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GED® TEST OVERVIEW

The GED® Test is a national examination that demonstrates both high school equivalency as well as college and career readiness. It represents the content-area knowledge and the reading, writing, thinking, and problem-solving skills needed for postsecondary educational programs and for the world of work. This means that your GED® diploma is not an end in itself—it is the springboard to more education and to both better-paying jobs and career pathways.

TAKE FOUR SUBTESTS IN FOUR CONTENT AREAS

Reasoning through Language Arts—2½ Hours (one 10-minute break)

- 54 questions
- Includes one extended written response to reading passages—up to 45 minutes

Mathematical Reasoning—1½ Hour

- 46 questions
- First section—5 questions, no calculator allowed
- Second Section—calculator allowed; Texas Instruments TI-30XS Multiview™ calculator

Social Studies—1½ Hour

- 35 questions
- Includes one extended written response to passages and/or graphics—up to 25 minutes

Science—1½ Hour

- 34 questions
- Includes 2 short answer written responses to passages and/or graphics—up to 10 minutes each

You can read detailed information about each test in the four *About the Test* sections that introduce each content area.

RESPOND TO SEVEN COMPUTER-BASED QUESTION FORMATS

In order to test a range of skills, the GED® Test uses a variety of computer-based question formats. You will see examples of each type of question in *GED® Computer-Based Testing* and in the four *About the Test* sections. When you take the test, you will use these question formats:

- **Multiple choice**—click to choose from four choices (A through D)
- **Fill-in-the-blank**—type a word, phrase, or numbers in a box
- **Drag and drop**—move words, numbers, or objects across the computer screen
- **Drop-down**—select from menus embedded in text on the computer screen
- **Hot spot**—click on “sensors” embedded in graphics on the computer
- **Short answer**—write a paragraph or two of explanation in response to passages or graphics or a combination of the two
- **Extended response**—compose a well-developed and supported response to passages or graphics or a combination of the two



READ AND WRITE ACROSS THE TEST

You will read and interpret passages and word problems on all four tests. In addition, three out of four subtests (*Reasoning through Language Arts*, *Social Studies*, and *Science*) require that you read a passage or two and compose a response about what you have read.

The type of writing that you will use is called “evidence-based writing,” which means that you need to cite specific evidence from the readings in your response. This is a key characteristic of the type of writing that is required in workplaces and in educational programs. This book contains special lessons and practice activities to help you write effectively on all three of the subtests.

PERFORM MATH SKILLS ACROSS THE TEST

In addition to the questions on the *Mathematical Reasoning Test*, math items also appear on the *Science Test* and the *Social Studies Test*. Both of those sections of this book have specific instruction and practice activities to help you apply math skills to social studies and science materials.

All three of the tests will provide access to a computer-based version of the Texas Instruments TI 30XS MultiView™ calculator to use with math items. **You are strongly encouraged to purchase a hand-held version of this calculator to use with this study guide.** You can buy this calculator at stores that carry office and school supplies and through online vendors. Specific lessons in the *Mathematical Reasoning* section of this book will help you learn to use this calculator.

USE THE GED TESTING SERVICE® MYGED™ INTERNET PORTAL

MyGED™ is a personalized online program that will be your entry point to all test activities, including scheduling testing and retesting (if necessary), viewing score reports, ordering transcripts and your diploma, and investigating your next steps in making the transition to college or to a career.

TAKE THE TEST: UNDERSTAND YOUR SCORE

There are three possible scores that you can receive on the GED® Test:

- **Not Passing**—lower than 150 on any of the four tests. You can reschedule up to two times a year to retake any or all of the tests.
- **GED® Passing Score**—at or higher than the minimum score (150 per test and 600 total) needed to demonstrate high school equivalency-level skills and knowledge
- **GED® Score with Honors**—at or higher than the minimum needed to demonstrate career and college readiness

REASONING THROUGH LANGUAGE ARTS PRETEST

PART II: WRITING AND LANGUAGE SKILLS

Directions: You may fill in the circles next to the correct answers or write your answers on a separate piece of paper.

Questions 1 through 6 refer to the following paragraphs.

