In republican government, the lawmakers who make up the legislative branch will always have the greatest share of power. The remedy to this problem is to divide them into two legislative branches. Each branch should be distinguished by different systems of election and different principles of action. They should be as little connected with each other as possible.

The division of power between the federal government and state governments offers another protection against abuses. In the republic of America, power is divided between the states and the federal government. It is then divided again among the branches of each government. Therefore, government power is divided twice and controlled.

### **"To Guard Society"**

It is of great importance in a republic to guard society against its rulers and to guard one part of the society against the injustice of the other part. Different interests exist in different classes of citizens. If a majority is united by a common interest, the rights of the minority will be challenged.

To defend against this evil, we must make it unlikely that an unjust party will gain a majority of support. The people should be broken into so many parts, interests and classes of citizens that the

rights of individuals, or of the minority, will not be in much danger from interested combinations of the majority. The size of the United States, and the number of people under the same government, offers some protection in this regard. There are so many different interests and groups within the country that it is unlikely that any single group will gain a majority of support.

Such safeguards benefit all citizens. Even powerful groups are more secure under a government that protects all parties, including minorities and majorities.

PUBLIUS.

## Quiz

1 According to James Madison, what is important to consider when appointing a judge?

1. *the person's skills and experiences in law*
2. *the person's popularity with government officials*
3. *the salary the judge will be paid*

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

2 Read the second paragraph of the essay.

*The separate and distinct exercise of different departments of government is essential to preserving liberty. As such, each department should have a will of its own. The members of each should have as little power as possible in appointing the members of the others. Ideally, this would be achieved by having voters independently elect members of each department.*

According to this paragraph, why are voters important?

- (A) They exercise a will of their own rather than the will of a political party.
- (B) They are more objective than government members and will select more qualified candidates.
- (C) They are committed to preserving liberty, whereas politicians can become corrupt.
- (D) They prevent government members from holding too much influence over other branches.

3 Why is it important for a government to be divided into multiple departments?

- (A) It allows one branch to have the most authority.
- (B) It is necessary to prevent any abuse of control.
- (C) It encourages secrecy across the government.
- (D) It eliminates the need for other government safeguards.

4 Which excerpt expresses a problem the authors anticipate AND its solution?

- (A) Furthermore, members of each government department should be able to keep other departments from overtaking their authority. The system should encourage individuals to defend their department's powers.
- (B) In a perfect world, we would not need such safeguards. If angels were to govern men, no controls on government would be necessary.
- (C) In republican government, the lawmakers who make up the legislative branch will always have the greatest share of power. The remedy to this problem is to divide them into two legislative branches.
- (D) In the republic of America, power is divided between the states and the federal government. It is then divided again among the branches of each government.

- 5 Why is a checks and balances system needed in the government?
- (A) It allows each branch to monitor the power of the other two branches.
  - (B) It limits the power the branches have to guide and govern the people.
  - (C) It provides a final authority when there is a misunderstanding of the law.
  - (D) It grants permission for the formation of state and federal branches.
- 6 The authors want to protect the independence of each branch of government. What suggestions do they make to achieve that aim?
- 1. Judges should be appointed to their positions for life.
  - 2. Lawmakers should not determine the salary of the president.
  - 3. The two legislative groups should follow different rules.
  - 4. The people should be divided into different parts, interests and classes.
- (A) 1 and 2
  - (B) 3 and 4
  - (C) 1 and 3
  - (D) 2 and 4
- 7 According to James Madison, which of the following helps to ensure that no one group gains too much power?
- (A) Having a nation of people split into three groups by region.
  - (B) Having a nation of people who unanimously agree to belonging to a single faction.
  - (C) Having a nation of people who belong to the same social class so there is no minority caused by wealth.
  - (D) Having a nation of people split into many groups according to interest, social class, and other common factors.
- 8 Read the section "To Guard Society."
- What goal do the writers express in this section?
- (A) to fulfill all of the interests of the group that is in the majority
  - (B) to protect the rights of a group that is in the minority
  - (C) to ensure that powerful groups feel secure in their position
  - (D) to unite all citizens around various common interests

# The Judicial Branch

By UXL Civic, adapted by Newsela staff on 11.28.19

Word Count **813**

Level **1080L**



The front of the US Supreme Court building in Washington, DC. Photo by Getty Images.

