

Lesson 8

Verb Moods



Introduction

Verb moods indicate the writer's view as to whether a statement is a fact, a command, a question, a possibility, or something that is contrary to fact.

Verb Mood	Example
Indicative expresses a fact or opinion.	The election will be on Tuesday.
Imperative gives a command, omitting the subject.	Remember to vote.
Interrogative asks a question.	Have you met all the candidates?
Conditional expresses a possibility or uncertainty, often using <i>could</i> , <i>would</i> , or <i>might</i> .	Kim would make the best president.
Subjunctive expresses something contrary to fact, or makes a suggestion, using a <i>that</i> clause.	I wish Tyler were a candidate. I recommend <u>that</u> you vote for Kim.

- When you use the subjunctive mood with a singular subject, use the plural verb form in most cases. If the verb is *be*, use the past plural, *were*, when expressing something contrary to fact.

I suggest that he **join** (not *joins*) the campaign.

Jenna acts as if she **were** (not *was* or *is*) already president.

- When a main clause uses conditional words like *would* or *might*, these words are often unnecessary in the subordinate clause and should be avoided.

I **would have** voted for Maya if she **had** (not *would have*) asked me.



Guided Practice

Rewrite each sentence, changing the mood as indicated in parentheses.

Hint

You can combine a subordinate clause that is subjunctive with a main clause that is conditional.

Example:

If I were you, I would register to vote.

- If it is not too late, I will vote. (subjunctive and conditional; see Hint) _____
- Will you vote for Harry for president? (imperative)

- He commands the stage like a movie star. (subjunctive, using "as if") _____
- Harry would be an excellent president. (indicative)



Independent Practice

For numbers 1–5, choose the correct answer.

- 1** If you want an intelligent leader, you should choose Marty.

Which revision changes the underlined clause from the conditional to the imperative mood?

- A** choose Marty
- B** you will choose Marty
- C** Marty might be the best choice
- D** Marty would be the best choice

- 2** If all the votes have been counted, is Marty the winner?

Which revision changes the underlined clause from the interrogative to the indicative mood?

- A** Marty should be the winner.
- B** Marty would be the winner.
- C** Marty were the winner.
- D** Marty is the winner.

- 3** They will be surprised when you announce the winner.

Which revision changes the underlined clause from the indicative to the conditional mood?

- A** They might be surprised
- B** Will they be surprised
- C** Surprise them
- D** They were surprised

Answer Form

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

Number Correct 5

- 4** The committee urged that Travis should consider his vote carefully.

Which of the following is the best substitute for the underlined verb phrase in the sentence?

- A** consider
- B** will consider
- C** considers
- D** would consider

- 5** If Lori was a candidate, I would have voted for her.

Which of the following is the best substitute for the underlined verb in the sentence?

- A** will be
- B** is
- C** were
- D** could be



Independent Practice

For numbers 1 and 2, read the sentences. Which revision best corrects the shift in verb mood?

- 1** Find out how to get tickets, and it is a good idea to buy them right away.
- A** Find out how to get tickets, and buy them right away.
 - B** You will need to find out how to get tickets, and make sure to buy them right away.
 - C** Did you find out how to get tickets, and it is a good idea to buy them right away?
 - D** Find out how to get tickets, and is it a good idea to buy them right away?

- 2** Melissa Podcasy is a wonderful dancer, and enjoy watching her perform.
- A** Melissa Podcasy is a wonderful dancer, and will you enjoy watching her perform?
 - B** Melissa Podcasy is a wonderful dancer, and you will enjoy watching her perform.
 - C** Is Melissa Podcasy a wonderful dancer, and might you enjoy watching her perform?
 - D** Melissa Podcasy would be a wonderful dancer, and enjoy watching her perform.

Answer Form

1 (A) (B) (C) (D)

2 (A) (B) (C) (D)

3 (A) (B) (C) (D)

4 (A) (B) (C) (D)

Number
Correct

4

For numbers 3 and 4, read the sentences. Which revision best corrects the shift in verb voice?

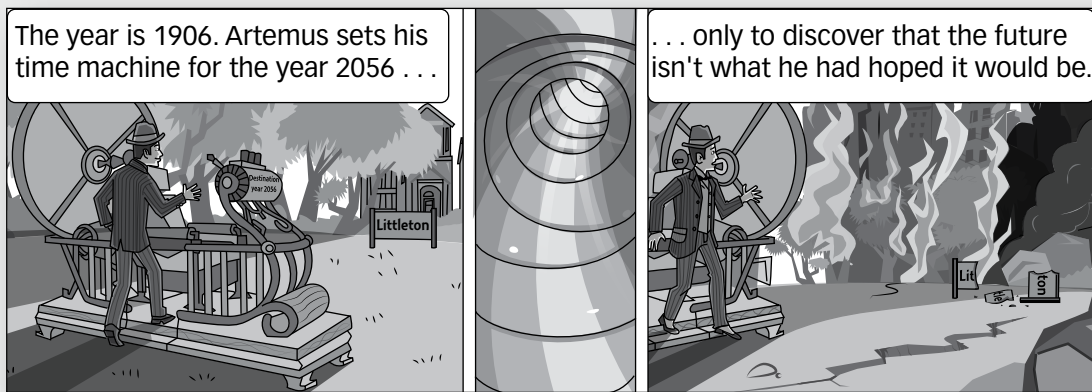
- 3** Podcasy performed with the ballet, and tours were arranged for her by Columbia Artists.
- A** Podcasy has performed, and tours have been arranged for her.
 - B** Podcasy performed with the ballet, and tours have been arranged for her by Columbia Artists.
 - C** Podcasy performed with the ballet, and Columbia Artists arranged tours for her.
 - D** Podcasy was performed with the ballet, and tours happened.
- 4** Performances have been arranged by dancer Timour Bourtasenkov, and he has starred in many roles.
- A** Performances have been arranged, and dancer Timour Bourtasenkov has starred in many roles.
 - B** Performances, arranged by dancer Timour Bourtasenkov, and he has starred in many roles.
 - C** Performances were arranged by dancer Timour Bourtasenkov, and he starred in many roles.
 - D** Dancer Timour Bourtasenkov has arranged performances, and he has starred in many roles.

Summarizing Literary Texts

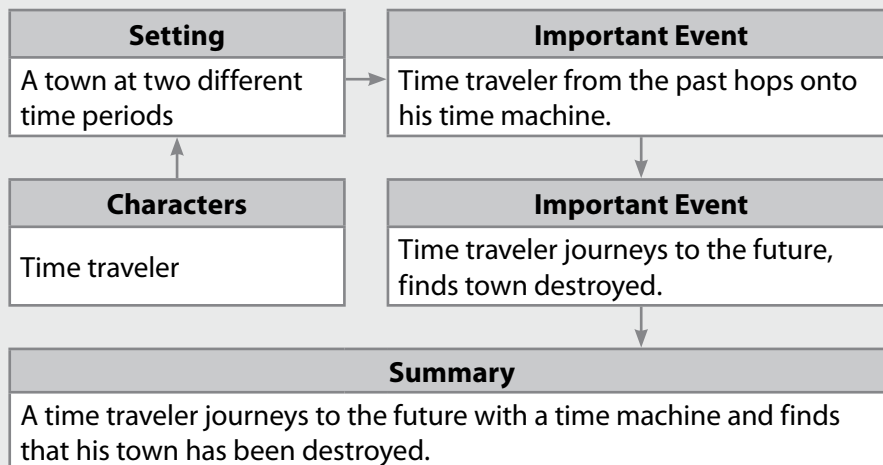
Theme: *Views of Other Worlds*

Your best friend missed her favorite show. She knows you watch it, too, and calls asking you to **summarize** what happened. When you summarize, you briefly retell the main characters, setting, conflict, and important events. To paint as clear a picture as possible, you make sure your summary is **objective**, or free of your own opinions.

Study these images about a time traveler. Look for details about character, setting, and events.



Now review the graphic organizer below. Notice that it includes only essential details, tells events in the order they happened, and is free of personal opinions.



Summarizing isn't just a way for you to describe a story to others. It can also be a tool to help you understand what you're reading. Stop occasionally to summarize what has happened. Be sure you include only the most important details. This process will help you check your understanding of a text and remember important details.



Read the first three paragraphs of this science fiction story.

Genre: Science Fiction

Touchdown on Spectra Omicron 8 *by William Nicols*

This just in! The UFP Ulysses vessel has touched down on the planet Spectra 8. This signifies the first stage in its terraforming expedition. The complex multi-stage terraforming process will make Spectra's atmosphere more like that of Earth and livable for humans.

Captain Jane Young and her crew of 21 blasted off in May of 2218 for the 6-year journey through deep space to reach the lifeless planet. They encountered a number of problems along the way. First, they were stuck in the gravitational pull of an anti-matter black hole. They also had to deal with a salmonella outbreak in the ship's food storage.

In October of this year, the Ulysses established orbit. Lieutenant Bobby Sullivan piloted the vessel toward the planet's surface. He set the angle-of-entry so the ship would not burn up when passing through the atmosphere. After securing visual confirmation of the landing site, Sullivan deployed the landing gear, applied the thrusters, and brought the ship in for a soft three-point landing.

(continued)

Explore how to answer this question: *"How can you best summarize this part of the story?"*

Remember that a summary is a brief retelling that includes the main characters, setting, and important events. Underline each of these things in the story above.

Summaries should be objective, or free of opinions and judgments. Read the following summary of the story. Cross out any opinions and personal feelings in the summary.

In the year 2218, the Ulysses sets off on a really dangerous mission to begin the terraforming of planet Spectra 8. They have to deal with some scary problems along the way, but they finally reach the planet. The most interesting part is how pilot Bobby Sullivan brings the ship in for a safe landing.

- "Really dangerous" in the first sentence is an opinion and not a detail from the text. Cross it out.
- The word "scary" in the second sentence is another opinion. Cross it out, too.
- Remove "The most interesting part," which is a judgment.

Find a partner and work together to improve this part of the summary. Include additional information about the characters, setting, and important events. Also be sure to keep the summary objective by avoiding opinions and judgments, such as "My favorite part was . . ." or "It was great how . . ."



Close Reading

Before you start summarizing, **underline** the names of important characters as well as clues about the setting. **Circle** important events.

Hint

Avoid answer choices that include an opinion or unimportant details.

Continue reading the science fiction story. Then answer the question that follows.

(continued from page 78)

Now that the Ulysses has landed, it is time for Young and her team to begin exploring the planet’s surface. Spectra Omicron 8 is little more than loose rocks of red clay. One of Captain Young’s top priorities is establishing the Ulysses base camp with its many domed sections. With so much carbon monoxide in the atmosphere, oxygen corridors must be built to connect the domes, which will be used for farming, geological research, and communications. A molten-carbon drill will then be constructed in the camp’s center to burrow through to the planet’s core, carrying the terraforming unit that will aid in surface reconstruction.

Circle the correct answer.

Which is the best summary for this portion of the text?

- A** Captain Young explores the planet’s surface and begins building the base camp.
- B** Captain Young shows she is a strong leader by quickly establishing the base camp.
- C** The domes in the base camp will be used for farming, geological research, and communications.
- D** The drill at the center of the camp is made from molten-carbon.



Show Your Thinking

Explain why the other answer choices are not good summaries of the second part of the text.



Take turns briefly summarizing the entire story with a partner, using details about character, setting, and important events. Make sure your summaries are free of opinions and judgments.



Read the science fiction story. Use the Study Buddy and the Close Reading to guide your reading.

Genre: Science Fiction



As I read, I will pause to summarize who the characters are, where the story is set, and what some of the important events are.

Close Reading

In addition to the narrator, who are the main characters in the story? **Circle** the first mention of each one.

Underline important details that provide clues about where Allya was and the alien they have encountered.

Prime Contact

by Justin Greenfield

Imperator's log, the 36th of Quelnar, 4278

- 1 Today I had a fascinating meeting with a promising new captain by the name of Allya. The first thing I noticed about her was the remarkable hue of her purple eyes, much more vibrant than the rest of ours.
- 2 At any rate, she relayed to me how her crew had recently returned from a mission to the third planet from the central star, where they had an encounter with one of the dominant life forms. I inquired as to the extent of the creatures' technology, and Allya replied that they had advanced machines but preferred to let their servants operate them. These servants live with them—in fact, there are often several servants in each home. They walk about on two legs, prepare food, and feed their four-legged masters.
- 3 Allya then told me that a member of this alien race had returned with them on their ship. Of course, I asked to see the creature straight away, and when it was brought into my throne room, I was taken with how friendly it appeared, inviting but cautious. Its wide, green eyes were alert and confident, but—dare I say—bored?
- 4 Since it was a very short and very furry sort of alien, I lay down on the floor to establish better verbal communication with it. I welcomed it to Harlapan, home of the Galactic Confederacy. The creature stretched out its front legs and appeared to bow. I distinctly heard an odd purring sound coming from it. A form of telepathic language it shares with its species, perhaps?
- 5 “Meow,” it said with great dignity before turning to the task of licking its paws. Fascinating.



Hints

Which of the four answer choices is an important statement about the story that does not contain an opinion?

Omit the choices that are not connected to the ending, or that are unimportant or not objective.

The story tells the events in a certain order. That is not, however, the order in which the events actually happened in time.

Use the Hints on this page to help you answer the questions.

- 1 Which of the following would you include in a summary of "Prime Contact"?
 - A It's very funny that the Emperor doesn't realize that the alien is a house cat.
 - B The Emperor of Harlapan asks to meet the alien that has returned with Allya.
 - C The alien loses interest in the Emperor and starts licking its paws.
 - D The Emperor is fascinated by Allya's remarkable purple eyes.
- 2 Which is the best summary for the last events of the story?
 - A Allya travels to the third planet and brings back an alien.
 - B The people of Harlapan are clearly very advanced.
 - C The servants the Emperor describes must be humans.
 - D The alien meows and licks its paws, revealing that it's a cat.
- 3 The notes for a summary need to be arranged correctly into the order in which the events occur in the passage.

Indicate the correct chronological order of the events below by writing the numbers 1 to 8 on the blank before each sentence.

- _____ An alien creature boards Allya's ship.
- _____ Captain Allya tells how the servants care for their masters.
- _____ The Emperor lies down on the floor.
- _____ The Emperor meets with Captain Allya.
- _____ Allya and her crew visit another planet.
- _____ The Emperor notices the alien's confidence.
- _____ The alien makes a strange purring sound.
- _____ The Emperor asks to meet the alien.



Read the story. Then answer the questions that follow.

from *The War of the Worlds*

by H. G. Wells

Earth was not prepared for the Martian invasion that began in a field outside of London. Disbelief turned to horror as the Martian forces spread throughout the country, destroying everything in their path. No human weapons were able to stop their deadly attacks and superior technology. Then a sudden and surprising set of events occurred that changed everything.

1 I came upon the wrecked handling-machine halfway to St. John's Wood station. At first I thought a house had fallen across the road. It was only as I clambered among the ruins that I saw, with a start, this mechanical Samson lying, with its tentacles bent and smashed and twisted, among the ruins it had made. The forepart was shattered. It seemed as if it had driven blindly straight at the house, and had been overwhelmed in its overthrow. It seemed to me then that this might have happened by a handling-machine escaping from the guidance of its Martian. I could not clamber among the ruins to see it, and the twilight was now . . . far advanced. . . .

2 Wondering still more at all that I had seen, I pushed on towards Primrose Hill. Far away, through a gap in the trees, I saw a second Martian, as motionless as the first, standing in the park towards the Zoological Gardens, and silent. A little beyond the ruins about the smashed handling-machine I came upon the red weed¹ again, and found the Regent's Canal, a spongy mass of dark-red vegetation. . . .

3 Great mounds had been heaped about the crest of the hill, making a huge redoubt² of it—it was the final and largest place the Martians had made—and from behind these heaps there rose a thin smoke against the sky. Against the sky line an eager dog ran and disappeared. The thought that had flashed into my mind grew real, grew credible. I felt no fear, only a wild trembling exultation, as I ran up the hill towards the motionless monster. Out of the hood hung lank shreds of brown, at which the hungry birds pecked and tore.

4 In another moment I had scrambled up the earthen rampart and stood upon its crest, and the interior of the redoubt was below me. A mighty space it was, with gigantic machines here and there within it, huge mounds of material and strange shelter places. And scattered about it, some in their overturned war-machines, some in the now rigid handling-machines, and a dozen of them stark and silent and laid in a row, were the Martians—dead—slain by the putrefactive³ and disease bacteria against which their systems were unprepared; slain as late the red weed was being slain; slain, all after man's devices had failed, by the humblest things that God, in his wisdom, has put forth upon this earth.

¹ **red weed:** a fictional plant native to Mars

² **redoubt:** temporary fortification, or wall built as a defense

³ **putrefactive:** rotting, having a foul odor



5 For so it had come about, as indeed I and many men might have foreseen had not terror and disaster blinded our minds. These germs of disease have taken toll of humanity since life began here. . . . But there are no bacteria on Mars, and directly these invaders arrived, directly they drank and fed, our microscopic allies began to work their overthrow.

Answer Form

1 (A) (B) (C) (D)

2 (A) (B) (C) (D)

3 (A) (B) (C) (D)

4 (A) (B) (C) (D)

**Number
Correct**

/ 4

- 1** Which detail from paragraph 1 would be **least** important to include in a summary of the paragraph?
- A** On the way to St. John's Wood station, the narrator finds a demolished handling-machine.
 - B** The machine seems to have collapsed in the middle of destroying a house.
 - C** The narrator believes that the wreckage might be the result of a Martian losing control of the machine.
 - D** Due to the lack of light, the narrator cannot see inside the wreck.
- 2** Which of the following is **not** an objective statement of events?
- A** The narrator notices a second smashed and motionless handling-machine as he continues on his way towards Primrose Hill.
 - B** The aliens probably felt they had nothing to fear from the weak creatures of Earth.
 - C** After seeing smoke behind the Martian redoubt, the narrator has a thought that causes him to run eagerly toward another immobile machine.
 - D** The remains of a Martian's body are hanging out of the hood of one of the machines.
- 3** Which statement is the **best** summary of paragraph 2?
- A** As the narrator approaches Primrose Hill, he finds more signs of the dying Martians.
 - B** The narrator explores the area around the Zoological Gardens and the Regent's Canal.
 - C** Curious about the crashed machine, the narrator makes his way toward Primrose Hill.
 - D** Two Martian machines have mysteriously broken down, and the narrator investigates.

Read the passage. Then answer the questions that follow.

from *Five Weeks in a Balloon*

by Jules Verne

published by George Routledge and Sons, 1876

1 Dr. Ferguson had a friend—not another self, indeed, an alter ego, for friendship could not exist between two beings exactly alike.

2 But, if they possessed different qualities, aptitudes, and temperaments, Richard Kennedy and Samuel Ferguson lived with one and the same heart, and that gave them no great trouble. In fact, quite the reverse. . . .

3 The acquaintanceship of these two friends had been formed in India, when they belonged to the same regiment. While Richard would be out in pursuit of the tiger and the elephant, Samuel would be in search of plants and insects. Each could call himself expert in his own province, and more than one rare botanical¹ specimen, that to science was as great a victory won as the conquest of a pair of ivory tusks, became the doctor's booty.

4 Since their return to England they had been frequently separated by the doctor's distant expeditions; but, on his return, the latter never failed to go, not to ASK for hospitality, but to bestow some weeks of his presence at the home of his crony Richard.