To: Parents and Guardians

From: Sonia Vasquez, School Nurse

(A)

(1) A student in your child's class have been diagnosed with strep throat. (2) Strep throat is a highly contagious disease and a common illness in children. (3) Unlike most sore throats, which are caused by viruses, strep throat is caused by bacteria and is treatable with antibiotics. (4) The time between exposure to the disease and the appearance of symptoms is usually one to three days. (5) To safeguard your child's health, please take the following precautions. (6) Watch your child for strep symptoms. (7) Such as sore throat, fever, swollen glands, and headache. (8) If your child developed any of these symptoms, take him or her to the doctor. (9) If a throat culture is positive, treatment can be started. (10) It is extremely important to take all the prescribed medicine until it is gone.

(B)

(11) Children should get immediate treatment for several reasons. (12) For one, treatment reduces spread of the disease. (13) In addition antibiotics may prevent rheumatic fever.

(14) Treatment also prevents other rare but possibly dangerous complications.

(C)

(15) Your child may return to school after taking medicine for 24 hours and the fever must be gone. (16) Please call us with any questions or concerns you have.

1. Sentence 1: **A student in your child's class have been diagnosed with strep throat.**

Which correction should be made to sentence 1?

- A. replace your with you're
- B. change child's to children
- C. insert a comma after class
- D. change have to has

2. Sentences 6 and 7: **Watch your child for strep symptoms. Such as** sore throat, fever, swollen glands, and headache.

Which is the best way to write the underlined portion of these sentences?

- A. symptoms. Such as
- B. symptoms, the best known are
- C. symptoms, such as
- D. symptoms examples are

-
3. Sentence 8: **If your child developed any of these symptoms, take him or her to the doctor.**

Which correction should be made to sentence 8?

- A. replace your with you're
 - B. change developed to develops
 - C. remove the comma
 - D. replace him or her with them
4. Which revision would improve the effectiveness of the passage?

Begin a new paragraph with

- A. sentence 3
- B. sentence 4
- C. sentence 5
- D. sentence 6

5. Sentence 13: **In addition antibiotics may prevent rheumatic fever.**

Which correction should be made to sentence 13?

- A. insert a comma after addition
- B. insert a comma after antibiotics
- C. change may prevent to are preventing
- D. change rheumatic fever to Rheumatic Fever

6. Sentence 15: **Your child may return to school after taking medicine for 24 hours and the fever must be gone.**

The most effective revision of sentence 15 would begin with which group of words?

- A. After the fever is gone and your child has taken
- B. Having taken medicine for 24 hours and the fever
- C. Your child, once having taken medicine for 24 hours, may
- D. The fever being gone and the medicine being finished,

Questions 20 and 21 refer to the following information and diagram.

When the U.S. Mint had to design a new dollar coin to replace the old Susan B. Anthony dollar, it faced a problem. It wanted to design an appealing, distinctive golden-color coin that vending machines would recognize as an Anthony dollar, which looks like a quarter. Vending machines identify coins by their weight, size, and electromagnetic signature. They test a coin by passing an electric current through it and measuring the resulting magnetic field. Thus the new Sacagawea dollar coin had to be similar to the Anthony dollar in size, weight, and electromagnetic signature.

Size and weight were easy to imitate, but the electromagnetic signature was not. The Anthony dollar had a copper core covered by a silver-colored copper-nickel alloy. All the golden alloy sample coins had three times as much electrical conductivity as the Anthony dollar. Vending machines did not recognize them. Finally, metallurgists came up with the idea of adding manganese, which has low conductivity, to zinc and copper. The result was a coin consisting of 77 percent copper, 12 percent zinc, 7 percent manganese, and 4 percent nickel. The pure copper core was covered with a golden alloy of manganese, zinc, copper, and nickel. This golden coin has electromagnetic properties similar to those of the Anthony dollar, so it is recognized by U.S. vending machines.

20. It can be inferred from the passage above that an alloy is

- A. a magnetic material.
- B. a material that stops electricity.
- C. a mixture of metals.
- D. the core of a coin.

21. The U.S. Mint could have solved its technical problems with the Sacagawea dollar by making it out of the same metals as the Anthony dollar. Why did the people at the Mint decide against this?

- A. The metals in the Anthony alloy were too rare and expensive to use in the new coin.
- B. Like nickels, dimes, and quarters, the Anthony dollar was silver-colored and therefore not distinctive.
- C. The electromagnetic signature of the Anthony coin was not recognized by vending machines.
- D. The size and weight of the Anthony coin made it impractical for use in vending machines.

Question 22 refers to the following chart.