The judicial branch of the federal government consists of the Supreme Court, district courts and courts of appeals. It is responsible for interpreting and applying the laws created by the legislative branch. According to Article III, Section 1 of the Constitution, "the judicial Power of the United States, shall be vested in one supreme Court, and in such inferior Courts as the Congress may from time to time ordain and establish."

Federal courts serve as both appellate courts and courts of first appeal. There are 94 federal district courts in the country that hear both criminal and civil cases. Federal courts also deal with cases involving multiple states, in which jurisdiction cannot be placed upon a single state court.

Criminal legal proceedings begin when a person is arrested and charged with a crime. However, the defendant (as the accused is known) is presumed innocent until he or she has admitted guilt or been proven guilty by a trial. During a trial, the defendant has a right to a lawyer. This lawyer presents arguments in defense of the defendant before a jury. If a jury finds the person not guilty, he or she is released if he was being held in jail. If a jury finds the person guilty, then the judge sentences the person based on the law. Punishment can range from a fine to prison time. In some states, people convicted of murder may be executed.

Civil cases are legal disputes between private parties. The main difference between civil and criminal cases is the potential punishment. If a party is found legally responsible in a civil suit, they are ordered by the court to pay damages to the injured party. In a criminal case, the defendant may be sentenced to imprisonment.

Sometimes, a civil or criminal case does not end after the verdict. Decisions can be appealed to a state or federal court of appeal. There, a panel of judges may review the trial record. They examine it for any error in court procedure that affected the outcome of the case. This panel may uphold the ruling, dismiss the case or, in rare instances, call for a new trial.

It is important to note that fewer than 10 percent of cases — criminal or civil — go to trial. Most are settled before the case reaches that point. In civil cases, the two sides may agree on a financial settlement. In criminal cases, the defendant may plead guilty in exchange for lesser charges or a shorter sentence.

### **The U.S. Supreme Court**

As the highest court of the land, the Supreme Court holds ultimate responsibility for the proper operation of the nation's legal system. It ensures against misinterpretations of the law by lower courts. It also establishes precedents on new laws and circumstances. The president of the United States selects a Court's justice when there is an opening, and the Senate must approve the choice before a justice can serve on the Court. Since 1869, the Court has consistently had nine justices. One of the nine justices is the chief justice, who acts as the spokesperson for the judicial branch. Justices serve until they die or choose to retire.

Unlike other federal courts, the Supreme Court chooses which cases it will hear. In order to be considered by the Supreme Court, a case has to have lost in appellate court several times. Only then can the losing side petition the Supreme Court to consider the case by requesting a writ of certiorari, or appeal for a hearing. The Court only grants a writ of certiorari if the justices feel that some aspect of the case involves previously undecided or critically important issues. The Court receives more than 7,000 petitions for a writ of certiorari every year. It grants fewer than 200 of them. When a case does go before the Supreme Court, the justices study and evaluate the evidence and arguments already put forward in earlier proceedings. They hear oral arguments, then meet to issue a decision.

### **Lower And Specialized Courts**

Congress has the constitutional power to create lower federal courts. Each is designed to address a specific sector of the justice system. Congress also has the power to create specialized courts that deal with only one topic, such as tax law or international trade. All federal courts must observe the earlier rulings by the Supreme Court. In other words, they cannot rule in contradiction to the specific interpretation of laws that the Supreme Court provides.

The judicial branch also operates the Administrative Office of the United States Courts. It is responsible for performing the administrative functions of the court system. Its staff organizes, coordinates and regulates the massive amounts of information produced by the courts. Also part of the judicial branch is the Federal Judicial Center. It collects court information and provides judges and other professionals with continuing legal education.

## Quiz

1 Read the sentence from the first paragraph of the article.

*According to Article III, Section 1 of the Constitution, "the judicial Power of the United States, shall be vested in one supreme Court, and in such inferior Courts as the Congress may from time to time ordain and establish."*

Which two words would BEST replaced "vested" and "inferior" in the sentence above?

- (A) qualified; ineffective
- (B) preferred; subpar
- (C) concentrated; unimportant
- (D) appointed; lower-ranking

2 Read the sentence from the section "The U.S. Supreme Court."

*It also establishes precedents on new laws and circumstances.*

Why did the author use the word "precedents"?