5 The Scot talked of the past; the doctor busily prepared for the future. The one looked back, the other forward. Hence, a restless spirit personified in Ferguson; perfect calmness typified in Kennedy—such was the contrast.

6 After his journey to the Thibet, the doctor had remained nearly two years without hinting at new explorations; and Richard, supposing that his friend's instinct for travel and thirst for adventure had at length died out, was perfectly enchanted. They would have ended badly, some day or other, he thought to himself; no matter what experience one has with men, one does not travel always with impunity² among cannibals and wild beasts. So, Kennedy besought the doctor to tie up his bark for life, having done enough for science, and too much for the gratitude of men.

7 The doctor contented himself with making no reply to this. He remained absorbed in his own reflections, giving himself up to secret calculations, passing his nights among heaps of figures, and making experiments with the strangest-looking machinery, inexplicable to everybody but himself. It could readily be guessed, though, that some great thought was fermenting³ in his brain.

8 “What can he have been planning?” wondered Kennedy, when, in the month of January, his friend quitted him to return to London.

9 He found out one morning when he looked into the Daily Telegraph.

10 “Merciful Heaven!” he exclaimed, “the lunatic! the madman! Cross Africa in a balloon! Nothing but that was wanted to cap the climax! That's what he's been bothering his wits about these two years past!”

¹ **botanical:** relating to plants

² **impunity:** being free from punishment or harm

³ **fermenting:** being in a state of intense activity

Go On

11 . . . On that very evening Kennedy, half alarmed, and half exasperated, took the train for London, where he arrived next morning.

12 Three-quarters of an hour later a cab deposited him at the door of the doctor's modest dwelling, in Soho Square, Greek Street. Forthwith he bounded up the steps and announced his arrival with five good, hearty, sounding raps at the door.

13 Ferguson opened, in person.

14 "Richard! You here?" he exclaimed, but with no great expression of surprise, after all.

15 "Richard himself!" was the response. . . .

16 "And what have you come to town for?"

17 "To prevent the greatest piece of folly that ever was conceived."

18 "Folly!" said the doctor.

19 "Is what this paper says, the truth?" rejoined Kennedy, holding out the copy of the Daily Telegraph, mentioned above.

20 "Ah! That's what you mean, is it? These newspapers are great tattlers! But, sit down, my dear Richard."

21 "No, I won't sit down!—Then, you really intend to attempt this journey?"

22 "Most certainly! All my preparations are getting along finely, and I—"

23 "Where are your traps? Let me have a chance at them! I'll make them fly! I'll put your preparations in fine order." And so saying, the gallant Scot gave way to a genuine explosion of wrath.

24 "Come, be calm, my dear Richard!" resumed the doctor. "You're angry at me because I did not acquaint you with my new project."

25 "He calls this his new project!"

26 "I have been very busy," the doctor went on, without heeding the interruption; "I have had so much to look after! But rest assured that I should not have started without writing to you."

27 "Oh, indeed! I'm highly honored."

28 "Because it is my intention to take you with me."

29 Upon this, the Scotchman gave a leap that a wild goat would not have been ashamed of among his native crags.

30 "Ah! Really, then, you want them to send us both to Bedlam!"

31 "I have counted positively upon you, my dear Richard, and I have picked you out from all the rest."

32 Kennedy stood speechless with amazement. . . .

33 But he made up his mind to oppose his friend's departure by all means in his power, and so pretended to give in, at the same time keeping on the watch. As for the doctor, he went on diligently with his preparations.

17 This question has two parts. First, answer part A. Then, answer part B.

Part A

How does Richard Kennedy feel when he reads the newspaper article about Samuel Ferguson's plan?

- A** He is shocked.
- B** He is angry but amused.
- C** He is nervous.
- D** He is secretly proud.

Part B

Which sentence from the story **best** supports the answer to part A?

- A** "While Richard would be out in pursuit of the tiger and the elephant, Samuel would be in search of plants and insects."
- B** "The Scot talked of the past; the doctor busily prepared for the future."
- C** "'Merciful Heaven!' he exclaimed, 'the lunatic! the madman!'"
- D** "'Oh, indeed! I'm highly honored.'"

18 What themes are revealed through the descriptions and interactions of Richard Kennedy and Samuel Ferguson? Select all that apply.

- A** True friends are willing to forgive past mistakes.
- B** Even the closest friends face challenges in their relationship.
- C** Even the best friendships can fade over time.
- D** Good friends always agree about important issues.
- E** Friendship is more important than success.
- F** Close friendships can develop between very different people.

Go On

19 Read the dialogue in paragraphs 21 through 27 of the excerpt. What does the dialogue reveal about Richard Kennedy?

- A** He is hurt because the doctor didn't tell him about the plans.
- B** He is outraged because he considers the trip to be dangerous.
- C** He is impatient to get started on the journey.
- D** He is pleased that he will be included on the trip.

20 The ancient Greek poem *The Odyssey* tells of the journey Odysseus makes to return to his home after the Trojan War and the many obstacles he faces and strange worlds he encounters. Based on the excerpt, how is the universal theme of the journey different in *Five Weeks in a Balloon*?

- A** The main character knows he must make the journey alone without help from others.
- B** The main character chooses to leave home and seek out adventure.
- C** The main character does not have a home that he can return to.
- D** The main character's journey will take him to a familiar and popular place.

Read the following excerpt from a play adapted from *Five Weeks in a Balloon*.

It is morning, outside Dr. Samuel Ferguson's modest home in London. Richard Kennedy exits a cab, runs up the steps, and pounds on the door. Samuel opens it.

SAMUEL [Enthusiastic but not surprised]: Well hello, Richard! What are you doing here?

RICHARD [Shaken]: What do you think? I'm here to stop you from committing the most outrageous foolishness of your life!

SAMUEL [Furrowing his brow]: Foolishness?

RICHARD [Holding out and waving a copy of the Daily Telegraph, open to the article about Samuel and his plan to cross Africa in a balloon]: Is it true what the paper says? What on earth can you be thinking?

SAMUEL [Smiling]: Is that what all this fuss is about? Come inside, my dear friend, and take a seat.

[The two men step inside and enter Samuel's front room. Samuel gestures toward the couch.]

RICHARD: [Angrily.] No, I will not sit down! Are you honestly going to attempt this ill-fated journey?

SAMUEL: [Calmly] Absolutely. All my preparations are coming along most smoothly.

Compare and contrast how the differing structures of the story and the play contribute to the communication of meaning. Use details from both texts to support your response.

Go On

Read the story. Then answer the questions that follow.

from *A Pair of Silk Stockings*

by Kate Chopin, 1876

1 Little Mrs. Sommers one day found herself the unexpected possessor of fifteen dollars. It seemed to her a very large amount of money, and the way in which it stuffed and bulged her worn old *porte-monnaie*¹ gave her a feeling of importance such as she had not enjoyed for years.

2 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.

3 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*² 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.

4 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 to-morrow never comes.

5 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.

6 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!

¹ **porte-monnaie:** a small pocketbook or wallet for carrying money

² **percale:** a kind of fabric usually used for making sheets and clothing

Go On

7 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 nearby announced that they had been reduced in price from two dollars and fifty cents to one dollar and ninety-eight cents; 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.

8 Two hectic blotches came suddenly into her pale cheeks. She looked up at the girl.

9 “Do you think there is any eights-and-a-half among these?”

10 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.

11 “A dollar and ninety-eight cents,” she mused aloud. “Well, I’ll take this pair.” She handed the girl a five-dollar 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.

12 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.

6 This question has two parts. First, answer part A. Then, answer part B.

Part A

In the last paragraph, what does the reader understand about Mrs. Sommers that she probably does not understand herself?

- A** She has just taken the silk stockings without paying.
- B** She has forgotten how to behave properly in public.
- C** She is not able to think clearly because she is so upset.
- D** She longs for the life she had before she had children.

Part B

Which sentence from the passage **best** supports the answer to part A?

- A** "Mrs. Sommers after that did not move in the direction of the bargain counter."
- B** "She took the elevator, which carried her to an upper floor into the region of the ladies' waiting-rooms."
- C** "Here, in a retired corner, she exchanged her cotton stockings for the new silk ones which she had just bought."
- D** "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."

7 What does Mrs. Sommers' plan for using the money help the reader understand about what kind of person she is? Select all that apply.

- A** Her plan shows that she enjoys spending money on herself.
- B** Her plan shows that she is used to putting others before herself.
- C** Her plan shows that she often does things without thinking.
- D** Her plan shows that she does not really care about her family.
- E** Her plan shows that she behaves practically and sensibly.

Go On

- 8** What effect does the author create by comparing the silk stockings to a “tiara of diamonds”?
- A** The author expresses that the stockings are a luxury item.
 - B** The author implies that the stockings are shiny.
 - C** The author illustrates that the stockings are delicate.
 - D** The author suggests that the stockings are covered in jewels.

- 9** Many religious works include a character who gives in to temptation. For example, the Bible includes the story of Adam and Eve, in which Eve is tempted to eat a piece of forbidden fruit by a serpent. How does the character of Mrs. Sommers update this common literary character type?
- A** Because it is set in a city instead of a garden, Mrs. Sommers is tempted to spend extra money on her daughter’s shoes instead of being tempted to take a bite from the forbidden fruit.
 - B** Because the character of Mrs. Sommers is a mother, she is tempted to buy too many items for her children instead of being tempted to take a bite from the forbidden fruit.
 - C** Because of the more modern setting, Mrs. Sommers is tempted to spend money on what she wants instead of being tempted to take a bite from the forbidden fruit.
 - D** Because the character of Mrs. Sommers is poor, she is tempted to steal a pair of stockings from a store instead of being tempted to take a bite from the forbidden fruit.

- 10** Which of the following choices **best** summarizes this passage?
- A** After Mrs. Sommers comes into possession of fifteen dollars, she decides to use the money on clothes for her children. However, she ends up spending some of it on a pair of silk stockings for herself.
 - B** Mrs. Sommers goes to the store to buy a new pair of stockings. While there, she also purchases a variety of shoes, cloth, gown patterns, caps, and sailor-hats for her children.
 - C** Mrs. Sommers has an admirable plan for using the money she finds, but her good intentions don’t last when she sees a beautiful pair of stockings. She spends all of the money on stockings.
 - D** When Mrs. Sommers comes into an unexpected sum of money, she sees an opportunity for providing her children with new clothing. She plans to use her knowledge of bargains as she shops.

11

Read the statements below. One describes a theme of the passage and the other describes how this theme is developed through the passage's setting. Find a sentence from the story that supports each statement. Then write it in the box beside the statement it supports.

Theme	It can be difficult to live in the service of others.	Support from the passage:
How the setting helps develop this theme	The setting of the store provides Mrs. Sommers with the option of doing something for herself.	Support from the passage:

Go On

Lesson 3 Introduction

8.NS.A.1
8.NS.A.2

Understand Rational and Irrational Numbers



Think It Through

What are rational numbers?

Rational numbers are numbers that can be written as the quotient of two integers. Since the bar in a fraction represents division, every fraction whose numerator and denominator is an integer is a rational number.

Any number that *could* be written as a fraction whose numerator and denominator are integers is also a rational number.

Think Every integer, whole number, and natural number is a rational number.

You can write every integer, whole number, and natural number as a fraction. So they are all rational numbers.

$$3 = \frac{3}{1} \quad -5 = -\frac{5}{1} \quad 0 = \frac{0}{1} \quad \sqrt{25} = 5 \text{ or } \frac{5}{1}$$

The square root of a perfect square is also a rational number.



Think Every terminating decimal is a rational number.

You can write every terminating decimal as a fraction. They are all rational numbers.

You can use what you know about place value to find the fraction that is equivalent to any terminating decimal.

$$\begin{array}{l} 0.4 \qquad \text{four } \underline{\text{tenths}} \\ 0.75 \qquad \text{seventy-five } \underline{\text{hundredths}} \\ 0.386 \qquad \text{three hundred eighty-six } \underline{\text{thousandths}} \\ \sqrt{0.16} = 0.4 \qquad \text{four } \underline{\text{tenths}} \end{array}$$

Think Every repeating decimal is a rational number.

You can write every repeating decimal as a fraction. So repeating decimals are all rational numbers.

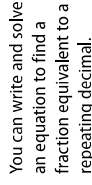
As an example, look at the repeating decimal $0.\overline{3}$.

$$\text{Let } x = 0.\overline{3}$$

$$10 \cdot x = 10 \cdot 0.\overline{3}$$

$$10x = 3.\overline{3}$$

The repeating portion goes to the tenths place. Multiply both sides by 10.



You can write and solve an equation to find a fraction equivalent to a repeating decimal.

$10x - x = 3.\overline{3} - 0.\overline{3}$ Subtract x from the left side and $0.\overline{3}$ from the right side. The equation is still balanced because x and $0.\overline{3}$ are equal.

$$9x = 3$$

$$\frac{9x}{9} = \frac{3}{9}$$

$$x = \frac{3}{9} \text{ or } \frac{1}{3}$$

$$0.\overline{3} = \frac{1}{3}$$

Here's another example of how you can write a repeating decimal as a fraction.

$$x = 0.\overline{512}$$

$$1,000x = 512.\overline{512}$$

The repeating portion goes to the thousandths place. Multiply by 1,000.

$1,000x - x = 512.\overline{512} - 0.\overline{512}$ Subtract x from the left side and the repeating decimal from the right side.

$$999x = 512$$

$$x = \frac{512}{999}$$

Reflect

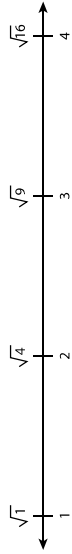
1 What fraction is equivalent to 5.17? Is 5.1 a rational number? Explain.

Think About Estimating Irrational Numbers



Let's Explore the Idea What numbers are not rational? Let's look at a number like $\sqrt{2}$, the square root of a number that is not a perfect square.

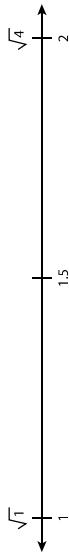
- 2** Look at the number line below. The number $\sqrt{2}$ is between $\sqrt{1}$ and $\sqrt{4}$. Since $\sqrt{1} = 1$ and $\sqrt{4} = 2$, that means that $\sqrt{2}$ must be between what two integers?



- 3** Draw a point on the number line where you would locate $\sqrt{2}$. Where did you draw the point?

4 Calculate: $1.3^2 = \underline{\hspace{2cm}}$ $1.4^2 = \underline{\hspace{2cm}}$ $1.5^2 = \underline{\hspace{2cm}}$

- 5** Based on your calculations, draw a point on the number line below where you would locate $\sqrt{2}$ now. Where did you draw the point?



6 Calculate: $1.41^2 = \underline{\hspace{2cm}}$ $1.42^2 = \underline{\hspace{2cm}}$

- 7** Based on these calculations, $\sqrt{2}$ is between which two decimals?

- 8** You can continue to estimate, getting closer and closer to the value of $\sqrt{2}$. For example, $1.414^2 = 1.999396$ and $1.415^2 = 2.002225$, but you will never find a terminating decimal that multiplied by itself equals 2. The decimal will also never have a repeating pattern.

$\sqrt{2}$ cannot be expressed as a terminating or repeating decimal, so it cannot be written as a fraction. Numbers like $\sqrt{2}$ and $\sqrt{5}$ are not rational. You can only estimate their values. They are called **irrational numbers**. Here, *irrational* means "cannot be set as a ratio." The set of rational and irrational numbers together make up the set of **real numbers**.

Now try this problem.

- 9** The value π is a decimal that does not repeat and does not terminate. Is it a rational or irrational number? Explain.



Let's Talk About It You can estimate the value of an irrational number like $\sqrt{5}$ and locate that value on a number line.

- 10** $\sqrt{5}$ is between which two integers? Explain your reasoning.

- 11** Mark a point at an approximate location for $\sqrt{5}$ on the number line below. $\sqrt{5}$ is between which two decimals to the tenths place?



12 Calculate: $2.22^2 = \underline{\hspace{2cm}}$ $2.23^2 = \underline{\hspace{2cm}}$ $2.24^2 = \underline{\hspace{2cm}}$

Based on your results, $\sqrt{5}$ is between which two decimals to the hundredths place?

- 13** Draw a number line from 2.2 to 2.3. Label tick marks at hundredths to show 2.21, 2.22, 2.23, and so on. Mark a point at the approximate location of $\sqrt{5}$ to the thousandths place.

Try It Another Way Explore using a calculator to estimate irrational numbers.

- 14** Enter $\sqrt{5}$ on a calculator and press Enter. What is the result on your screen?
- 15** If this number is equal to $\sqrt{5}$, then the number squared should equal _____.
- 16** Clear your calculator. Then enter your result from problem 14. Square the number. What is the result on your screen?
- 17** Explain this result.

Understand Rational and Irrational Numbers

Name: _____



Prerequisite: How can you convert fractions to repeating or terminating decimals?

Study the example problem showing how to use division to express fractions as repeating decimals. Then solve problems 1–7.

Example

Erika uses division to write $\frac{1}{3}$ and $\frac{2}{3}$ as decimals.

First she estimates that because $\frac{1}{3}$ is between $\frac{1}{4}$ and $\frac{1}{2}$ it will be between 0.25 and 0.5. Likewise, because $\frac{2}{3}$ is between $\frac{1}{2}$ and $\frac{3}{4}$ it will be between 0.5 and 0.75. Then she divides as shown at the right.

$$\frac{1}{3} = 0.333\dots \text{ or } 0.\overline{3} \quad \frac{2}{3} = 0.666\dots \text{ or } 0.\overline{6}$$

$$\begin{array}{r} 0.333 \\ 3 \overline{)1.000} \\ \underline{-9} \\ 10 \\ \underline{-9} \\ 10 \\ \underline{-9} \\ 1 \\ \underline{-1} \\ 0 \end{array} \qquad \begin{array}{r} 0.666 \\ 3 \overline{)2.000} \\ \underline{-18} \\ 20 \\ \underline{-18} \\ 20 \\ \underline{-18} \\ 2 \\ \underline{-2} \\ 0 \end{array}$$

1 Erika says that no matter how many decimal places she divides to when she divides 1 by 3, the digit 3 in the quotient will just keep repeating. Is she correct? Explain.

2 Is the decimal for $\frac{4}{3}$ a repeating decimal? Explain.

3 How could Erika have used the decimal that she wrote for $\frac{1}{3}$ to find the decimal for $\frac{2}{3}$?

Vocabulary

repeating decimal a decimal that never ends but instead repeats the same digit or group of digits over and over. 0.333... and 0.1666... are repeating decimals.

Solve.

4 Write the decimal for $\frac{1}{8}$. Explain why this decimal is called a terminating decimal.

5 Tell whether each statement below is true or false. If it is false, write an example that proves the statement is false. All fractions can be written as repeating decimals.

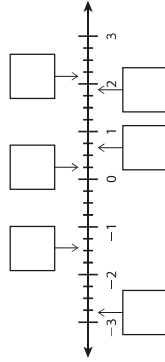
If a fraction can be written as a repeating decimal, only one digit can repeat over and over, without end.

6 Raj is playing a game. He needs to find pairs of cards that have the same value. Which two pairs of cards does Raj have that express the same value?

$\frac{7}{5}$	$\frac{3}{8}$	$\frac{3}{5}$	0.375	0.5	0.7	0.675
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7 Write each number in the appropriate box to show its placement along the number line.