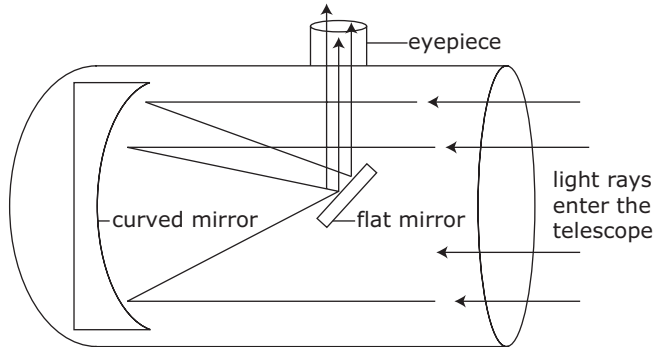
Types of Plants

Type	Characteristics
Annual	Completes life cycle in one growing season
Biennial	Completes life cycle in two growing seasons; flowers during second year
Perennial	Lives for years and flowers each year
Tender	Sensitive to cold (can be annual, biennial, or perennial)
Hardy	Can withstand frosts (can be annual, biennial, or perennial)

22. Marion has little interest in or time for gardening, yet she would like to have flowers in her front yard. Which of the following types of plants would probably give her the most flowers for the least effort?

- A. annuals
- B. biennials
- C. tender plants
- D. hardy perennials

Question 23 refers to the following information and diagram.



23. If the flat mirror were removed from this telescope, what would happen as a result?

- A. Light rays would not enter the telescope.
- B. Light rays would not reflect off the curved mirror.
- C. A viewer could not see anything through the telescope.
- D. A viewer could see only objects that were in focus.

24. The discovery of a new drug was once largely the result of trial and error, laboratory experiments, and clinical trials. Although these methods are still used, computer science is being applied to the drug discovery process to refine it and speed it up. For example, computers can analyze genetic material to locate genes that may hold promise in the development of new drugs. Computers can analyze data generated by lab experiments. Computer simulations can even help predict how a particular drug will work under specific circumstances.

What is the main reason that computers are now being used in the drug discovery process?

- A. They enable scientists to abandon trial-and-error methods.
- B. They help scientists analyze large amounts of data in a systematic way.
- C. They have made laboratory experiments unnecessary.
- D. They have made clinical trials unnecessary.

25. People planning to visit tropical countries may need to be vaccinated against disease. For example, two to four weeks before a trip, travelers should be vaccinated against typhoid fever. The vaccine is 50 to 80 percent effective. Additional precautions against typhoid fever include avoiding food and water that may be dirty.

If a traveler is vaccinated against typhoid fever two to four weeks before a brief trip to the tropics, which of the following best explains why he or she should take extra precautions against contracting the disease?

- A. The typhoid fever vaccination is effective for only a few months.
- B. The typhoid fever vaccination is only 50 to 80 percent effective.
- C. The typhoid fever vaccination can cause soreness, fever, and headache.
- D. Typhoid fever spreads only through air and water.

Answers and explanations for *Science, Part II* start on page 633.

Word Choice

Key Ideas

- Writers choose words carefully to make an impact on the reader.
- They deliberately choose words with positive, negative, or neutral connotations.
- Writers also use figurative language such as similes, metaphors, and personification to enhance descriptions.

GED® TEST TIP

Read closely to see how a writer's word choice affects how you picture something or feel about it. You may have to answer questions that require an awareness of the impact of both words' connotations and figurative language.

Writers make careful decisions to select words that will impact their audience. One choice that writers make is to select words that have a **connotation** associated with a particular image or feeling. Think of the different connotations of *dog*, *mutt*, and *man's best friend*. The word *dog* has a neutral connotation; it just describes the animal. To some, the word *mutt* would have a negative connotation, and the phrase *man's best friend* would have a positive connotation.

► Assign a *P* (positive) or an *N* (negative) to the following words to indicate the connotation that might be associated with them:

- (1) shack
- (2) villa

You are correct if you assigned an *N* to (1) and a *P* to (2). The word *shack* probably brings to mind a small, poorly built or rundown building. On the other hand, the word *villa* might be associated with a house in the countryside or a vacation destination.

Writers use **figurative language** to make their descriptions clearer and more vivid. They use **similes**, which use the words *like* or *as* to compare two things; for example, "His voice was like velvet." This indicates that his voice was smooth. Another type of figurative language is a **metaphor**, which implies a comparison between two things. One familiar metaphor is "Life is a journey"; this compares two dissimilar things in order to describe life. A third figure of speech is **personification**, by which a writer assigns human characteristics to something that is not human. For example, a writer may describe a storm as "slashing at the windows and knocking on the door."