- (A) to convey a sense of presidential power
- (B) to convey a sense of fairness and tradition
- (C) to convey a sense of continuous change
- (D) to convey a sense of priority and importance

3 How are the sections organized to help develop understanding?

- (A) The sections are organized in sequential order to describe the process by which a case might make its way to the Supreme Court.
- (B) The sections are organized in chronological order to describe how the judicial branch was developed and refined over the course of history.
- (C) The sections are organized to first provide an overview of the U.S. justice system, and then to describe different types of courts in detail.
- (D) The sections are organized to provide several examples of court cases and their outcomes at various levels of the U.S. justice system.

4 What is one reason why the author includes information about the number of petitions for a writ of certiorari submitted to, and granted by, the Supreme Court each year?

- (A) to emphasize how selective the Supreme Court is in the cases it handles
- (B) to highlight the need for more than nine justices to serve on the Supreme Court
- (C) to explain why it can take such a long time for a Supreme Court case to be decided
- (D) to show the pressure Supreme Court justices experience as they prepare for trial

# How U.S. Supreme Court justices interpret the Constitution

By The Handy Law Answer Book, adapted by Newsela staff on 01.31.20

Word Count **442**

Level **1110L**



The nine U.S. Supreme Court justices on November 30, 2018. Seated (from left): Stephen G. Breyer, Clarence Thomas, Chief Justice John G. Roberts Jr., Ruth Bader Ginsburg and Samuel A. Alito. Standing (from left): Neil M. Gorsuch, Sonia Sotomayor, Elena Kagan and Brett M. Kavanaugh. Photo by: Fred Schilling/Wikimedia Commons

When addressing a Supreme Court case, the nine justices have to interpret the meaning of laws written in the Constitution. These cases are highly complex. In turn, it's rare that interpreting the Constitution is a straightforward task. To address that complexity, the nation's highest court has used several different approaches, called doctrines, when interpreting the Constitution.

## Original Intent

The first is the doctrine of original intent. It involves determining the constitutionality of a law on the basis of the original intent of the Founding Fathers. Justices who follow the doctrine of original intent often review key documents in order to "get inside the founders' heads." Such examples would include The Federalist Papers, James Madison's notes at the Constitutional Convention, and speeches made during the ratifying campaign.

## A Living Document

Some criticize the original intent method of thinking. They say that the issues before the court today are more complex than 200 years ago. They say current issues were probably never considered by the Constitution's authors. Instead, they view the Constitution as a living document, adaptable in light of the changing times. These critics maintain that a law's constitutionality should be judged in the context of the entire history of the United States as a nation. In short, whether or not a given law is constitutional should reflect society's current conditions and values. Critics say this living document doctrine is highly subjective: It reduces constitutional interpretation to an individual justice's view of history.

### **Plain Meaning Of Text**

From these two viewpoints emerged a third type of interpretation. It's often called the plain meaning of text doctrine. Under this doctrine, a law's constitutionality is measured against what the words of the Constitution obviously seem to say. Supporters of this perspective say that, unlike original intent, this measuring stick does not require debates about the intentions of a small group of men hundreds of years ago. And unlike the living Constitution theory, it does not invite a personal perspective on the country's history. However, reviewing the Constitution in terms of what it seems to say has its opponents. The Constitution's writers purposely included unclear language in order to win ratification.

### **Judicial Restraint Vs. Judicial Activism**

Justices consider these different ideas of constitutional interpretation when voting on a particular case. They may also consider previous court decisions, known as precedents. Sometimes a judge is noted for using judicial restraint. When judges are seen as exercising restraint, it means they believe in holding back when deciding whether or not to overturn a precedent. Judicial activism, on the other hand, says that sometimes precedents need to be overturned in light of society's conditions today.