-2.8	$\frac{2}{3}$	$2.\overline{16}$	$1\frac{7}{8}$	0.25	$-\frac{13}{9}$
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Vocabulary

terminating decimal a decimal that ends, or terminates. 0.5; 4.08; 0.300

Lesson 3

Estimate Irrational Numbers

Name: _____

Study the example problem showing how to estimate the value of an irrational number. Then solve problems 1–8.

Example

Estimate the value of $\sqrt{6}$ to the nearest hundredth.

Because $\sqrt{6}$ is between $\sqrt{4}$, which equals 2, and $\sqrt{9}$, which equals 3, $\sqrt{6}$ is between 2 and 3, but it is closer to 2 than to 3.

Find the squares of tenths that are closer to 2 than to 3 in order to find which two tenths $\sqrt{6}$ is between.

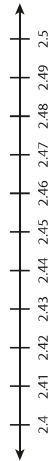
$$2.3^2 = 5.29 \quad 2.4^2 = 5.76 \quad 2.5^2 = 6.25$$

Because 6 is almost exactly halfway between 5.76 and 6.25, $\sqrt{6}$ must be almost exactly halfway between 2.4 and 2.5. Now you can find which two hundredths $\sqrt{6}$ is between.

$$2.44^2 = 5.9536 \text{ and } 2.45^2 = 6.0025$$

$\sqrt{6}$ is between 2.44 and 2.45, but it is closer to 2.45.

- 1** Mark a point at the approximate location of $\sqrt{6}$ to the hundredths place.



- 2** Check your answer by finding $\sqrt{6}$ using a calculator. What is the result on your screen?

- 3** Find $\sqrt{10}$ to the nearest hundredth. Explain how you found your answer.

Vocabulary

irrational number a number that cannot be expressed as the quotient of two integers. The decimal form never terminates or repeats. $\sqrt{3}$ is an irrational number.

Solve.

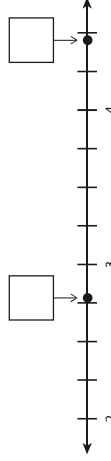
- 4** Explain how a rational number and an irrational number are different.

- 5** Describe how you would compare 3.6 and $\sqrt{12}$.

- 6** Is 1.75 a reasonable estimate of the value of $\sqrt{8}$? Explain your reasoning.

- 7** On a number line, will $\sqrt{20}$ be closer to 4.4 or 4.5? Explain your reasoning.

- 8** Look at the two points on the number line. Each number graphed is the square root of a whole number that is not a perfect square. Write the appropriate square root in each box. Explain how you found your answers.



Vocabulary

rational number a number that can be expressed as the quotient of two integers. $2.5 = \frac{25}{10}$ $0.8333\dots = \frac{5}{6}$

8.NS Identifying Rational Numbers

Task

Decide whether each of the following numbers is rational or irrational. If it is rational, explain how you know.

- a. $0.\overline{333}$
- b. $\sqrt{4}$
- c. $\sqrt{2} = 1.414213 \dots$
- d. 1.414213
- e. $\pi = 3.141592 \dots$
- f. 11
- g. $\frac{1}{7} = 0.\overline{142857}$
- h. $12.34565656\overline{56}$



8.NS Identifying Rational Numbers
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8.NS Placing a square root on the number line

Task

Place $\sqrt{28}$ on a number line, accurate to one decimal point.



8.NS Placing a square root on the number line
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Practice Finding an Unknown Length in a Right Triangle

► Study the Example showing how to find an unknown length in a right triangle. Then solve problems 1–4.

Example

A meteorologist ties a spherical balloon that is 2 feet in diameter to a stake in the ground.

The string is 15 feet long. The wind blows the balloon so that the top of it is 8 feet to the right of the stake. What is the distance, b , from the top of the balloon to the ground?

Use a right triangle. The lengths of the hypotenuse and one leg are known. Use the Pythagorean Theorem to find the length of the other leg.

$$b^2 = c^2 - a^2$$

$$b^2 = 17^2 - 8^2$$

$$b^2 = 289 - 64$$

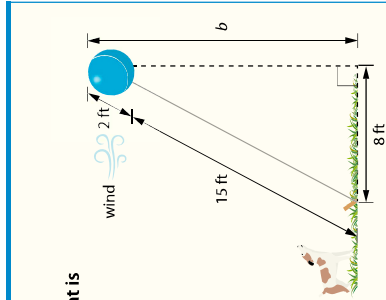
$$b^2 = 225$$

$$b = \sqrt{225} \text{ or } 15$$

The distance from the top of the balloon to the ground is 15 ft.

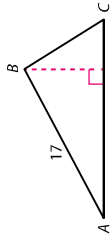
1 Imani used the equation $8^2 + b^2 = 17^2$ to find the distance from the top of the balloon to the ground in the Example. Why does this equation also work?

2 Kamal said the distance from the top of the balloon to the ground in the Example is $\sqrt{353}$ ft. What mistake might Kamal have made?



3 The diagram shows $\triangle ABC$.

a. What is the height of $\triangle ABC$? Show your work.

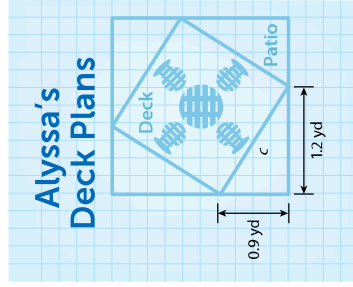


SOLUTION

b. What is the length of \overline{BC} in $\triangle ABC$? Show your work.

SOLUTION

4 Alyssa is designing a square wooden deck with side length c yards. She will build the deck over her square patio, as shown in the diagram. Find the perimeter of the deck. Show your work.



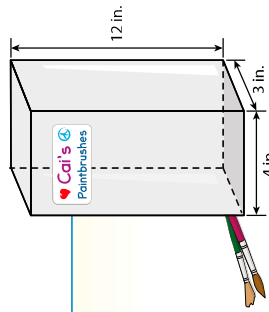
SOLUTION

640 LESSON 27 Apply the Pythagorean Theorem

639 LESSON 27 Apply the Pythagorean Theorem

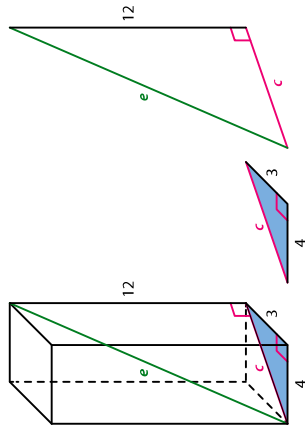
➤ Explore different ways to find an unknown length in a right rectangular prism.

Cai has a box for her paintbrushes. The box is a right rectangular prism. What is the longest paintbrush that will fit in the box?



Picture It

You can draw a diagram to represent the problem. Look for right triangles that can help you find the length you need.



You can use the diagonal length of the base, c , to find the diagonal length of the box, e .

Model It

You can use the Pythagorean Theorem to write equations.

To find the diagonal length of the base: $3^2 + 4^2 = c^2$

To find the diagonal length of the box: $c^2 + 12^2 = e^2$

Substitute to get one equation: $3^2 + 4^2 + 12^2 = e^2$



CONNECT IT

➤ Use the problem from the previous page to help you understand how to find an unknown length in a right rectangular prism.

1 Look at **Picture It** and **Model It**. How does finding the length of diagonal c help you find the length of diagonal e ?

2 Solve the last equation in **Model It** to find e . What is the longest paintbrush that will fit in the box?

3 Tyrone says you can also solve the problem by first solving $3^2 + 4^2 = c^2$ for c and then using this value of c to solve $c^2 + 12^2 = e^2$ for e . Is Tyrone correct? Explain.

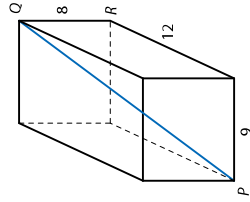
4 When can you use the Pythagorean Theorem to find an unknown length in a right rectangular prism?

5 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to solve the **Try It** problem.

Apply It

► Use what you learned to solve these problems.

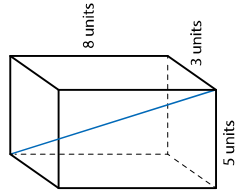
- 6 Find the length of the diagonal from P to Q in this right rectangular prism. Show your work.



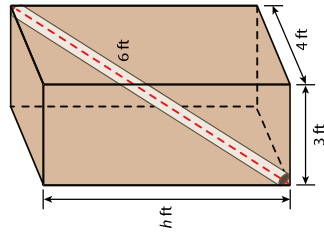
SOLUTION

- 7 What is the distance from one corner of the bottom base to the opposite corner of the top base in this right rectangular prism?

- A $\sqrt{34}$ units
- B $\sqrt{80}$ units
- C $\sqrt{89}$ units
- D $\sqrt{98}$ units

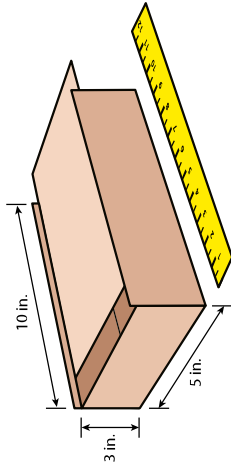


- 8 Anica is shipping a poster to a customer. When the poster is rolled up, it measures 6 feet long. She will use a box that is a right rectangular prism with a base that is 3 feet by 4 feet. What whole number could be the shortest height of the box that will hold the poster? Show your work.

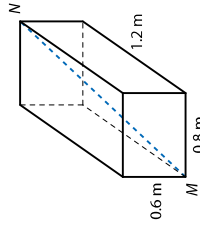


SOLUTION

- 3 Will a 12-inch ruler fit in a box that is a right rectangular prism with a width of 5 inches, a length of 10 inches, and a height of 3 inches? Explain your answer.



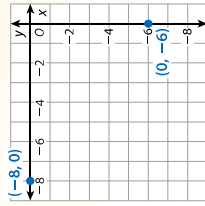
- 4 In the right rectangular prism, what is the length of the diagonal from M to N to the nearest tenth of a meter? Show your work.



SOLUTION

➤ Explore different ways to find the distance between points in the coordinate plane.

Find the shortest distance between the points $(0, -6)$ and $(-8, 0)$.

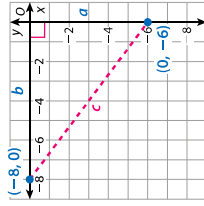


Picture It

You can draw a right triangle.

Draw a line segment between the points. Then draw a right triangle so the distance between the points is the hypotenuse.

In the right triangle, a and b are the lengths of the legs and c is the length of the hypotenuse.



Model It

You can use the Pythagorean Theorem to find the unknown distance.

$$a^2 + b^2 = c^2$$

$$6^2 + 8^2 = c^2$$

CONNECT IT

➤ Use the problem from the previous page to help you understand how to find the distance between two points in the coordinate plane.

- 1 Look at **Picture It**. How do you know the triangle formed by the two points and the origin is a right triangle?
- 2 Jessica said the lengths of the legs are -6 units and -8 units. What mistake did Jessica make? What are the correct lengths of the legs?
- 3 Look at **Model It**. What is the distance between $(0, -6)$ and $(-8, 0)$? Why can you use the Pythagorean Theorem to find this distance?
- 4 Why is it important that the distance between $(0, -6)$ and $(-8, 0)$ be the hypotenuse of the right triangle and not a leg?
- 5 Explain how to find the distance between any two points in the coordinate plane that do not lie on the same horizontal or vertical line.
- 6 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to find the distance between two points in the coordinate plane.

Practice Finding Distance in the Coordinate Plane

► Study the Example showing how to find the distance between two points in the coordinate plane. Then solve problems 1–3.

Example

What is the distance between $P(-1, 3)$ and $Q(3, -2)$ in the coordinate plane?

Draw a right triangle with $R(-1, -2)$ as the vertex of the right angle. Then use the Pythagorean Theorem to find the length of the hypotenuse, which is the distance between P and Q .

$QR = 4$ units, $RP = 5$ units, $PQ = c$ units

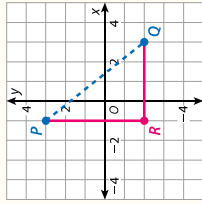
$$4^2 + 5^2 = c^2$$

$$16 + 25 = c^2$$

$$41 = c^2$$

$$\sqrt{41} = c$$

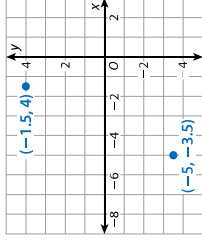
The distance between $P(-1, 3)$ and $Q(3, -2)$ is $\sqrt{41}$ units.



1 Look at the Example.

- Describe another right triangle you could draw from points $P(-1, 3)$ and $Q(3, -2)$.
- Will your triangle from problem 1a give you the same distance between points P and Q ? Explain.
- Would drawing a triangle with points $(-1, 3)$, $(3, -2)$, and $(3, 2)$ as vertices help you find the distance between the points? Explain.

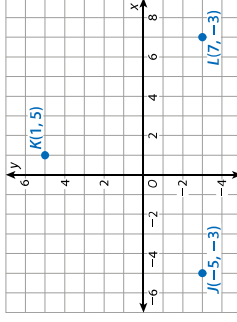
2 What is the distance between the points shown? Show your work. Round your answer to the nearest tenth.



SOLUTION

3 Dr. Patel plots points J , K , and L in the coordinate plane.

- What is the distance between points J and K ? Show your work.



SOLUTION

- What is the distance between points K and L ? Show your work.

SOLUTION

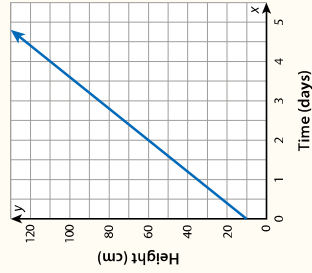
- Is $\triangle JKL$ an equilateral triangle? Explain.

Practice Deriving $y = mx + b$

- Study the Example showing how to write the equation of a line in slope-intercept form from a graph. Then solve problems 1–5.

Example

An oceanographer is studying the growth of giant kelp. She selects one giant kelp plant and records its height each day. Then she draws this graph. What is the equation of the line in slope-intercept form? Define your variables.



$(0, 10)$ and $(2, 60)$ are two points on the line.

$$m = \frac{60 - 10}{2 - 0}$$

$$= \frac{50}{2}, \text{ or } 25$$

The slope is 25.

The line intersects the y -axis at $(0, 10)$.

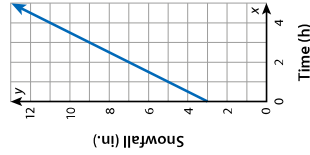
The y -intercept is 10.

The equation $y = 25x + 10$ shows the height, y , of the giant kelp plant after x days.

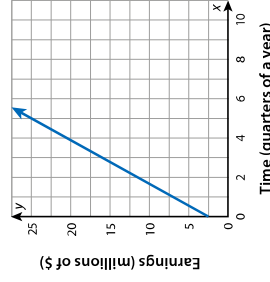
- 1 What do the slope and y -intercept in the Example represent in this situation?

- 2 A meteorologist tracks the amount of snowfall over a 5-hour period.

She graphs her measurements. What is the equation of the meteorologist's line in slope-intercept form? Define your variables.

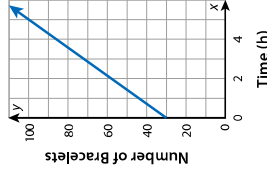


- 3 The growth in earnings for a digital music service is shown in the graph. What is the equation of the line? Show your work. Define your variables.



SOLUTION

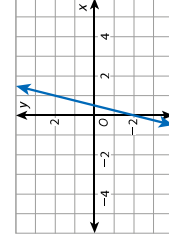
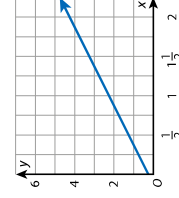
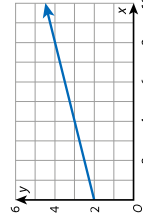
- 4 Daria and her brother want to make 100 bracelets to sell at a craft fair. They have made some already. Daria made this graph to show how they can reach their goal. The equation of Daria's line is $y = 14x + 30$ where y is the number of bracelets and x is the time in hours.



- a. What is the slope of the line?
- b. What is the y -intercept?

- 5 Write each linear equation under the graph of its line.

$$y = 4x - 2 \quad y = \frac{1}{4}x + 2 \quad y = 2x + \frac{1}{4}$$

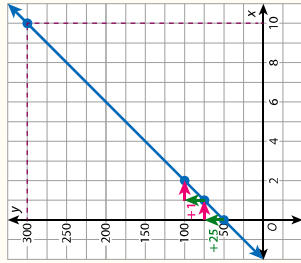


Practice Graphing a Linear Equation of the Form $y = mx + b$

- Study the Example showing how to graph a linear equation of the form $y = mx + b$. Then solve problems 1–4.

Example

Mr. Diaz uses a hose to fill a kiddie pool with water. When full, the pool holds 300 gallons of water. The equation $y = 25x + 50$ can be used to find the number of gallons of water, y , in the pool x minutes after he turns on the hose. Graph the equation. How long does it take to fill the pool?



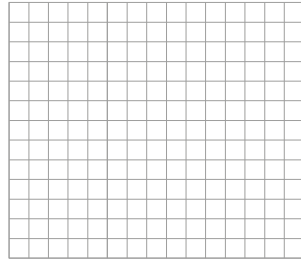
The y -intercept is 50, so the line intersects the y -axis at $(0, 50)$. The slope is 25, or $\frac{25}{1}$. There is a vertical change of 25 for every horizontal change of 1.

$$(0 + 1, 50 + 25) = (1, 75)$$

$$(1 + 1, 75 + 25) = (2, 100)$$

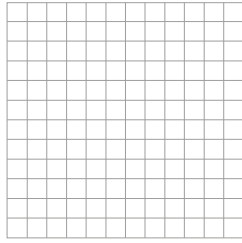
Plot the points and draw a line through them. The pool is filled when the number of gallons, y , is 300. This corresponds to an x -value of 10, so it takes 10 minutes to fill the pool.

- 1 At the end of the day, Mr. Diaz drains the pool. The equation $y = -50x + 300$ can be used to find y , the number of gallons of water left after draining the pool for x minutes. Graph the equation. How long does it take to drain the pool? Explain.

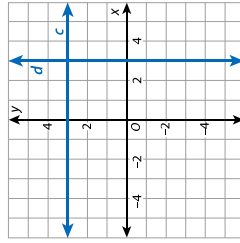


- 2 Tameka signs up for membership at a rock climbing gym. She pays a one-time \$100 membership fee. Then she will pay a \$25 monthly fee. The equation $y = 25x + 100$ can be used to find y , the total cost of a gym membership for x months. What is the slope of the line? What is the y -intercept?

- 3 Graph the linear equation $y = -\frac{1}{2}x - 1.5$. Show your work.



- 4 Which line has the equation $y = 3$? Which has equation $x = 3$? Explain how you know.



Practice Determining the Number of Solutions to One-Variable Equations

- Study the Example showing how to determine the number of solutions to a one-variable equation. Then solve problems 1–6.

Example

How many solutions does $\frac{1}{3}(6w - 12) = 2w + 2$ have?

You can rewrite the equation until you identify a true statement like $3 = 3$, identify a false statement like $1 = 4$, or solve for w .

$$\begin{aligned}\frac{1}{3}(6w - 12) &= 2w + 2 \\ 2w - 4 &= 2w + 2 \\ -4 &= 2\end{aligned}$$

$-4 = 2$ is a false statement. No value of w makes the equation true. So the equation has no solution.

- 1 Could you have stopped solving the equation in the Example sooner, before you reached the false statement $-4 = 2$? Explain.

- 2 Tell whether each equation has *no solution*, *one solution*, or *infinitely many solutions*.

- $1 + 3x = 3x + 1$
- $4x + 1 = 3x + 2$
- $5x + 1 = 5x - 2$
- $-3(x + 1) = -3x + 3$

- 3 How many solutions does $3(x + 5) - 3 = 2(3x + 1) - 3x$ have? Show your work.

SOLUTION

- 4 Complete the following sentences about one-variable equations.
- You solve an equation and get $8x + 7 = 8x + 7$. The equation has _____ solution(s).
 - You solve an equation and get $10t - 6 = 10t + 6$. The equation has _____ solution(s).
- 5 How many solutions does $4x + 5 = 6(x + 3) - 20 - 2x$ have? Show your work.

SOLUTION

- 6 Ria solves the equation $5 + 3r = 4 + 4r$ and gets $r = r$. She concludes that the equation has infinitely many solutions. What is the correct solution? What mistake did Ria make?

Practice Writing an Equation with No, One, or Infinitely Many Solutions

- Study the Example showing how to write a one-variable linear equation with no, one, or infinitely many solutions. Then solve problems 1–4.

Example

Write a constant term or variable term on the line to form an equation that has no solution, one solution, or infinitely many solutions.

$$4x + 7 = 4x + \underline{\hspace{2cm}}$$

No solution: The x -terms on both sides of the equation are the same.

Write a **constant term** so the constant terms on each side are different.

$$4x + 7 = 4x + 8$$

One solution: Write an **x -term** so the x -terms on each side of the equation will have different coefficients.

$$4x + 7 = 4x + 14x$$

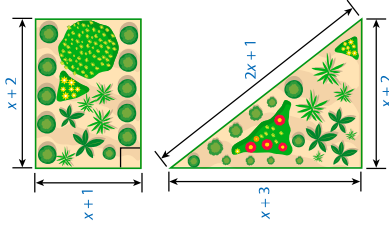
Infinitely many solutions: **7** results in identical expressions on both sides of the equation.

$$4x + 7 = 4x + 7$$

- Look at the Example. Decide whether there is more than one possible answer that will result in no solution, one solution, or infinitely many solutions. Where possible, write a different constant term or variable term.
 - No solution: $4x + 7 = 4x + \underline{\hspace{2cm}}$
 - One solution: $4x + 7 = 4x + \underline{\hspace{2cm}}$
 - Infinitely many solutions: $4x + 7 = 4x + \underline{\hspace{2cm}}$
- Complete the following sentences.
 - The one-variable linear equation $13x + 6 = 13x + \underline{\hspace{2cm}}$ has infinitely many solutions.
 - The one-variable linear equation $x + 6 = x + \underline{\hspace{2cm}}$ has no solution.
 - The one-variable linear equation $4x + 5 = \underline{\hspace{2cm}} + 10$ has one solution.

- Two garden beds are shown. The perimeters of the two gardens are equal.

a. Write an equation that sets the perimeters equal. Then solve the equation.



b. The side length of a garden cannot be a negative number or zero. What value(s) of x make the equation you wrote in problem 3a true in the context of this problem?

- Write an expression on the line to form an equation that has no solution, one solution, or infinitely many solutions.

a. No solution

$$2(h + 3) = \underline{\hspace{2cm}}$$

b. One solution

$$2h + 5 = \underline{\hspace{2cm}}$$

c. Infinitely many solutions

$$2h - 12 = \underline{\hspace{2cm}}$$

Learn About Using Substitution to Solve Systems of Equations

Read the problem below. Then explore how to use substitution to solve systems of equations.

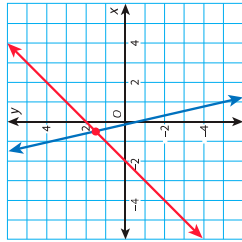
Solve this system of equations.

$$y = x + 2$$

$$y + 1 = -4x$$

Graph It You can graph the equations and estimate the solution.

Find the point of intersection. It looks like the solution is close to $(-\frac{1}{2}, \frac{1}{2})$.



Model It You can use substitution to solve for the first variable.

Notice that one of the equations tells you that $y = x + 2$. This allows you to use substitution to solve the system of equations.

Substitute $x + 2$ for y in the second equation.

$$y = x + 2$$

$$y + 1 = -4x$$

$$(x + 2) + 1 = -4x$$

Now you can solve for x .

$$x + 2 + 1 = -4x$$

$$x + 3 = -4x$$

$$3 = -5x$$

$$x = -\frac{3}{5}$$

Connect It Now you will solve for the second variable and analyze the solution.

2 What is the value of x ? How can you find the value of y if you know the value of x ? _____

3 Substitute the value of x in the equation $y = x + 2$ to find the value of y . _____

4 Now substitute the value of x in the equation $y = -4x - 1$ to find the value of y . _____

5 What is the ordered pair that solves both equations? Where is this ordered pair located on the graph? _____

6 Look back at *Model It*: How does substituting $x + 2$ for y in the second equation give you an equation that you can solve? _____

7 How does substitution help you to solve systems of equations? _____

Try It Use what you just learned to solve these systems of equations. Show your work on a separate sheet of paper.

8 $y - 3 = 2x$
 $y = 4x - 2$

9 $y = 1.4x + 2$
 $y - 3.4x = -2$

Lesson 16  Modeled and Guided Instruction

Learn About

Using Elimination to Solve Systems of Equations

Read the problem below. Then explore how to solve systems of equations using elimination.

Solve this system of equations.

$$-x - 2y = 4$$

$$3y = -0.5x + 2$$

Model It You can use elimination to solve for one variable.

First, write both equations so that like terms are in the same position. Then try to eliminate one of the variables, so you are left with one variable. To do this, look for a way to get opposite coefficients for one variable in the two equations.

$$-2y = x + 4$$

$$3y = -0.5x + 2$$

$$2(3y = -0.5x + 2)$$

$$6y = -x + 4$$

$$-2y = x + 4$$

$$6y = -x + 4$$

$$4y = \frac{\quad}{8}$$

$$y = 2$$

$$-x - 2(2) = 4$$

$$-x - 4 = 4$$

$$-x = 8$$

$$x = -8$$

The solution is $x = -8, y = 2$.

Check:

$$3(2) \stackrel{?}{=} -0.5(-8) + 2$$

$$6 = 4 + 2$$



Connect It Now analyze the solution and compare methods for solving systems of equations.

10 What happens when you add opposites? Why do you want to get opposite coefficients for one of the variables? _____

11 How did you get opposite coefficients for x in the solution on the previous page? _____

12 Why does the equation stay balanced when you add the values on each side of the equal sign? _____

13 Which equation in the system was used to find the value of x ? Can you use the other equation? Explain. _____

14 How is elimination like substitution? How is it different? _____

15 How can you check your answer? _____

Try It Use what you just learned about elimination to solve this problem. Show your work on a separate sheet of paper.

16 $2x + y = 9$

$3x - y = 16$

Practice Solving Systems of Equations Algebraically

Study the example below. Then solve problems 17–19.

Example

Solve this system of equations.

$$3y = x + 1$$

$$2y = 6x - 2$$

Look at how you could use substitution to solve a system of equations.

$$\frac{2y}{2} = \frac{6x-2}{2}$$

$$y = 3x - 1$$

Since $y = 3x - 1$, I can substitute $3x - 1$ for y in the first equation.

$$3(3x - 1) = x + 1$$

$$9x - 3 = x + 1$$

$$8x = 4$$

$$x = \frac{1}{2}$$

$$3y = \frac{1}{2} + 1; y = \frac{1}{2}$$

$$\left(\frac{1}{2}, \frac{1}{2}\right)$$

Solution



The student divided each term in the equation $2y = 6x - 2$ by 2 to get an expression equal to y .



Pair/Share
Solve the problem using elimination.



Can it help to write both equations in the same form?



Pair/Share
Discuss your solution methods. Do you prefer using substitution or elimination?

17 What ordered pair is a solution to $y = x + 5$ and $x - 5y = -9$?

Show your work.

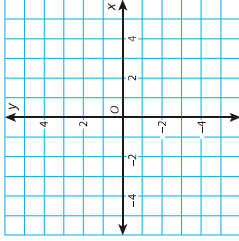
Solution _____

18 Graph the equations. What is your estimate of the solution of this system of equations?

$$y = 3x - 2$$

$$y = -2x$$

Show your work.



Do the equations have the same or different slopes?



Pair/Share
Solve the problem algebraically and compare the solution to your estimate.

Solution _____

19 Which of these systems of equations has no solution?

A $y = \frac{1}{4}x + 2$

$$y = 4x - 1$$

B $y = \frac{2x}{3} - 3$

$$y = 2x - 3$$

C $y = 4x$

$$y = 4x - 5$$

D $x + y = 3$

$$2y = -2x + 6$$



What do you know about the lines in a system of equations with no solution?

Sheila chose **D** as the correct answer. How did she get that answer?



Pair/Share
Graph the solution to verify your answer.

Practice Linear and Nonlinear Functions

- Study how the Example shows how to determine whether a function is linear or nonlinear. Then solve problems 1–4.

Example

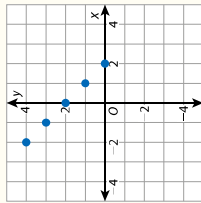
Use a graph to determine whether the function is a linear function.

Input: x , a number; Output: y , 2 more than -1 times x

Make a table of input and output values.

Input (x)	-2	-1	0	1	2
Output (y)	4	3	2	1	0

Graph the (input, output) pairs. The points lie on a straight line. Plotting more points will continue to follow the same straight line. The function is linear.



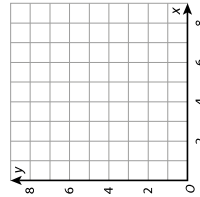
- 1 a. What is an equation that represents the rule in the Example?

- b. Use the equation to explain why the rule is a linear function.

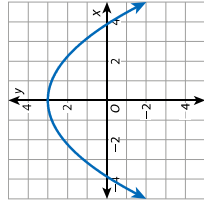
- 2 Complete the table and graph for the function. Tell whether the function is linear or nonlinear. Explain your reasoning.

Input: x , a number; Output: y , 6 divided by x

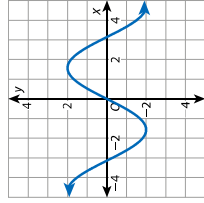
Input (x)	Output (y)
1	
2	
3	
4	



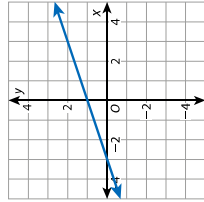
- 3 Each graph represents a function. Tell whether the function is linear or nonlinear.



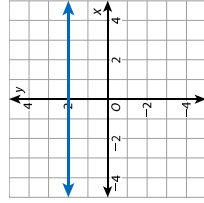
a. _____



b. _____



c. _____



d. _____

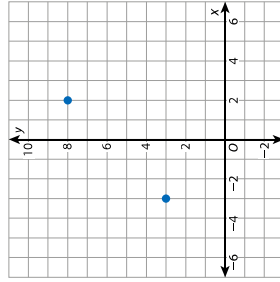
- 4 Felipe wants to figure out if the equation $y = x(x + 2)$ represents a linear function.

He finds two (x, y) pairs and plots them.

x	-3	2
y	3	8

Felipe says he can draw a line through these two points, so the equation represents a linear function.

- a. Explain why Felipe's reasoning is incorrect.



- b. Does the equation represent a linear function? Explain your reasoning.

Practice Interpreting a Linear Function

➤ Study the Example showing how to interpret a linear function. Then solve problems 1–4.

Example

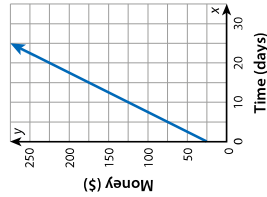
Snow falls early in the morning and stops. Then at noon snow begins to fall again and accumulate at a constant rate. The table shows the number of inches of snow on the ground as a function of time after noon. What is the initial value of the function? What does this value represent?

Hours After Noon	Inches of Snow
0	6
1	8.5
2	11

The initial value is 6, the number of inches of snow at noon, when the time value is 0. It represents the amount of snow that was already on the ground before it began snowing again.

- What is the rate of change of the function in the Example? What does this value represent?
- Suppose there was no snow on the ground before it began snowing at noon. What is the equation of this function?

- The graph shows money in dollars as a function of time in days. Write an equation for the function, and describe a situation that it could represent. Include the initial value, rate of change, and what each quantity represents in the situation.



- Each day Kyle buys a cup of soup and a salad for lunch. The salad costs a certain amount per ounce. The equation below models the total cost of Kyle's lunch.

$$y = 0.45x + 3.75$$

a. What do the variables x and y represent? Use the phrase *is a function of* to describe how the equation relates these quantities to one another.

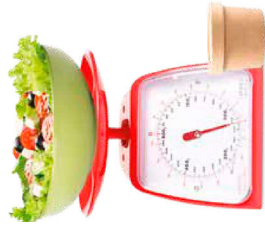
b. What does the value of the function for $x = 0$ represent?

c. What does the rate of change represent?

d. What is the cost of an 8-ounce salad without soup? How do you know?

- Carmela is a member of a social club. She pays an annual membership fee and \$15 for each event she attends. The equation $y = 15x + 25$ represents her total cost each year. Which statement about the function is true? Select all that apply.

- A The initial value is 15.
- B x represents the cost of each event.
- C The rate of change is 15.
- D The initial value represents the annual membership fee.
- E The number of events she attends is a function of the total cost.
- F The total cost is a function of the number of events she attends.



Mutations

Reflect

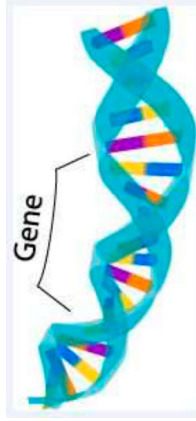
What comes to mind when you hear the word **mutation**? Does your mind jump to movie scenes where normal people fall into vats of toxic waste and are converted into superheroes? Or do you think about microscopic changes to a single gene on a strand of DNA?

If you're like most people, you probably thought of the superhero movie. Now, which of those two do you think actually happens? Hopefully, you chose the microscopic change this time.

Mutations are changes to the genetic information of an organism. Do you think these changes are good or bad? This question does not have a simple answer. Some mutations benefit the organisms, others harm them, and the rest have no notable impact whatsoever.

How is genetic information stored?

All organisms have genetic information stored in their cells' DNA. The genetic information is contained in strands of DNA that are tightly wound into chromosomes. A **gene** is a small section of DNA that encodes a specific protein or RNA. These genes determine an individual's traits.



gene – a small section of DNA

The effects of human mutations are much smaller than they show in the movies.

mutation – a change to an organism's genetic information



Reflect

How do mutations occur?

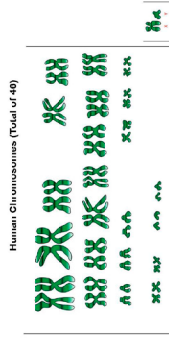
Humans have 23 pairs of chromosomes that contain all their DNA. Base pairs are the building blocks of DNA. The base guanine pairs with cytosine, while the base adenine pairs with thymine. These pairs are commonly abbreviated G-C and A-T.

Whenever a cell splits, its DNA content has to be replicated or copied. If a single gene (or, more commonly, a single base pair) is not copied correctly, a mutation occurs. This mutation will then be copied every time that new cell (and all its future daughter cells) splits.

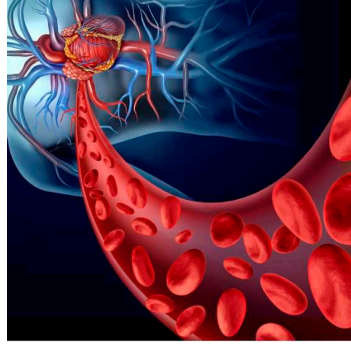
Are mutations harmful?

In some cases, the incorrect base pair (or pairs) is located in DNA that is not part of any gene, and no harm is done to the organism. However, if the mutated base pair or pairs do fall within a gene, a harmful impact is possible. The blood disorder sickle cell anemia, for example, is the result of a mutated gene. In people with this mutation, red blood cells form a crescent shape instead of the typical round shape. These blood cells can then cause "roadblocks" in arteries and veins when they are caught. Sickle cell disease is associated with a lot of additional health problems.

Mutations



Two sex chromosomes (Two X's in a female, one X and one Y in a male, chromosomes appear as XX)



Normal red blood cells are shaped like those in the image above. Sickle cells are shaped like crescents.

Mutations

What Do You Think?

How could a mutation be beneficial? Mutations cause variations in genes, and variations are what make us unique. Genetic variations affect skin tone, eye color, hair color, and height. Beneficial mutations can also make people less susceptible to certain diseases, making it easier for them to pass on their genes to future generations.



Mutations help make you you!

Try Now

What Do You Know?

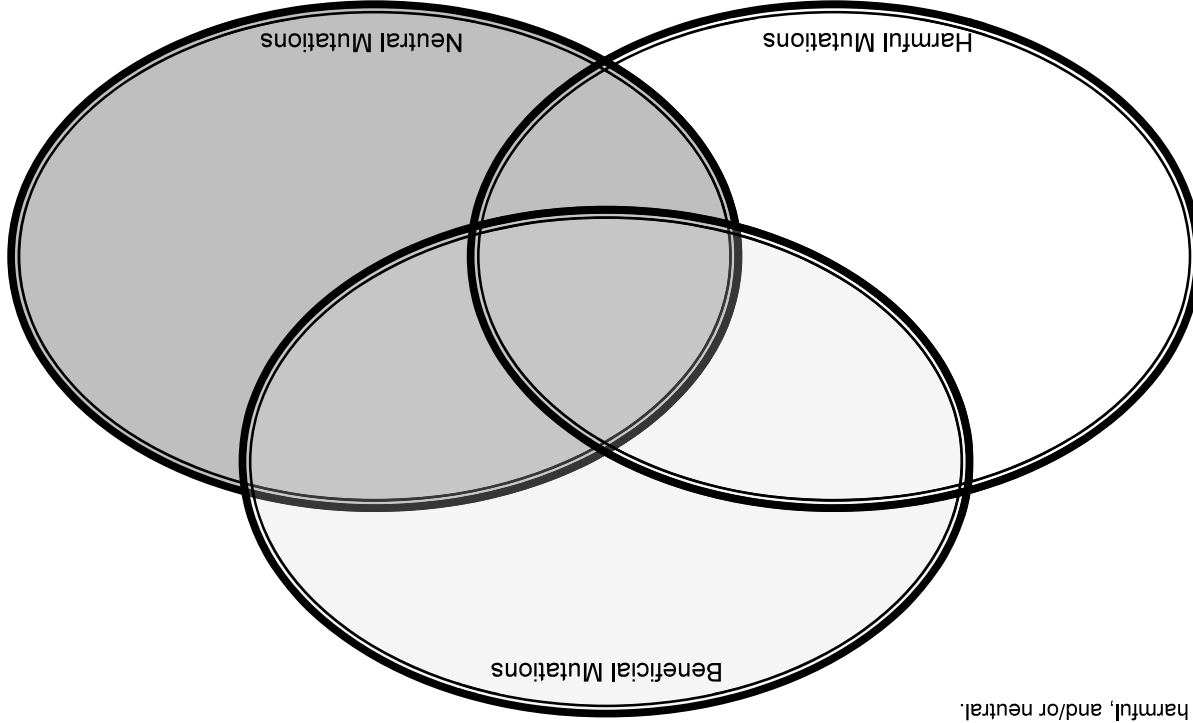
The chart below compares the benefits and disadvantages of genetic mutations. Use the information in the reading and do some outside research to complete the chart.