## Quiz

- 1 Which section of the article BEST explains why the original intent doctrine might not be as effective as other methods?
- (A) "Original Intent"
  - (B) "A Living Document"
  - (C) "Plain Meaning Of Text"
  - (D) "Judicial Restraint Vs. Judicial Activism"
- 2 Which piece of evidence from the article BEST explains the cause of complexity in interpreting the Constitution?
- (A) To address that complexity, the nation's highest court has used several different approaches, called doctrines, when interpreting the Constitution.
  - (B) Under this doctrine, a law's constitutionality is measured against what the words of the Constitution obviously seem to say.
  - (C) The Constitution's writers purposely included unclear language in order to win ratification.
  - (D) Justices consider these different ideas of constitutional interpretation when voting on a particular case.
- 3 Which two of the following sentences from the article include central ideas of the article?
1. *When addressing a Supreme Court case, the nine justices have to interpret the meaning of laws written in the Constitution.*
  2. *To address that complexity, the nation's highest court has used several different approaches, called doctrines, when interpreting the Constitution.*
  3. *Such examples would include The Federalist Papers, James Madison's notes at the Constitutional Convention, and speeches made during the ratifying campaign.*
  4. *When judges are seen as exercising restraint, it means they believe in holding back when deciding whether or not to overturn a precedent.*
- (A) 1 and 2
  - (B) 1 and 4
  - (C) 2 and 3
  - (D) 3 and 4
- 4 Which detail from the article would be MOST important to include in a summary of the article?
- (A) Justices who follow the doctrine of original intent often review key documents in order to "get inside the founders' heads."
  - (B) Critics say this living document doctrine is highly subjective: It reduces constitutional interpretation to an individual justice's view of history.
  - (C) From these two viewpoints emerged a third type of interpretation.
  - (D) They may also consider previous court decisions, known as precedents.

# The powers of Congress

By USHistory.org on 02.13.17

Word Count **664**

Level **MAX**



The Capitol, where Congress meets, in Washington, D.C. Photo from: Wikimedia Commons

At its creation in 1789, the legislative branch was the most innovative.

Rule by kings and emperors was an old style of government, and the legislature in many ways represented the new. Almost certainly, the founders intended Congress to have more important powers than the president and the Supreme Court. However, they placed many checks and balances on the legislature that have prevented absolute power in the hands of one branch. Founders controlled power not only by checks from the other branches, but by creating a bicameral, or two-house, Congress: the Senate and the House of Representatives. The powers of Congress, then, are both constitutional and evolutionary.

## **Constitutional Powers**

The Constitution specifically grants Congress its most important power: the authority to make laws. A bill, or proposed law, only becomes a law after both the House of Representatives and the Senate have approved it in the same form. The two houses share other powers, many of which are listed in Article I, Section 8. These include the power to declare war, coin money, raise an army

and navy, regulate commerce, establish rules of immigration and naturalization, and establish the federal courts and their jurisdictions.

The Constitution also gives each house of Congress some special, exclusive powers. Such powers given to the House of Representatives include the following:

- Revenue Bills must originate in the House of Representatives. Although this power is still honored today, it tends to have blurred over the years. Often, budget bills are considered simultaneously in both houses. For example, current discussions of possible tax cuts are taking place not only in both houses, but in the executive branch as well.
- Impeachment power, the authority to charge the president and other "civil officers" with wrongdoing, is given to the House. A simple majority vote can impeach an elected official.

Special, exclusive powers given to the Senate include the following:

- Major presidential appointments must be confirmed by the Senate. The Senate offers "advice and consent" to the president by a majority vote on the appointments of federal judges, ambassadors and Cabinet positions.
- Treaties with other nations entered into by the president must be approved by a two-thirds vote by the Senate. This provision is an illustration of checks and balances, and it has served as a very important restriction to foreign policy powers of the president.
- An impeachment trial occurs in the Senate. If the House votes to impeach an elected official, the accused party gets a hearing in the Senate. A two-thirds majority can convict the individual and remove him or her from office.

## Evolutionary Powers

The "elastic," or implied powers, clause gives Congress the authority to pass laws it deems "necessary and proper" to carry out its enumerated functions. Many congressional powers that have evolved over the years are based on this important clause. Here are a couple:

- **Oversight of the budget.** Congress reviews and restricts the annual budget prepared by the executive branch. When a law is passed setting up a government program, Congress must pass an authorization bill that states the maximum amount of money available. When the nation's budget is set, only Congress can set the appropriations — the actual amount available in a fiscal year — for each program that it has authorized.
- **Investigation.** Congress may investigate both issues that warrant study and wrongdoings by public officials. Through committee hearings, Congress has examined issues such as crime, consumer safety, health care and foreign trade. Although Congress must abide by protected individual rights, their committees have examined many allegations against elected officials. Famous recent investigations include the Whitewater and the Clinton-Lewinsky hearings.