Benefits of Mutations	Disadvantages of Mutations

Graphic Organizer



Directions: Mutations are permanent changes in the sequence of DNA inside cells. They can be beneficial or harmful to the survival of organisms. If they do not help or harm the organism, the mutations are considered neutral. Provide examples of mutations that are beneficial, harmful, and/or neutral.





Name: _____ Date: _____

Mutation Ideas

(Identifying, Defining, Engaging, Analyzing, and Summarizing)

I D E A S

Identifying: List the important terms in the reading.

Defining: Define words that you listed, especially those you do not understand.

Engaging: Create three sentences for the three most important concepts. Use each word correctly in terms of its meaning.

Analyzing: Create a challenge question for each Engage sentence. This will help you determine if your sentence is logical or if it needs improvement.

Summarizing: Explain in just 20 words what the main idea of the text is and its importance.



Reading Science

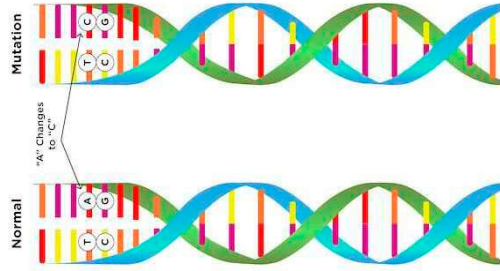
Name: _____ Date: _____

Mutations: Helpful or Harmful?

1 What is a mutation? At first, it may sound like a bad thing, and sometimes it is. However, life as we know it today could not exist without mutations. They are the reason that organisms have changed over the course of time. What does this mean? Mutations generate the raw material for natural selection. They are the main source for genetic variation in the gene pool. Mutations can be harmful, beneficial, or neutral. (Neutral means they have no effect on the organism in which the mutation occurs.) Let us look at mutations, how they occur, and how they contribute to genetic variation.

2 First, a quick review of how genetic information is carried and passed along in individual organisms. All living organisms have DNA, or deoxyribonucleic acid. The DNA molecule is made of a long strand of compounds called nucleotides attached to a sugar-phosphate backbone. It is the sequence of nucleotides along the strand that makes individual organisms unique. Why? Along each DNA strand are segments that code for traits. The segments of DNA that code for traits are called **genes**. Traits include such things as skin color, height, fruit size, or amount of fur. Each organism has its own sequence of nucleotides along its DNA. It is this sequence that makes every organism unique.

3 Every time a cell is replicated, the sequence of the nucleotides found on the DNA strand must be copied exactly. If the copies are exact, the organism can function and reproduce properly. However, the cellular machinery that copies DNA sometimes makes mistakes. There may be changes in the sequence of nucleotides that is copied. An extra base may be inserted or left out. In its most basic sense, a mutation is any change in the sequence of DNA in a cell. In other words, mutations are random changes in the sequence of DNA that occur to individual organisms. Many mutations occur in sections of the DNA strand that do not code for traits. Therefore, they have no effect on an organism's traits. If the mutations do occur in a gene sequence, the mutation may be either harmful or helpful.





Reading Science

- 4 Mutations may happen during the replication process in several ways. A point mutation happens when one "letter" of the genetic code is changed to another. In another type of mutation, sections of DNA can be added to or removed from genes. In a third type of mutation, genes, or parts of genes, can become reversed or duplicated. But these "mistakes" do not occur to all of the DNA within an organism at the same time. Most mutations only occur within single cells. It is the type of cells in which these mutations occur that is important.
- 5 In single-celled organisms, all mutations can be passed to the next generation. Things are more complicated in multicellular organisms. Mutations that occur in the somatic (nonreproductive) cells usually only affect the individual organism with the mutation. If the mutation occurs within these types of cells, the individual organism may change. Those changes will not be passed to future generations. It is the mutations that occur within the reproductive cells that become important for evolutionary change. Mutations that occur in reproductive cells (gametes) can be passed-on to offspring. Mutations in any particular gene sequence are rare. They are the only way, however, that new traits can be generated within a population.
- 6 All of the mutations that occur to DNA sequences are random. They do not occur as the result of a "need." For example, imagine that an organism's environment suddenly turns much colder than it was before. Its DNA will not simply generate a mutation that results in thicker fur. A mutation that results in thicker fur would need to arise naturally. An organism cannot just generate a mutation for a specific purpose. To follow this example, consider an organism in a colder environment that has a mutation, by chance, that creates thicker fur. This individual organism will be more likely to survive to reproduce. It might be possible for the organism to pass this new trait of thicker fur, caused by the mutation, to its offspring. If it can pass on the trait, its offspring will also be more likely to survive. If the individuals with less fur become less likely to survive, then more and more individuals with the thick fur mutation will live. Each new generation is able to pass on this beneficial mutation to the next generation. Since individuals with thick fur are more likely to survive, they are more likely to reproduce successfully. Therefore, it will not take long before the entire population will have the mutated gene for thicker fur. The population will have evolved.
- 7 New traits that come from a mutation start out at a very low frequency within the population. In fact, a mutation will usually start with one individual out of the total population. If this individual is born with a beneficial mutation, that individual will be more likely to survive than others without the mutation. This principle is called "survival of the fittest." The beneficial mutation will likely be passed on to the next generation. This is why mutations are the raw materials for evolutionary change. Natural selection favors beneficial mutations, increasing their frequencies, and eliminates harmful ones. If a particular mutation happens to work well with the environment, that mutation could be favored by natural selection. The frequency of that gene would increase within that population. On the other hand, it could have a negative effect on the organism and cause it to be less successful or even die; therefore, the effect of a mutation often depends on the environment and on the other traits within the organism and the population.



Reading Science

1. Which of the following statements is not true regarding mutations?
- Mutations are always harmful.
 - Mutations may be helpful.
 - Mutations generate the raw material for natural selection.
 - Mutations create variety in the gene pool.
2. Which of the following correctly describes what a mutation is?
- A change in the DNA code of an organism
 - A change to a gene of an organism
 - A change to the nucleotide sequence
 - All of the above
3. There are several ways that a mutation may occur. Which of the following is not a way for a mutation to occur during the DNA replication (copying) process?
- Sections of genes can be removed.
 - Sections of genes may be added.
 - All of the organism's genes are removed.
 - An entire gene may be reversed.



Concept Attainment Quiz

Name: _____ Date: _____

I. Vocabulary Matching

Match each term on the right to the correct definition.

- | | |
|--|---------------|
| 1. _____ Structural changes to genes | A. Proteins |
| 2. _____ Basic unit of heredity | B. Gene |
| 3. _____ Organized pieces of DNA | C. Variation |
| 4. _____ Occurring in more than one form | D. Mutation |
| 5. _____ Large molecules made of amino acids | E. Chromosome |

II. Identification

Use the clues provided to fill in the blanks.

Word Bank

chromosomes	variations	beneficial	neutral
harmful	sequence	coding	proteins
			amino acids

1. _____ are made of DNA that contain genes that control the production of _____ within the cell.
2. If the _____ of the proteins changes, this is called a mutation.
3. Genetic mutations cause _____ in the traits of organisms, which can be beneficial, harmful, or neutral.
4. An example of a _____ mutation is the high frequency of genetic mutations that code for the production of a protein that provides resistance to a deadly disease in areas where there has been a history of that disease.



Reading Science

4. In which types of cells must mutations occur in order for the mutation to be passed-on to future generations?

- A. Somatic cells
- B. Genes
- C. Gametes
- D. Alleles

5. What is the best way to describe how mutations relate to the concept of survival of the fittest? Choose the best answer from the choices below.

- A. Only those mutations that are helpful will be passed-on.
- B. Mutations that allow organisms to survive are more likely to be passed-on.
- C. Only those mutations that are harmful will be passed-on.
- D. Mutations do not relate to survival of the fittest.

6. Imagine a population of small animals. All of the animals in this population have short legs. They all eat the leaves off of the low shrubs in their environment. One animal happens to be born with a mutation that gives it very long legs. It is the only individual in this population with this mutation, and it makes it very hard for it to eat the leaves so low to the ground. But suddenly there is a fire that burns all of the shrubs, so the only food source is now up in the low tree branches. How might this individual animal with the long-leg mutation affect the entire population?

- A. If the mutation cannot be passed-on, the entire population may die.
- B. Those animals with short legs will not survive to pass their traits to the next generation.
- C. The animal with the mutation for long legs will be more likely to survive to pass those traits on to its offspring.
- D. All of the above



Concept Attainment Quiz

Mutations



Multiple Choice

Mutations

Name: _____ Date: _____

III. Open-Ended Response

Answer the questions below. Use additional paper if needed.

- How does a genetic mutation occur?
- Do mutations only occur in sexually reproducing organisms? Explain your thoughts.

- A certain genetic mutation is found with a high frequency in populations of humans living in places that experienced a deadly disease in the past. This same mutation is rare in places that have no history of the disease. Based on how genes work, this data best supports which of the following explanations?

- The genetic mutation was present in all populations but did not get passed on in places where humans did not contract the disease.
- This genetic mutation codes for the production of a protein that provides resistance to the disease.
- The disease causes the genetic material of humans to mutate just before it causes their disease.
- Humans with this mutation develop this disease and then spread it to other humans without the mutation.



Multiple Choice

Mutations



Multiple Choice

Mutations

- 2 In humans, the protein CFTR regulates the components of sweat, digestive fluids, and mucus. Humans can have a normal form of the gene or a mutated form. Which of the following would provide evidence that the mutated form of the CFTR protein is harmful to humans?
- A Both the normal and the mutated form of the CFTR gene can be found in healthy humans.
 - B Healthy individuals, with the normal form of the CFTR gene, can pass on a mutated form.
 - C Most illnesses have symptoms associated with sweat, digestive fluids, and mucus.
 - D Individuals who inherit the mutated form of the gene usually develop serious health problems.
- 3 A genetic mutation will most immediately affect which of the following?
- A The number of chromosomes within each cell of the body
 - B The ability of the organism to survive in its environment
 - C The overall health of the individual throughout its life span
 - D The structure of one or more proteins produced by the organism
- 4 Which of the following observations would support the claim that a particular mutation is neutral?
- A The frequency of the mutation in a population, once it first appears, tends to increase over time.
 - B In a given population, individuals that possess this mutation have a greater rate of reproduction.
 - C The mutation is higher in populations of organisms that produce fewer offspring and have shorter life spans.
 - D The frequency of the mutation goes up and down with no observable effect on the health of a population.



Multiple Choice

- 5 Students are modeling how genes produce proteins by using wooden tiles with letters to represent the genes. In this model, the words that the combination of letters produce represents the proteins.

Wooden tiles



Genes

Word

“dove”

Protein

In this model, which of the following best represents a mutation?

- A Combining many different words to create a complete message
- B Creating any word that is spelled exactly the same way forward and backward
- C Changing one or more of the letters so that they spell a different word, or no word at all
- D Making different words, with a certain number of letters, that have the same meaning

Mutations



Claim-Evidence-Reasoning

Name: _____ Date: _____

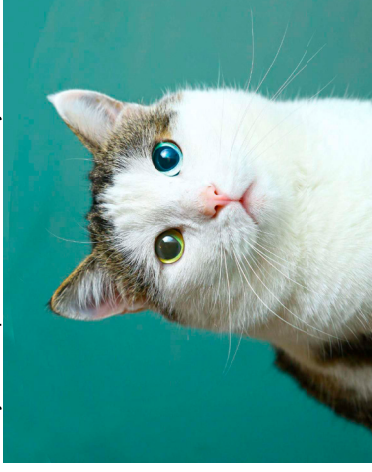
Mutations

Scenario

A mutation is any change in the sequence of DNA. Not all mutations affect the development of an organism. Most mutations do not change the structure of proteins; therefore, the function remains the same. Only a small percentage of mutations lead to a genetic disorder.

External Data

Heterochromia (pictured below) is when a person's iris consists of different colors or when one iris is a different color from the other. People who inherit heterochromia do not experience any symptoms and do not have any health problems with their eyes.



Prompt

Write a scientific explanation explaining if all mutations are harmful.

Claim:

Evidence:

Reasoning:

PEER EVALUATION

Peer Name:

Rebuttal:

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Fossil Record

Reflect

How can fossils tell us about organisms that lived millions of years ago?

Fossils are preserved parts or traces of animals or plants that lived in the past. Fossils are clues to the past. They tell us what organisms lived in a certain place, how they looked, and what the environment was like in the place where they lived. Fossils can also show how organisms have changed over time. If you find fossils of seashells high on a mountain, you could conclude that the mountain used to be underwater at some point in time.



There are different kinds of fossils.

Inclusion fossils are formed when all or part of an organism is covered in a solid substance, such as ice or amber, that preserves the material trapped inside. This kind of fossil is different from all the rest in that the actual tissues of the dead organism are still present, and in rare cases, its DNA may even still be intact.

Mold fossils are formed when part of an organism has been buried in sediment and slowly decayed. The dead organism creates an impression in the soft sediment. The sediment then hardens into solid stone, preserving the impression in stone.

Cast fossils are the kind you probably picture in your mind when you think of fossils. For a cast fossil to form, a dead organism must first be buried in sediment. Then, as the organism slowly decays, it leaves behind open spaces where minerals crystallize and fill in the exact shape of the decaying organism or part. This process is called *petrification* and produces stones that mimic the exact shape of the tree stump, bone, shell, or whatever part decayed in that spot.

Trace fossils are fossils that are formed not by the actual dead organism but by its activities while it was alive. Examples of trace fossils include animal tracks preserved in stone, petrified nests, burrows, etc.

Look Out!

Remember, fossils are rarely the actual organisms themselves. Rather, their body parts have broken down and been replaced with mineral solutions that have hardened into rock.

Fossil Record

Reflect

Fossils do not have dates printed on them. Yet there are ways to figure out the age of a fossil. One way to determine the actual age of a fossil is to determine the age of the rock layer in which the fossil is found. This makes sense because the organism that produced the fossil was trapped in the rock when it formed.

Layers of rock form one on top of the other. The bottom layer was laid down first, so it is the oldest layer. The top layer was laid down last, so it is the youngest layer. The layers in between are in order from oldest to youngest from bottom to top. The *law of superposition* states that in any sequence of rock or sediment layers, the youngest sediments or rocks are at the top of the sequence and the oldest are at the bottom.



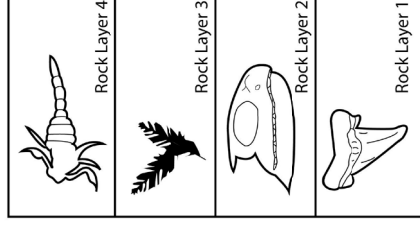
To get an idea of how this works, imagine that you baked a layer of cake for each day on Monday, Tuesday, Wednesday, and Thursday, setting each layer on top of the other on the day it was baked. The Monday layer would be at the bottom, and the Thursday layer would be on top. Let's say you put walnuts in Monday's layer and raisins in Thursday's layer. You give the cake to a friend who knows that the bottom layer is oldest and the top layer is youngest. What could your friend conclude about the age of the walnuts and raisins?

Another method of dating fossils is radioactive dating. Scientists can examine the radioactive particles in a sample of sediment from a fossil or sediment layer to determine its approximate age.

The collection of fossils and their placement in chronological order is known as the fossil record. It documents the existence, diversity, extinction, and change of many life-forms throughout the history of life on Earth.

What Do You Think?

Take a look at the illustrations on the right. They show fossils found in different layers of rock. What is the order of these fossils, from oldest to youngest?



What do you call scientists who study fossils?

They are called paleontologists. Paleontology is the scientific study of prehistoric life. Paleontologists use fossils to figure out three main things about fossils: the identity and origin of the fossil, the fossil's environment, and what the fossil can tell us about the history of Earth.

Fossil Record

Reflect

Seashells seem to be everywhere. Most of the time you will find them on beaches, but every now and then, you may find them far from the sea. For example, you may find a shell stuck in a rock high on a mountain. What could such a find tell you?

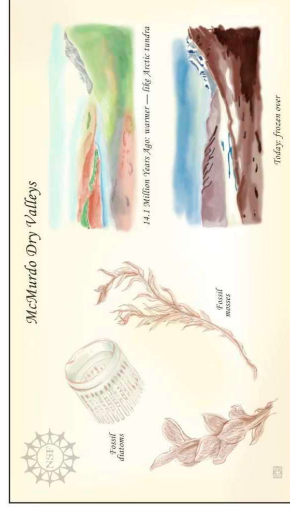
How can fossils tell us what environments were like millions of years ago?

Scientists tell us that environments change over time. However, what evidence backs up this claim? In 1988, Gordon Hubbell and a team of fossil hunters dug a hole in a desert in Peru. This desert is one of the driest places on Earth; almost no rain falls there. After digging for a while, Hubbell discovered a jawbone and more than 200 sharp, triangular teeth. Hubbell is an expert in fossil sharks. He recognized that the teeth belonged to an ancestor of the great white shark.

For about 20 years, the teeth were stored in Hubbell's collection of fossils. Then, in the early 2000s, a team from the Florida Museum of Natural History in Gainesville figured out that the fossil teeth were 4 million years old! The conclusion? One of today's driest places was underwater 4 million years ago. Fossils proved that the environment in this place had greatly changed.

Here is another example. Today, the continent of Antarctica, which surrounds Earth's South Pole, is the coldest place on our planet. Temperatures there can dive below -84°C (-120°F). No plants or animals permanently make their homes in the interior of Antarctica. Has Antarctica always been this cold and empty of living things? According to fossil evidence, the answer is no.

Scientists exploring the Dry Valleys area in Antarctica found fossils of mosses and tiny animals. The fossils were unearthed in ancient lake beds. The scientists calculated that the fossils were about 14.1 million years old. At that time, shrubs grew from the ground around the lakes. Some insects lived there too. To support these living things, summer temperatures would need to have been much warmer than they are now. Again, fossils proved that an environment on Earth had changed greatly over time.



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3

Fossil Record

Look Out!

Fossils are most often formed from the hard parts of organisms. The soft parts usually break down before they can be preserved in rock. However, there are some exceptions with inclusion fossils. For example, animals trapped under ice may be preserved whole. This is what happened to some woolly mammoths like the one shown in the image at the top right. Woolly mammoths are extinct animals that looked a bit like modern elephants. Some lived in the icy regions close to the North Pole. Some insects have been preserved whole too. This is especially true of insects trapped in tree sap. When the sap hardens, the insect is preserved inside. This happened to the mosquito in the image at the top right.

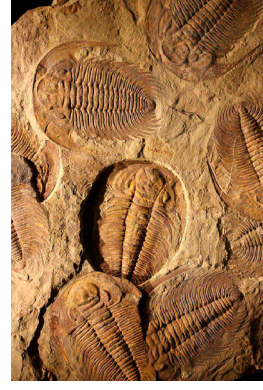


How can we represent fossils and past environments, using models?

Scientists often use models to describe objects or events in nature. A model is a representation of a real thing. A model may be as simple as a drawing or a shape made out of clay. It may be an animal reconstructed from just a few fossil bones. The fossils in the dinosaur skeleton shown below were used to make a model of a complete dinosaur.

Another type of model is a diorama that shows both an organism and its environment. The environment may be in the present or in the distant past. The American Museum of Natural History in New York City shows two organisms related to human beings walking on a dusty plain in Africa. This model was based on actual fossil footprints preserved in rock. By studying the shapes of the footprints, scientists can draw conclusions about the body shapes and sizes of the organisms that made the prints.

Try Now



Collect a variety of small objects, such as stones, leaves, coins, or marbles. Make an imprint of each object by pressing one side of the object into a piece of modeling clay. These imprints represent fossils. Label each imprint with a number and create a key to identify each imprint. Ask your classmates to identify the source of each "fossil" (the object that made each imprint) and explain how they came up with their answers.

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Fossil Record

The following chart lists five different locations on Earth today. Suppose that scientists found a fossil of an ancient organism in each location. Based on the type of fossil found there, decide how the location has changed over time. In particular, determine whether each location:

- used to be a forest,
- used to be underwater,
- used to be a tropical island, or
- has not changed since the fossil was formed.

Fossil	Where Was It Found?	How Has the Location Changed?
Seashell	The side of a mountain	
Palm branch	An ice sheet in the Arctic	
Imprint of a cactus leaf	A desert	
Insect trapped in tree sap	Under the ocean floor	
Shark tooth	A wide-open grassland	



Discover Science: What Lucy Tells Us

In 1974, fossil hunters working in Africa discovered a nearly complete skeleton of an adult female that lived a little more than 3 million years ago. They named the skeleton Lucy. Studies of Lucy's bones revealed that she was less than 1.1 m (3 ½ feet) tall and she probably weighed less than 30 kg (66 lbs). Most importantly, her bone structure provided evidence that she walked upright. Fossilized footprints also found in Africa further supported this conclusion. The footprints belonged to other members of Lucy's group of organisms and showed two organisms walking much as we do today. As far as scientists know, Lucy and her kind were the first humanlike organisms to walk upright.

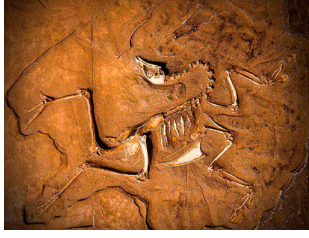


Fossil Record

Reflect

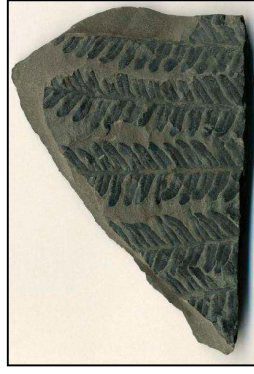
The Fossil Record

The fossil record is the collective accumulation of the remains of organisms from all over the world that have been preserved, particularly in rock, and that are generally at least 10,000 years old. It provides us with interesting information about the once-living organisms here on Earth. Scientists do their best to study the information that comes from the fossil record to better understand our world.



What Scientists Look At

People who study the fossil record are trying to learn about the organisms that have been fossilized. The fossil record can be used to piece together how organisms interacted. Scientists study how the fossils were created, along with the exact location where they were preserved. Their findings provide clues about when the fossilized creature lived, the geological and meteorological conditions at the time, their habitat, and their migration. These findings play a very important role in many scientific fields.



Diversity in Fossils

Even though only a small number of living organisms become fossilized, the diversity between them is quite significant. The fossils that have been found only make up a small percentage of what has yet to be discovered. Scientists such as paleontologists have found remains ranging from small bacteria to gigantic mammals, such as the most well-known dinosaur fossils. By comparing evidence from fossils with our present-day ecosystems, it is clear that ancient Earth was most definitely not the same as it is today. Why certain organisms became extinct is still one of science's biggest mysteries.



Extinction

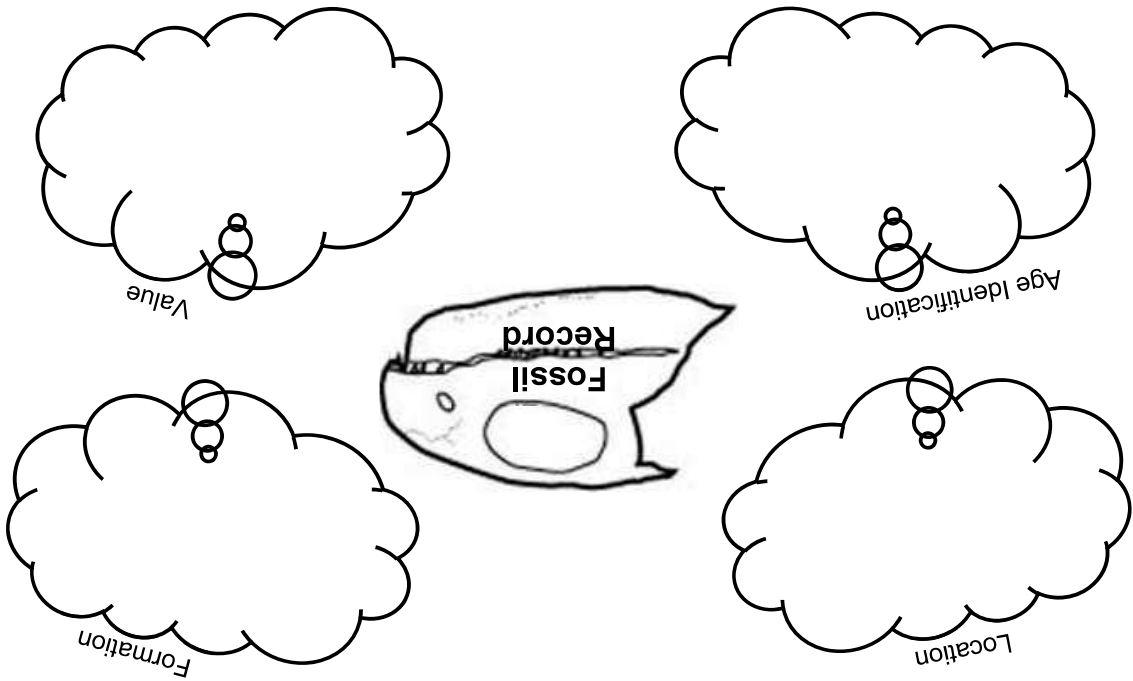
Extinction is an evolutionary process that leads to the disappearance of a species or a population. When a species becomes extinct, such as the ammonite pictured on the right, its entire gene pool is lost. Through evolution, a species can give rise to another species as some of its members adapt to environmental changes or undergo changes in their gene pool. This process is known as speciation, or the birth of a new species. Speciation and extinction are both part of the natural evolutionary process of living beings. The most famous extinction event happened 65.5 million years ago and wiped out 50% of all species living at the time, including all the families of dinosaurs.



Directions: Fossil records hold immeasurable information about the history of life on Earth. On this graphic organizer, include where fossils can be found, the types of fossil formation, different methods of identifying fossil age, and their overall value to us.

Mysteries from the Past

Name: _____ Date: _____



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Linking Literacy



Name: _____ Date: _____

Desert Fish

While hiking through the desert of New Mexico, the Smith family found a fish fossil. They thought it was strange to find something that belonged in the ocean in the desert. They each came up with a reason why there would be fish living in the desert. Who do you agree with and why?



Mrs. Smith: A bird must have dropped the fish as it flew over the desert.

Mr. Smith: Water, wind, and ice must have brought the fish to the desert.

John: A desert formed in an area that was once covered by ocean.

Mary: The fossil came from a volcano that started on the ocean floor.

Your answer here:

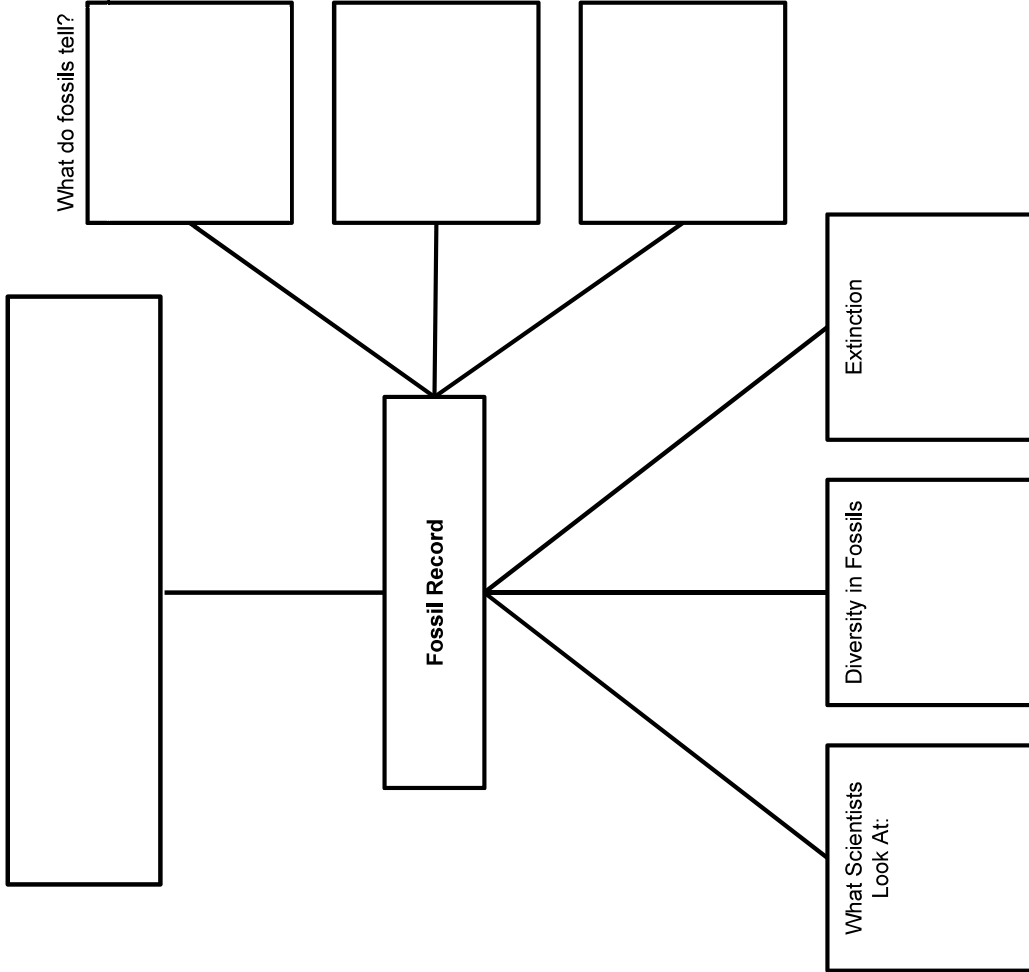
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Name: _____ Date: _____

Concept Definition Map

What is it? (Definition)



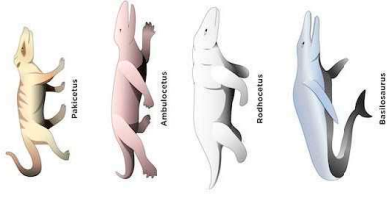
Name: _____ Date: _____



Reading Science

Whale Evolution

- Whales are mammals that live their entire lives in the ocean. Has this ever made you wonder how whales came to be on Earth? Archaeologists are scientists who study prehistoric times. They use fossils to discover how animals have changed over time. Fossil records can be used today to help determine the evolutionary history of animals. This is done by studying a few key elements of fossils. The location of a fossil can provide the time period in which the animal lived. It can also tell the age of the fossil and where the animal died. Studying the size and shape of a fossil can tell how big it was. It can also tell what it looked like. The orientation of body parts can reveal how the animal lived. It can explain what it ate and how it moved. Fossil finds have continued to fill in much of the story of animal evolution. The study of fossils of many animals has helped trace the evolution of whales.
- Scientists have studied fossils for years. They studied a fossil called *Pakicetus*. *Pakicetus* is a fossil that is likely an ancestor to modern whales. Scientists believe *Pakicetus* lived about 52 to 48 million years ago. This animal is believed to have had four legs. Its eyes were close together on top of its head. The location of the eyes on its head suggests that *Pakicetus* looked for things above the water. The ear bones are thick, but the jawbone lacks the space for mammals. These animals are also known as cetaceans. The structure and wear pattern of its teeth suggest that *Pakicetus* was carnivorous and ate fish and small animals.
- About 50 to 48 million years ago, an amphibious mammal called *Ambulocetus* hunted in the shallow ocean. Fossils of *Ambulocetus* show that it was about 3 meters long. It had back legs, which were more suited for swimming than for walking. It could hear well underwater, and its teeth resembled those of modern cetaceans. Its limb anatomy suggests that it was slow both on land and in water. *Ambulocetus* probably hunted much like modern crocodiles.
- Fossil records of the next generation of early whales are between 49 and 35 million years old. These fossils revealed animals that still had four limbs. These limbs were shorter and some had tail flukes. They probably did not use their hind limbs for locomotion. Instead they swam by moving their tails up and down. Were these animals truly aquatic or still amphibious? One fossil appears to contain a fetus. It is positioned head first for birth. Animals born on land are born head first. Whales born in the water are born tail first. The position of the fetus in the fossil suggests that at least some species of early whales still gave birth on land.





Reading Science

- 5 *Basilosaurus* was an early whale that lived between 40 and 34 million years ago. These fossils show similarity to modern whales in both their structure and size. *Basilosaurus* fossils are up to 18 meters long. This is comparable to modern whales. Fossils of *Basilosaurus* indicate that they were adapted to an entirely aquatic life. They had tail flukes. Their forelimbs were flipper-like, while the hind limbs were tiny. They were probably used only during mating. Some modern whales have teeth that are very similar to those found in *Basilosaurus* fossils.
- 6 Fossil evidence provides insight into the actual evolutionary path of animals. Whale evolution went through many transitional steps. It started with small four-legged animals adapting to hunt under water. This then led to larger four-legged creatures that grew more amphibious. Next, larger animals with smaller hind limbs and strong tails developed. Fossil records play a key role in learning about prehistoric times. They also help us gather information about the animals of previous time periods. The study of numerous animal fossils has helped trace the evolution of whales today.



Reading Science

1. How do Archaeologists use fossils?
- Archaeologists only use fossils to discover how birds evolve over time.
 - Archaeologists use fossils to build animals.
 - Archaeologists only use fossils to learn about whale evolution.
 - Archaeologists use fossils to discover how animals evolve over time.
-
2. Which of the following can help to determine the age of a fossil?
- Shape of the fossil
 - Orientation of body parts
 - Location of the fossil
 - Size of the fossil
-
3. Which part of *Pakicetus* anatomy most suggests that it is an ancestor of whales?
- It had eyes near the top of the head.
 - It had a tail fluke.
 - It had teeth consistent with a carnivorous diet.
 - It had four legs.



Independent Practice

Name: _____ Date: _____

Part I: Riddle

Directions: Use the clues to fill in the missing words. Then match the numbers under the letters to find the answer to the riddle.

1. Data about fossils that includes number, type, and location

___ 18 ___ S ___ ___ ___ 9 ___ D

2. Impressions of organisms left in rock layers

___ O ___ ___ 2 ___

3. A list that goes from oldest to newest

C ___ 22 ___ 12 ___ 21 ___ ___ 17 ___

4. Formed when new sand and rocks are deposited on older layers of sand and rocks and then compacted

___ 5 ___ D ___ 13 ___ ___ 20 ___ 6 ___ 4 ___ R ___

5. Organisms that share a common ancestor

___ 23 ___ ___ O ___ 14 ___ ___ N ___ 11 ___ ___ 10 ___

6. Having many different parts

___ 1 ___ I ___ ___ ___ 19 ___



Reading Science

4. Which of the following statements is **NOT** true regarding *Ambulocetus*?

- A. It could hear well underwater.
- B. It lacked hind limbs.
- C. Its teeth resemble modern whale teeth.
- D. It was slow.

5. How can scientists determine whether an extinct animal gave birth on land or underwater?

- A. Location of the hind limbs of the fetus
- B. Position of the nostrils
- C. Position of the head of the fetus
- D. Location of the fossils

6. Fossils of *Basilosaurus* resemble that of modern whales because—

- A. there are similarities in both anatomy and size.
- B. they both have the exact same fossil coloring.
- C. they lived during the same time period.
- D. there are similarities in where the fossils were found.



Independent Practice

7. Using a radioactive isotope's half-life to date materials

7 ----- 15 ----- D ----- 16 -----

8. When a species no longer exists

24 ----- T ----- 8 -----

Riddle: These are examples of extinct species.

1 2 12 17 3 11 ----- U ----- 7 5

5 6 ----- B ----- 24 7 10 8 9 16 22 ----- 23 11 19

W ----- 17 18 20 21 4 ----- 13 15 14 13 17 10 22



Concept Attainment Quiz

Name: _____ Date: _____

I. Vocabulary Matching

Match each term on the right to the correct definition.

- | | |
|---|-----------------------|
| 1. _____ Variation among organisms in an ecosystem | A. Sedimentary layers |
| 2. _____ Remains, impressions, or traces of an organism that lived in the past | B. Fossils |
| 3. _____ The state of no longer existing | C. Diversity |
| 4. _____ Rock formed in layers from deposition and solidification | D. Extinction |
| 5. _____ The mineralized remains of organisms and the rock layers in which they are found | E. Fossil record |

II. Identification

Use the clues provided to fill in the blanks.

Word Bank

chronological order common ancestry fossil record nitrogen dating
radioactive dating sedimentary rock metamorphic rock timeline

- The total number of fossils that have been discovered and the information derived from them is called the _____.
- Fossils can usually be found in layers of _____.
- The approximate age of fossils can be determined by putting them into _____ based on the location of the sedimentary layers in which they were found.
- Scientists can determine the relative age of rocks using a technique called _____, which measures the amounts of a radioactive substance and its decay.



Concept Attainment Quiz



Multiple Choice

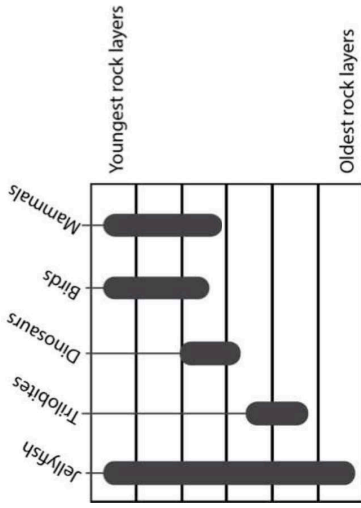
Name: _____ Date: _____

III. Open-Ended Response

Answer the questions below. Use additional paper if needed.

1. What does the fossil record document?
2. How does the fossil record help support the theory of evolution?

- 1 The following diagram shows where, in layers of rock, fossils of certain organisms are found.



The information in the diagram supports which of the following conclusions?

- A Birds descended directly from trilobites and dinosaurs.
- B Trilobites became extinct before dinosaurs appeared on Earth.
- C Jellyfish live longer than any other organism on Earth.
- D Mammals did not appear on Earth until after the dinosaurs went extinct.



Multiple Choice

Fossil Record



Multiple Choice

Fossil Record

- 2 The data table below provides information on the ancestors of the modern horse.