The American Congress has more power than any legislature among the world's modern democracies. The parliaments of Europe are often "arena" legislatures that provide a forum for

**Important Constitutional Differences  
Between the House and the Senate**

House	Senate
Initiates all revenue bills	Must confirm many major presidential appointments
Initiates impeachment procedures and passes articles of impeachment	Tries impeachment officials
Two-year terms	Six-year terms (One-third up for reelection every two years)
435 members (apportioned by population)	100 members (two from each state)
	Approves treaties

debate on policies proposed by a powerful prime minister or president. Only the American democracy enables its legislature with the critical role of setting the lawmaking agenda.

## Quiz

- 1 What are the two CENTRAL ideas of the article?
- (A) The Founding Fathers wanted the president to have more power than Congress and the Supreme Court; checks and balances help to prevent one branch from taking over.
  - (B) Congress has many elastic powers, such as setting the budget and conducting investigations; the American Congress is more powerful than European legislatures, which are headed by powerful leaders.
  - (C) Congress has the power to make laws and other more flexible powers to use as needed; Congress has checks and balances to prevent the other branches of government from having too much control.
  - (D) Congress is bicameral, which means that it has the Senate and the House of Representatives; the Senate has special powers the House does not have.
- 2 Which paragraph in the section "Evolutionary Powers" BEST reflects the central idea that Congress is unique in the authority it has?
- 3 Which answer choice BEST describes the structure of the article?
- (A) The article explains the two types of power that Congress has.
  - (B) The article explains two perspectives on the power of Congress.
  - (C) The article describes the history of how Congress accumulated its authority.
  - (D) The article compares and contrasts the Congress with the judicial and executive branches.
- 4 What purpose is served by including examples of the implied powers of Congress?
- (A) It shows how implied powers give the Senate more power than the Supreme Court.
  - (B) It shows how implied powers work differently in the House than in the Senate.
  - (C) It shows how implied powers affect the budget and taxation of the country.
  - (D) It shows how implied powers differ from Constitutional powers.

# How a bill becomes law

By House.gov on 01.03.17

Word Count **860**

Level **MAX**



President Barack Obama speaks to Congress regarding health care reform on September 9, 2009. Photo: Whitehouse.gov

Creating laws is the most important job of Congress. All laws in the United States begin as bills. Before a bill can become a law, it must be approved by the U.S. House of Representatives, the U.S. Senate and the President. Let's follow a bill's journey to become law.

## **The Bill Begins**

Laws begin as ideas. These ideas may come from a Representative — or from a citizen like you. Citizens who have ideas for laws can contact their Representatives to discuss their ideas. If the Representatives agree, they research the ideas and write them into bills.

## **The Bill Is Proposed**

When a Representative has written a bill, the bill needs a sponsor. The Representative talks with other Representatives about the bill in hopes of getting their support for it. Once a bill has a sponsor and the support of some of the Representatives, it is ready to be introduced.

## **The Bill Is Introduced**

In the U.S. House of Representatives, a bill is introduced when it is placed in the hopper — a special box on the side of the clerk’s desk. Only Representatives can introduce bills in the U.S. House of Representatives.

When a bill is introduced in the U.S. House of Representatives, a bill clerk assigns it a number that begins with H.R. A reading clerk then reads the bill to all the Representatives, and the Speaker of the House sends the bill to one of the House standing committees.

### **The Bill Goes To Committee**

When the bill reaches committee, the committee members — groups of Representatives who are experts on topics such as agriculture, education or international relations — review, research and revise the bill before voting on whether or not to send the bill back to the House floor.

If the committee members would like more information before deciding if the bill should be sent to the House floor, the bill is sent to a subcommittee. While in subcommittee, the bill is closely examined and expert opinions are gathered before it is sent back to the committee for approval.

### **The Bill Is Reported**

When the committee has approved a bill, it is sent — or reported — to the House floor. Once reported, a bill is ready to be debated by the U.S. House of Representatives.