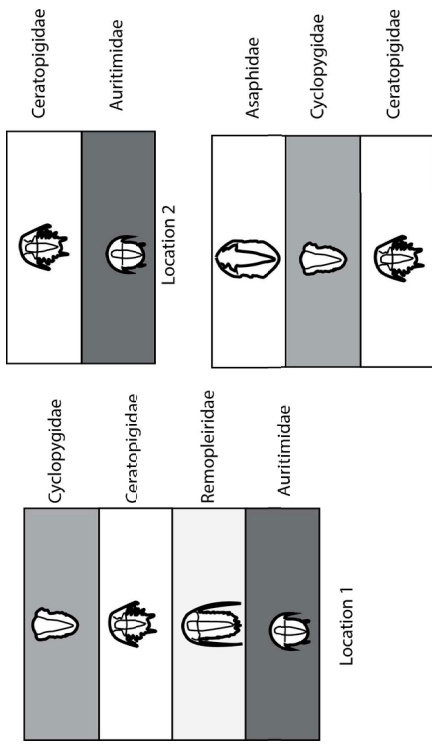
Organism	Fore Foot Toes	Skull Length (cm)	Height (cm)	Molar Length (cm)	First Appeared (mya*)
Equus	1	25	135	4.8	3.5
Pliohippus	1	18	120	3.9	5.2
Merychippus	3	10	100	3.7	26.5
Mesohippus	3	7.5	52	2.8	35
Orohippus	3	4	47	2.5	47
Eohippus	4	3	38	1.7	50

*mya = millions of years ago

Over the evolutionary history of the horse, there have been several trends in how their bodies have changed. Which trend shows a decrease?

- A The number of toes on the fore feet
- B The length of the skull
- C The height of the animal
- D The length of their molars

- 3 Three different rock layer sequences from three locations, each with different trilobite fossils, are shown here.



Based on the relative positions of the fossils, which of the following conclusions is best supported by the fossil evidence?

- A Auritimidae was the last trilobite to appear.
- B Cyclopygidae appeared after Ceratopigidae.
- C Remopleiridae appeared before Auritimidae.
- D Cyclopygidae was the first trilobite to appear.



Multiple Choice

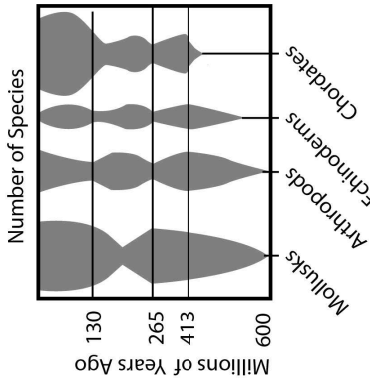
Fossil Record



Multiple Choice

Fossil Record

- 4 This diagram provides information on the diversity, in number of species, for four major groups of animals over time.



What is the only group that experienced an increase of diversity between 413 million years ago and 265 million years ago?

- A Mollusks
- B Arthropods
- C Echinoderms
- D Chordates

- 5 Over the evolutionary history of a certain kind of fish, the trend is for an increasing number of teeth. The data table provides information for several examples.

Millions of Years Ago	Representative Species	Number of Teeth
120	<i>W. columbae</i>	14
97	<i>W. arcus</i>	20
85	<i>W. arundinum</i>	26
66	<i>W. ipsum</i>	38
49	<i>W. ambulatus</i>	42

A fossil of a new species of this type of fish (*W. amatequorum*) is discovered. The complete fossil skeleton is found, and it has 34 teeth. The most reasonable estimation for the age of this fossil would be which of the following?

- A About 20 million years old
- B About 30 million years old
- C About 70 million years old
- D About 100 million years old



Claim-Evidence-Reasoning

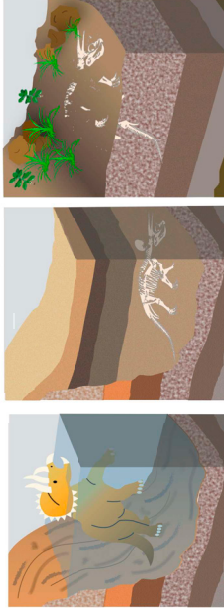
Name: _____ Date: _____

Scenario

After an organism dies, the soft tissues decay first, leaving the hard parts behind to decay much more slowly. In order for fossilization to occur, the organism has to be buried in sediments such as dirt, mud, or sand. If conditions are just right, groundwater will fill in the cavity left behind as the remains decay. The minerals naturally present in groundwater will then start to crystallize, filling in the shape of the structure as it decays with new sedimentary rock. This process is called petrification. The fossilized remains become part of the layer of rock and sediment that was just under the surface of the ground when the organism died. Over time, new layers of sediments are formed with each one forming on top of the one before. Each layer contains the fossils of organisms that lived while that layer was being formed. These layers develop very slowly over very long periods of time. Because each layer forms on top of the one before, we can assert that fossils deposited in deeper layers are older than ones located in layers closer to the surface.

External Data

Steps of Petrification



Fossil Record



Claim-Evidence-Reasoning

Prompt

Make a claim about which fossil in the diagram is the oldest. Use evidence and scientific reasoning to support your claim.

Claim:

Evidence:

Reasoning:

PEER EVALUATION

Peer Name:

Rebuttal:

8th Grade Social Studies**LEAP 2025 PRACTICE****Directions:**

Read each source and question. Circle your answer by choosing the correct choice.

1. Use the table and your knowledge of social studies to answer the question.

Top Louisiana Exports, 2014

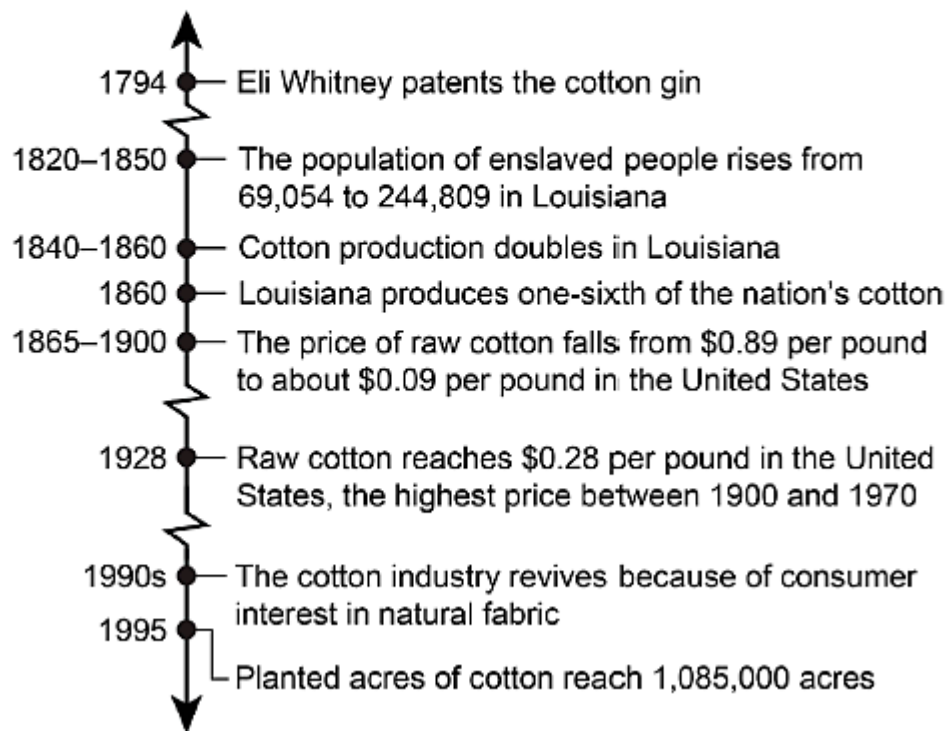
Goods Exported from Louisiana	Amount Exported in billions of dollars
petroleum and coal products	\$25.7
basic chemicals	\$4.1
grain and oilseed milling products	\$3.7
resins and synthetic fibers	\$3.5
agriculture and construction machinery	\$1.3

Which statement **best** explains the importance of Louisiana's exports to international trade?

- A. Louisiana exports petroleum and coal products mainly by container ship.
- B. Louisiana exports valuable natural resources and raw materials to other nations.
- C. Most goods exported from Louisiana are consumer products sold in stores abroad.
- D. Most goods exported from Louisiana are sold to tourists in other nations.

2. Use the timeline and your knowledge of social studies to answer the question.

Events Related to the Cotton Industry in Louisiana



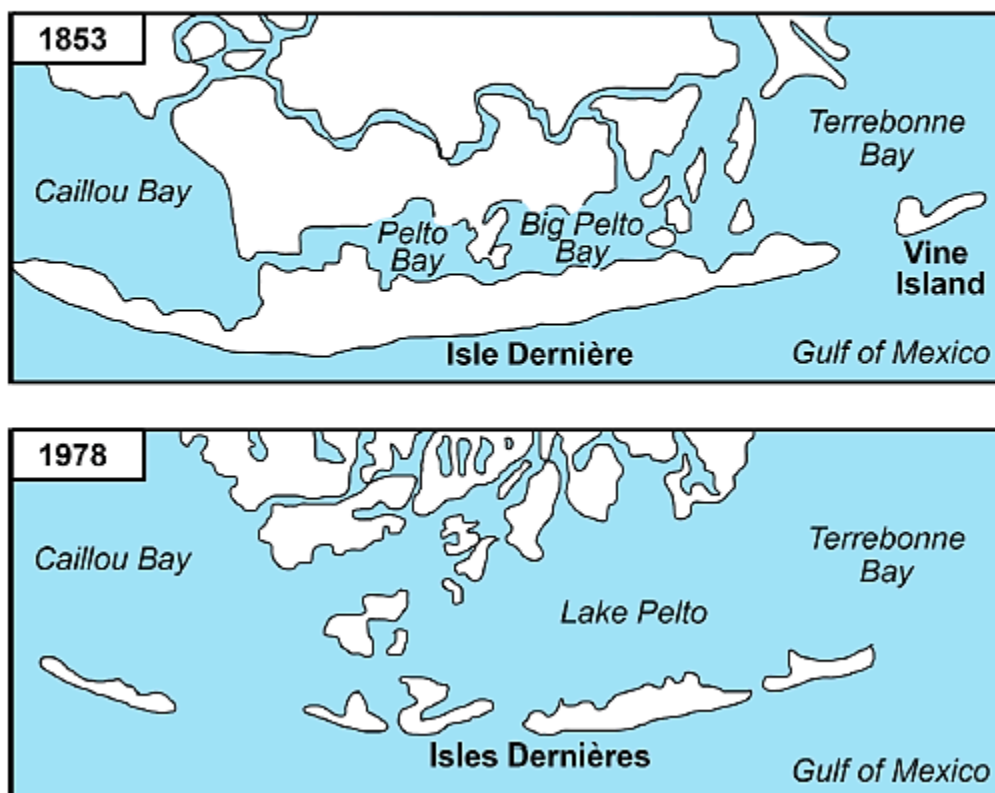
Which statement **best** describes a feature of the cotton industry in the economic development of Louisiana?

- A. Louisiana farmers have reduced the number of planted acres of cotton over time.
- B. Demand has had a large impact on the amount of cotton production in Louisiana.
- C. Technological innovations have usually increased the cost of cotton in Louisiana.
- D. Louisiana has produced more cotton fabric and clothing than any other state.

3. Use the maps and your knowledge of social studies to answer the question.

Louisiana Coastal Wetlands, 1853 and 1978

These maps show the Isles Demières in southeastern Louisiana.



Which factor **most** influenced the changes shown on the maps?

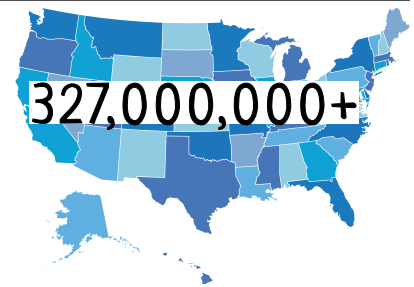
- A. rising sea levels that caused coastal erosion
- B. bridge construction that caused the shoreline to erode
- C. offshore oil drilling that changed the seafloor
- D. development of the coast that changed the shoreline

Get Counted!

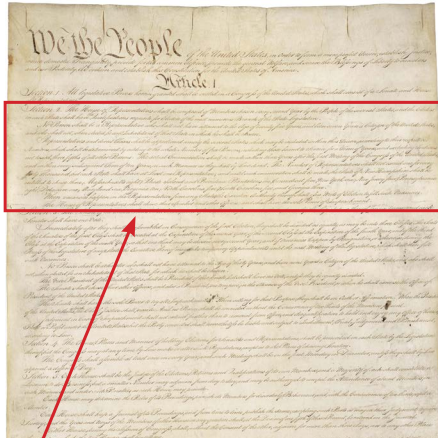
Name: _____

What is the Census?

The **census** is a count of every person in our country. It's our government's way of keeping track of our population. Every ten years, the government does a major count of every family and person, in every community across the country. The results help the government figure out what communities need and who should get what.



There are currently over 327 million people living in the United States.



The Framers thought the Census was so important they put it at the very beginning of the Constitution!

How Did the Census Start?

Article I, Section 2 of the U.S. Constitution called for a count of each state's population within three years after the first meeting of the new Congress. (And every ten years after that.) The population count would help our newly founded government figure out how to distribute the number of "**seats**" (which reflects the number of members) each state would get in the U.S. House of Representatives. That count was the first U.S. census. It happened in 1790. U.S. Marshals from district courts visited every home in the country—which only had thirteen states, three districts, and one territory at the time—and took a count of the men, women and children.

How Does It Work?

Since the first census a lot has changed. For one, U.S. Marshals no longer do the counting. Instead, we have a **Census Bureau**, an organization with thousands of people who work daily to complete the huge task of counting each and every person living in the United States. Every ten years, the Census Bureau distributes census surveys across the country. By March, households receive letters with instructions for how to complete the survey online, over the phone, or by mailing in a paper form. The Census Bureau also sends census workers called "door knockers" to rural areas and to houses that don't respond to the survey by early April to collect answers in person, too.



What Happens After Everyone Gets Counted?

Once everyone is counted, population data is shared with the President and U.S. Congress. States may lose or gain seats in the House of Representatives based on how their population has changed. The process of redistributing the House's 435 seats among the states is called **apportionment**, and it only happens after a census count. The seats are redistributed, or **reapportioned**, according to a **representation ratio** which helps ensure that each representative represents roughly the same number of people per state. Today, each representative in the House represents a little more than 747,000 people!

Get Counted!

Name: _____

Who's Counted?

A lot has changed about how people are counted. For one, now everyone is included. The first census counted white males and females and categorized them by age and gender. All other free persons, meaning mostly free blacks, were counted, too, but reported in one single category. Enslaved blacks were grouped into another category—but only counted as 3/5th of a person. Native Americans weren't counted at all, not until 1870. Today, the Census Bureau counts everyone equally. Your race doesn't matter and neither does citizenship status. The census count is a resident count, not a citizen count. If you live in the United States (or its surrounding territories), you must be counted.



Is it Hard to Count Everyone?



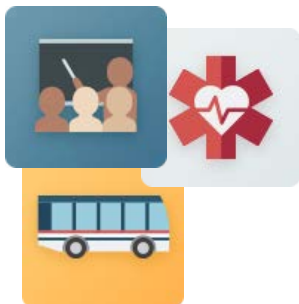
Counting every single person in the U.S. is a colossal task. Special workers called **enumerators** are hired by the Census Bureau help ensure an accurate count. But our country has hundreds of millions of diverse people, and some groups are harder to reach than others. Children ages 0-5, people who don't speak or read English well, the homeless, and some racial minorities have historically been hard for the Census Bureau to count. It's important to try to reach "**hard to count**" communities, because when people aren't fully counted, their communities miss out on the hundreds of billions of dollars the federal government distributes based on census data.

What Will the Census Ask?

The census only takes about ten minutes to complete. Only one person in your household needs to fill out the form. The census will ask for the number of people who live or stay at your home, their ages, gender, relationship to one another, and race. The census will also ask if each person is of Latino, Hispanic, or Spanish descent and if your family owns or rents your home. Any personal information like your name or address is kept private. The Census Bureau can't share that information with anyone, not even the FBI!



How Will the Census Affect Me?



Data from the census can be used to decide which communities will get money for new schools, better public buses and trains, and even hospitals. Businesses and city planners use the data to decide where to build factories, roads, offices, and stores, which help to create new jobs and improve neighborhoods. And considering that you'll be old enough to vote before the next census comes along, the results will determine the number of representatives you'll elect for your state and national governments and the amount of electoral votes your state will have in the 2024 and 2028 presidential elections. Make sure you're counted!

Get Counted!

Name: _____

Foldable. Define each word from the lesson and write a sentence using the word. Then sketch an image that will help you to remember it's meaning in the space under each word. When you're done, fold and cut your foldable according to the directions and add it to your notebook or binder.

Census

Definition:

Sentence:

Census Bureau

Definition:

Sentence:

Apportionment

Definition:

Fold Here

Sentence:

Representation Ratio

Definition:

Sentence:

Enumerator

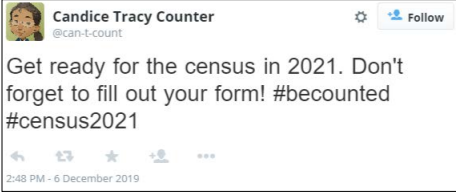
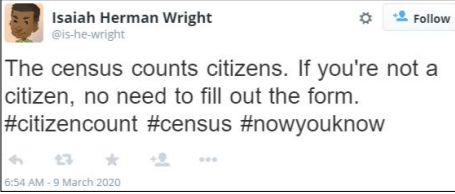
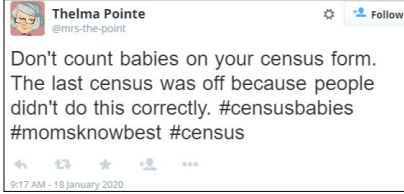



Definition:

Sentence:

Get Counted!

Name: _____

A. Misinformation Fake Out. It's important that people have correct information about the census. Don't be fooled by these deceptive social media posts. Read each post and fix it in the space below by sharing a corrected version.

 <p>Candice Tracy Counter @can-t-count</p> <p>Get ready for the census in 2021. Don't forget to fill out your form! #becounted #census2021</p> <p>2:48 PM - 6 December 2019</p>	 <p>Isaiah Herman Wright @is-he-wright</p> <p>The census counts citizens. If you're not a citizen, no need to fill out the form. #citizencount #census #nowyouknow</p> <p>6:54 AM - 9 March 2020</p>	 <p>Thelma Pointe @mrs-the-point</p> <p>Don't count babies on your census form. The last census was off because people didn't do this correctly. #censusbabies #momsknowbest #census</p> <p>9:17 AM - 18 January 2020</p>
 <p>2:48 PM - 6 December 2019</p>	 <p>6:54 AM - 9 March 2020</p>	 <p>9:17 AM - 18 January 2020</p>

B. The Census & You. Complete the chart by thinking about how each group listed will use the census data and how that data will eventually impact you! Write your answers in the space provided.

The Census & Me How the Census Affects You...				
National Government	State and Local Government	City Planners	Businesses	You! (How will census data impact you?)
<i>The national government will use census data to...</i>	<i>State and local governments will use census data to...</i>	<i>City planners will use census data to...</i>	<i>Business will use census data to...</i>	<i>Here's how the census will impact me...</i>

Get Counted!

Name: _____

C. Hard to Count. Hard to count communities exist all over the United States and vary from location to location. What do you think would make a community hard to count? Read through some of the possible reasons, then for each group list the factors that could prevent an accurate count and think of possible solutions to overcome them.



- Access to information
- Location
- Access to resources in languages other than English
- Lack of permanent address
- Inability to complete the form
- Fear that information will not be kept private

Group	What do you think contributes to this group being undercounted?	What could the Census Bureau do to improve their count of this group?
Children ages 0-5		
Homeless		
New Residents		

D. Primary Source. Read the excerpt and answer the questions. Some words have been defined for you. Others you'll have to figure out on your own. (Don't worry, we know you can do it!)

Article I, Section 2 of the U.S. Constitution

[Representatives and direct Taxes shall be **apportioned** among the several States which may be included within this Union, according to their respective Numbers, which shall be determined by adding to the whole Number of free Persons, including those bound to Service for a Term of Years, and excluding (not counting) Indians not taxed, three fifths of all other Persons.]¹ The actual **Enumeration** shall be made within three Years after the first Meeting of the Congress of the United States, and within every subsequent (next) Term of ten Years, in such Manner as they shall by Law direct. The Number of Representatives shall not exceed (be greater than) one for every thirty Thousand, but each State shall have at Least one Representative; and until such **enumeration** shall be made, the State of New Hampshire shall be entitled (able) to chuse (choose) three, Massachusetts eight, Rhode-Island and Providence Plantations one, Connecticut five, New-York six, New Jersey four; Pennsylvania eight, Delaware one, Maryland six, Virginia ten, North Carolina five, South Carolina five, and Georgia three.

¹The 14th Amendment, ratified in 1868, changed the rule that enslaved blacks be counted as 3/5th of a person.

1. How were representatives and direct taxes apportioned among the states?
2. When did the Constitution change to count enslaved blacks as whole persons?
3. In the reading you learned what an enumerator is. Now, use that knowledge and the context clues from the excerpt to write a definition for enumeration.
4. What was the representation ratio set by the U.S. Constitution?
5. How many representatives did each state have before the first census count?

Get Counted!

Name: _____

E. Practice Survey. Directions for completing the census will soon be making their way to your door. Practice by answering a few sample questions below. The questions here will cover the first 2 people in your home. The real census will have room for everyone living or staying in your home.

Start here OR go online to complete your 2020 Census questionnaire.

Use a blue or black pen.

Directions: Before you begin, use the guidelines here to help you get an accurate count of all the people in your home.

- Count everyone, including babies, living or sleeping in your home.
- Count anyone who doesn't have a permanent address who is staying with you on April 1st.
- Do not count anyone who lives away from your home on April 1st even if they will return to your home later (i.e. anyone away at college, in the Armed Forces, staying in a nursing home, jail, or prison.)

1. How many people live or stay in your home?

Number of people =

2. Is your house, apartment, or mobile home owned or rented? (Check one)

- Owned?
- Rented?
- Neither?

3. Answer the following questions about each of the people who live in your home. Start by listing the person who pays rent or owns the home as Person 1. If that person does not live in the home, you may start with any person.

Person 1:

a. First and Last Name

b. Gender (Check one)

- Male
- Female

c. Age and Birthday (if the person is less than a year old, write 0 for the age)

d. Hispanic, Latino, or Spanish descent?

- Yes
- No

e. Race or Ethnicity

Person 2:

a. First and Last Name

b. Gender (Check one)

- Male
- Female

c. Age and Birthday (if the person is less than a year old, write 0 for the age)

d. Hispanic, Latino, or Spanish descent?

- Yes
- No

e. Race or Ethnicity

Thank you for completing the Sample Census Questionnaire!

Get Counted!

Name: _____

***Optional Activity.** Create a poster or PSA (public service announcement) to get the word out about the census and the importance of being counted. Be sure to include when the census will be happening, how people can complete it, and two other pieces of information about the census that you think will help your community ensure a complete and accurate count.



Plug into Power

WITH THE U.S. CENSUS

The number of members a state has in the House of Representatives and the amount of money a state gets from the federal government are based on that state's population. Completing the census survey can plug your community into valuable resources.

HERE'S HOW IT WORKS!

U.S. GOVERNMENT
RECEIVES
POPULATION DATA
FROM THE
CENSUS BUREAU

STATES ARE
ASSIGNED SEATS
IN THE HOUSE BASED
ON POPULATION

YOUR COMMUNITY
RECEIVES
SERVICES FUNDED
BY THE STATE

INDIVIDUAL
COMPLETES
THE U.S. CENSUS



STATES ARE
ASSIGNED
ELECTORAL
VOTES

STATES GET A
PORTION OF THE
FEDERAL BUDGET TO
FUND SERVICES

Medical Assistance - \$311b
School Lunch Program - \$18b
Assistance for Needy Families - \$17b
Medicare - \$70b
Federal Pell Grant - \$29b

BILLIONS
OF DOLLARS
ARE DISTRIBUTED
BASED ON
CENSUS DATA
EACH YEAR

Housing Vouchers - \$15b
Special Education Grants - \$11b
Schools - \$14b
SNAP - \$71b
Roads - \$38b

Numbers taken from the Uses of Census Bureau Data in Federal Funds Distribution, U.S. Census Bureau 2017



Visit [iCivics.org](https://www.icivics.org) to download our Citizen and Participation Uni

Civic Action and Change

Name: _____



Take Action!

Read the situations and check the actions that you think would be the most effective way of making a positive change.

Situation One: There are too many stray cats and dogs in your town! Which *two* things would you do?

- Hold a bake sale to raise money for the local animal shelter.
- Write an editorial for the newspaper telling readers about the problems homeless animals face.
- Convince local veterinarians to donate their time for a spay and neuter clinic once a month.
- Set up an adoption service to take animals off the streets and into loving homes.
- Put food out on your back porch.

Situation Two: Kids in school are getting into fights more often than ever! What *two* actions would you help with?

- Have a rally at the school where a guest talks about non-violence and how to cool down.
- Volunteer as a mentor for younger students and discuss ways to deal with anger.
- Share information about teen violence with the students in your school.
- Ask the school board to add a class about anger management and communication skills to the curriculum.
- Try to get into fewer arguments with your friends and family.



Anticipation Activity

Civic Action and Change

Name: _____



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Anticipation A

INFORM

Get information on what the facts are, what problems exist, and who can help make the change you want.

Give an example of something you can do in this step.

ACT

Bring attention to the cause through protests, meetings, and petitions. Inform the public. Get laws passed that address your problems & meet your goals.

What acronym do these three words create?
_____!

Give an example of something you can do in this step.

MAINTAIN

Major change takes time. Continue to fight for change by keeping informed and staying focused. One success can lead to another.

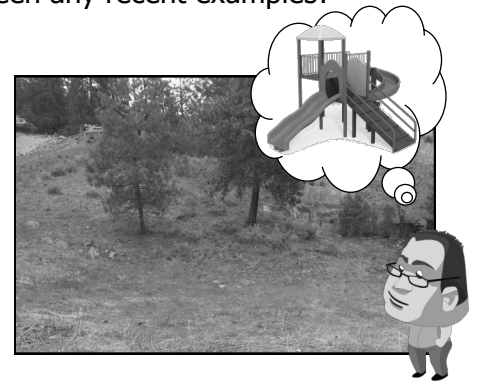
Recipe for Change



Civic action describes all the things people do to bring about social and political change. A democracy like ours is based on citizens engaging the government. When people take civic action, the government responds. Civic action can involve a million people marching in Washington, D.C. or a few people calling attention to a problem in their own hometown. The Civil Rights Movement of the 1950s and 1960s was a time when thousands of Americans were fighting for change, and their civic action was highly visible in the news media. Civic action still happens every day. Have you heard or seen any recent examples?

Civic Action Requires a Plan

Activism happens when people see a problem, gather together with a set of goals, and make a plan. Sometimes civic action plans take place at the local level. For example, people might set a goal to turn an abandoned lot into a playground. To achieve a bigger goal, such as getting a law changed, the group will need to take their plan to the state or national level and get lawmakers to listen.



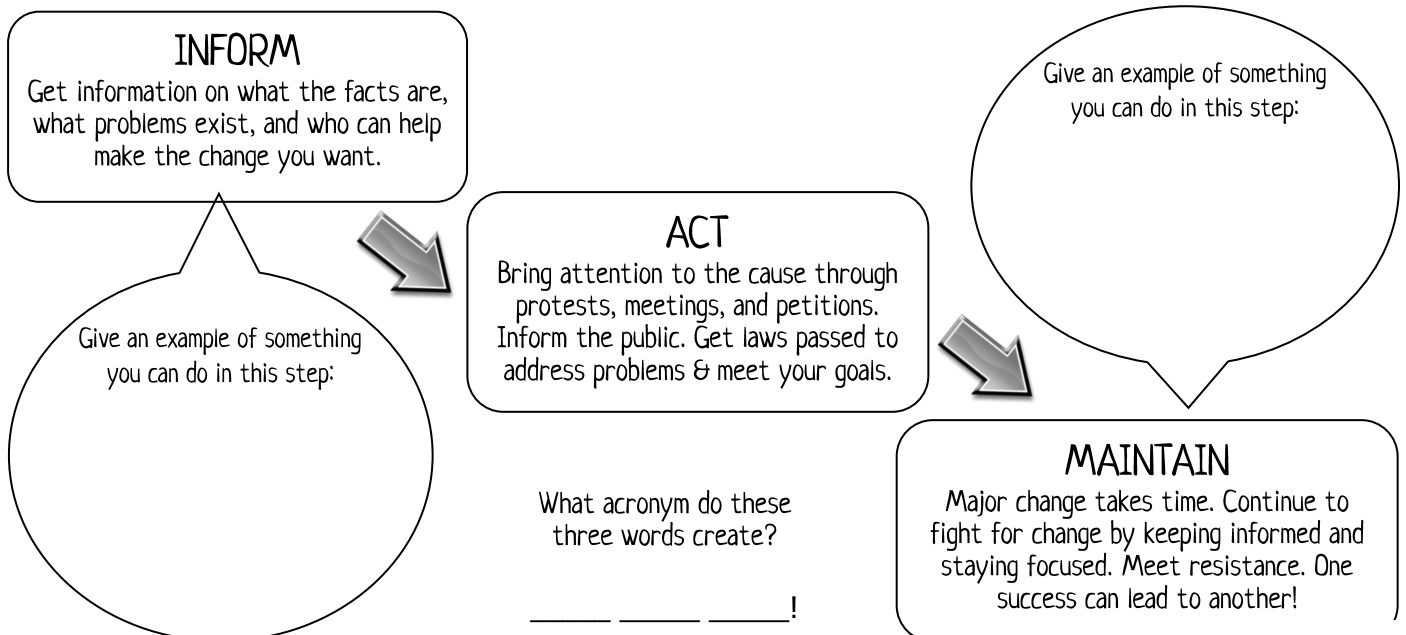
Civic Action is a Process



Civic action on the state or national level isn't like a school project that is over in a few weeks. It takes years or even decades to make changes in government and society. Think about all the work involved! First, a group that wants change must educate the public and lawmakers about the problems that exist. Sometimes this means changing peoples' attitudes and misconceptions. Then, the group must work to get laws passed, make sure the laws are carried out correctly, and maybe even defend the laws against challenges in the courts. It takes all three branches of the government to make change, as well as the "fourth branch"—citizens!

Three Steps of Civic Action

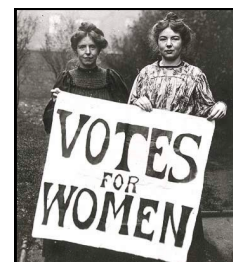
Every group or person may have a different goal for change, but the process they will go through to make change is always the same. Civic action has three main steps:



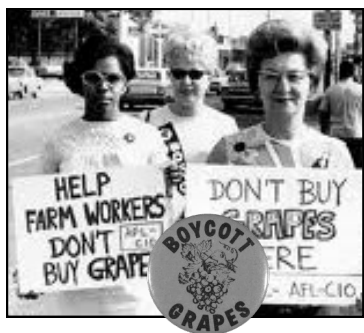
Women

Today it is hard to imagine that not so long ago, women in the United States had no political or social rights. For example, they were not allowed to vote, own property, attend college, or even be doctors or lawyers. In 1848, the first women's convention met to discuss the need for change. These meetings grew into what became the **Women's Rights Movement**. Thanks to that hard work, women got the right to vote when the **19th Amendment** was passed in 1920.

In the 1960s, women's rights activists focused on a woman's right to privacy and on equal opportunities for women at school and at work. For example, the **Equal Pay Act of 1963** promised equal pay for equal work. Employers were prohibited from discriminating based on gender. They also could not discriminate against women who were pregnant or had young children. Modern women continue to face equality issues, and many national groups are fighting for women's equality.



Farm Workers



In the late 1960s, migrant farm workers began to bring awareness to the poor working and living conditions of minorities who worked for large producers. They created the **United Farm Workers Union** so the workers would be able to organize. This group made demands for improved conditions. The UFW organized the most successful boycott in history when they convinced people to stop buying grapes. After five years, vineyard owners were forced to sign labor contracts protecting workers' rights. The Migrant and Seasonal Agricultural Worker Protection Act of 1983 put some key laws in place to protect farm workers from employer abuse, but many problems continue. The movement to protect farm workers' rights is still very active today.

People with Disabilities

Over 50 million people in the United States have at least one physical, mental, or learning disability. These disabilities have been the basis for **discrimination** in public places, schools, and jobs. Disabled people also had limited access to **public services** like transportation.

The **Civil Rights Act of 1964** made it illegal to discriminate against people because of their race, religion, or gender—but not because of disability. People with disabilities fought for their rights by talking to their elected representatives, writing letters and articles, and trying to meet with lawmakers. When companies and individuals refused to meet with them, disability rights activists used more extreme actions to have their concerns heard. You will learn about the two major laws that came out of this movement later in the lesson.



The protest sign refers to discrimination faced by African-Americans, who before 1964 were forced to sit at the back of public buses in many places.

American Indians

In the 1960s and 1970s, Native Americans living on reservations were faced with extreme unemployment, lack of health care and education services, and very poor living conditions. The Native history and lifestyle were constantly challenged by new laws and threats to the land on which the people lived. Activists fought for equal treatment and protection of traditional ways by bringing attention to these **injustices**. As a result of their work, Congress passed laws protecting Indian land. Successful challenges led to protection for Native American hunting and fishing



People with Disabilities

Problems

Facts

Actions

←

Laws

What happened next...

INFORM

ACT

MAINTAIN

Women

Problems

Facts

Actions

←

Laws

What happened next...

Civic Action and Change

Name: _____

Directions: Cut out the 10 boxes and glue to the IAM worksheet in the correct order. Read each box carefully to see how these movements met specific goals.



Passing ADA didn't fix everything. People needed to understand how to be sensitive to the needs of disabled people. Some businesses didn't want to pay to install accommodations so disabled people could be included. This kind of education became a new goal for the movement.

There were other problems that had not been solved. Years later, a law called IDEA (Individuals with Disabilities Education Act) helped children get access to public schooling despite their disabilities. IDEA requires public schools to provide a "free appropriate public education" that meets a disabled student's needs.

People with disabilities wrote "Discrimination Diaries" that talked about daily experiences with barriers and discrimination and sent them to lawmakers. Activists also blocked Greyhound buses demanding wheelchair lifts.

Facts

- 19% of the population in the U.S. has at least one disability.
- 8% of kids under 15 are disabled.
- Disabled people make up the largest minority group in the U.S.

Facts

- In 1971, girls made up only 7% of high school sports participants.
- That same year, 42% of college students were women.

Problems

- People with disabilities were not able to *access* public places and use public transportation.
- Laws banning discrimination did not protect the disabled.

Problems

- Girls lacked sports teams and after school activities at school because schools focused their money on boys' activities.
- Women were discriminated against when they applied for college & jobs.

Groups used court cases, petitions, protests, and Congressional hearings to pressure the government to create a law that gives women and girls equal access to educational and extracurricular activities.

The Americans with Disabilities Act

(ADA) was signed into law by President Bush in 1990. It banned discrimination based on disability in employment, public services, transportation, and communication. It also helped define a disability as an impairment that limits one or more major life activities.

Getting Title IX passed was a huge victory, but was met with resistance by many. The athletic part of the law required that there be equal funding and opportunity for male and female athletic teams. Coaches and supporters of male teams stated that funding for male sports teams suffered and that there was now discrimination against the guys!

These arguments against Title IX have been dismissed by the court system, but the subject is still controversial.

Supporters of the law continue to watch and make sure that women get equal opportunities in school and in athletics.

Title IX(9) was signed into law by President Nixon in 1972. It banned gender discrimination in all education programs and extracurricular activities in schools funded by the government. Now 40% of high school sports players and 57% of college students are female!

Civic Action and Change

Name: _____

A. Vocabulary:

Select the best synonym for the underlined word in each sentence.

- ___ 1. Discrimination is one form of unfairness. A. discrimination
- ___ 2. All of the groups in this lesson faced unequal treatment. B. awareness
- ___ 3. Protests and boycotts creates public understanding about a civil rights cause. C. injustice

B. Make it Accessible!

Look at each image. Decide whom each accommodation helps and how it helps.



Laws that allow guide dogs inside public places.

Helps Whom? _____

Helps How? _____



Closed captioning prints what is being said on TV.

Helps Whom? _____

Helps How? _____



Ramps as an alternative to stairs or steps.

Helps Whom? _____

Helps How? _____



Bumpy pavement beside train tracks or roads.

Helps Whom? _____

Helps How? _____

C. And in This Corner...

Every group met opposition during its fight for change. Match each movement with its opposition.

The Movement

- ___ 1. The **Equal Pay Act 1963** made it illegal for men and women to get paid different wages for doing similar work.
- ___ 2. The **Americans with Disabilities Act** requires all buildings used by the public to be accessible for the disabled.
- ___ 3. After court cases involving **Native American land rights** the US government allowed tribes to hunt and fish on their reservation and on land that had been taken away and sold to white settlers.
- ___ 4. The **Agricultural Worker Protection Act of 1983** required safe transportation and housing for migrant farm workers and made employers tell workers they will receive in exchange for their labor.

The Opposition

- A. Changing existing buildings, especially old ones, is really expensive. The government is not helping pay for the changes that have to be made.
- B. Other countries don't have strict labor laws. We can't compete with their cheap fruits and veggies if we have to spend money on houses and buses!
- C. Women miss more work because they are usually the ones to stay home when a kid is sick. They also take maternity leave when having a baby.
- D. It is not fair that some Americans can use land when other Americans are not allowed. Being a part of one group shouldn't give them more rights.

Civic Action and Change

Name: _____

Directions: Create your own I AM chart. Complete this chart by answering the questions and thinking like a civil rights mover and shaker!

Inform!

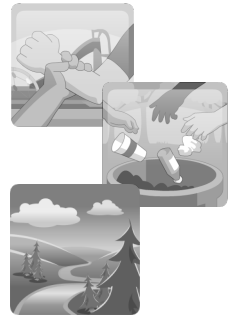
Title: _____

Facts and Figures: What is the situation?

Issue: What is the problem?



Goal: What is the solution?



Act!

Message: What do you need to say?
Who needs to hear it?

Outcome: What does the change look like?

Action: How will you take the message to the audience? (You can write it and draw it!)

Maintain!

Keep it Up! What is the next step for your movement? How do you continue your work?