### **The Bill Is Debated**

When a bill is debated, Representatives discuss the bill and explain why they agree or disagree with it. Then, a reading clerk reads the bill section by section and the Representatives recommend changes. When all changes have been made, the bill is ready to be voted on.

### **The Bill Is Voted On**

There are three methods for voting on a bill in the U.S. House of Representatives:

1. **Viva Voce (voice vote):** The Speaker of the House asks the Representatives who support the bill to say “aye” and those that oppose it say “no.”
2. **Division:** The Speaker of the House asks those Representatives who support the bill to stand up and be counted, and then those who oppose the bill to stand up and be counted.
3. **Recorded:** Representatives record their vote using the electronic voting system. Representatives can vote yes, no or present (if they don’t want to vote on the bill). If a majority of the Representatives say or select yes, the bill passes in the U.S. House of Representatives. The bill is then certified by the Clerk of the House and delivered to the U.S. Senate.

### **The Bill Is Referred To The Senate**

When a bill reaches the U.S. Senate, it goes through many of the same steps it went through in the U.S. House of Representatives. The bill is discussed in a Senate committee and then reported to the Senate floor to be voted on.

Senators vote by voice. Those who support the bill say “yea,” and those who oppose it say “nay.” If a majority of the Senators say “yea,” the bill passes in the U.S. Senate and is ready to go to the

president.

### **The Bill Is Sent To The President**

When a bill reaches the president, he has three choices. He can:

1. Sign and pass the bill — the bill becomes a law.
2. Refuse to sign, or veto, the bill — the bill is sent back to the U.S. House of Representatives, along with the president's reasons for the veto. If the U.S. House of Representatives and the U.S. Senate still believe the bill should become a law, they can hold another vote on the bill. If two-thirds of the Representatives and Senators support the bill, the president's veto is overridden and the bill becomes a law.
3. Do nothing (pocket veto) — if Congress is in session, the bill automatically becomes law after 10 days. If Congress is not in session, the bill does not become a law.

### **The Bill Is A Law**

If a bill has passed in both the U.S. House of Representatives and the U.S. Senate and has been approved by the president, or if a presidential veto has been overridden, the bill becomes a law and is enforced by the government.

## Quiz

- 1 Which of the following aspects of the article is NOT thoroughly discussed?
- (A) how a bill is introduced to the House of Representatives
  - (B) why the House votes three ways but the Senate only votes one way
  - (C) how a presidential veto may be overridden
  - (D) why a bill may be sent to a subcommittee review
- 2 Which selection from the article BEST supports the idea that bills are carefully crafted before being debated?
- (A) Citizens who have ideas for laws can contact their Representatives to discuss their ideas. If the Representatives agree, they research the ideas and write them into bills.
  - (B) The Representative talks with other Representatives about the bill in hopes of getting their support for it. Once a bill has a sponsor and the support of some of the Representatives, it is ready to be introduced.
  - (C) When the bill reaches committee, the committee members — groups of Representatives who are experts on topics such as agriculture, education or international relations — review, research and revise the bill before voting on whether or not to send the bill back to the House floor.
  - (D) While in subcommittee, the bill is closely examined and expert opinions are gathered before it is sent back to the committee for approval.
- 3 How do the first and final paragraphs of the article relate to one another?
- (A) The first paragraph suggests that all laws begin as bills that must be approved, and the final paragraph describes what may happen if there is a presidential veto that keeps a bill out of law.
  - (B) The first paragraph suggests that Congress has one main job and that is creating laws, and the final paragraph describes how members of Congress feel after completing this job.
  - (C) The first paragraph introduces the idea that creating a law is a lengthy process, and the final paragraph explains the final results of that process.
  - (D) The first paragraph introduces the idea that the House and Senate are part of Congress, and the final paragraph explains their complete roles and functions in Congress.
- 4 Which option BEST describes the structure of the article?
- (A) The article describes the most difficult obstacles that must be overcome by lawmakers trying to get bills passed.
  - (B) The article outlines the various steps Congress takes between the first idea for a bill and enforcing a bill as a law.
  - (C) The article lists the functions of the House of Representatives in interacting with their constituents to create a bill.
  - (D) The article illustrates the cooperation between members of the House and the Senate in revising bills and laws.