If you look very carefully, you can find the island of Ascension on a map about midway between Angola, in Africa, and Brazil, in South America. This South Atlantic island has a population of about 1,000 people and is home to an important GPS ground antenna and a British air force base. Its volcanic terrain greets visitors with a forbidding aspect; place names like "Comfortless Cove" indicate how rocky and uninviting Ascension Island may appear. Even so, with its dry subtropical weather, excellent sport fishing, and unique wildlife, this barren outpost attracts about 1,000 tourists each year.

► What does the personification in the third sentence suggest about Ascension Island?

- (1) Tourists are forbidden to visit the island.
- (2) The island doesn't look like a good place to visit.

You are correct if you chose (2). The writer refers to the island as if it were a person with an unfriendly appearance. Since the last sentence states that tourists do visit the island, you know that they are not forbidden to do so.

INTERPRETING NONFICTION AND INFORMATIONAL TEXT ► PRACTICE 7

Questions 1 through 5 refer to the following product description.

A COOL NEW BLANKET

1 Many people rely on electric blankets to keep warm on winter nights without turning on expensive central heating. In summer, though, there's no alternative to noisy fans and energy-hogging air conditioners if you want to stay cool . . . until now. The Starlight company recently introduced its newest product: an electric blanket that keeps you cool even on sweltering summer nights.

2 The CoolForter blanket works like an electric blanket, but it feels like a dream. The blanket contains a full tenth of a mile of flexible hose, fully insulated between layers of soft cotton. A small, quiet compressor refrigerates the safely enclosed cooling chemical and circulates it continuously through the coils. The CoolForter cuddles you in refreshing comfort, and you never have to worry about waking up shivering. That's because your sleeping temperature is precisely controlled by the built-in thermostat, which can be adjusted to your exact temperature preference.

3 Your CoolForter blanket also matches your decorating preferences: the replaceable cover comes in a wide variety of bland colors to suit any décor. If you decide to redecorate, choose from a selection of fun and gaudy prints to liven up your room.

4 Best of all, the CoolForter saves you money every time you use it. Consuming an average of just 80 watts, the twin-size blanket is like a regular household lightbulb, costing just pennies per day to run. It's an investment in comfort that will pay for itself many times over the lifetime of its generous ten-year warranty and beyond.

1. In paragraph 2, what is compared to a dream?

- A. an electric blanket
- B. the flexible hose used in the CoolForter blanket
- C. the cotton insulating layers
- D. The CoolForter blanket

2. What could be a reason that the writer used the word "cuddles" in paragraph 2?

- A. to show that the blanket keeps its user warm
- B. to show that the blanket is a pleasant indulgence
- C. to show that the blanket keeps its user cool
- D. to show that the user can wrap herself up in the blanket

3. What word could the writer have used instead of "chemical" in paragraph 2 that would have a less negative connotation?

- A. fluid
- B. antifreeze
- C. contaminant
- D. water

4. Which word in paragraph 3 means "neutral" and has a negative connotation?

- A. decorating
- B. replaceable
- C. bland
- D. gaudy

5. Why is "like a regular household lightbulb" from paragraph 4 an effective use of a comparison using figurative language?

- A. It reminds the consumer that, while a lightbulb generates heat, the CoolForter blanket keeps its user cool.
- B. It makes the CoolForter blanket seem ordinary.
- C. It emphasizes the difference in cost between running a regular lightbulb and operating a compact fluorescent lightbulb.
- D. It allows the consumer to compare the CoolForter's energy usage to that of a familiar item.

Answers and explanations start on page 639.

CONNECTING IDEAS

Relate Sentences and Paragraphs

Good writing flows smoothly and logically from one sentence to the next and from one paragraph to the next. To make your writing flow, use **transitions** to show how ideas are related. Here are some common transitions and their uses.

Key Ideas

- Use transitions to help your writing flow from sentence to sentence and from paragraph to paragraph.
- Choose the transition that expresses the correct relationship between ideas.

Transitional Word or Phrase	Use it to . . .
for example, for instance	give an example
also, furthermore, in addition, in the same way, likewise, moreover, similarly	compare ideas or add to an idea
however, nevertheless, on the other hand, in contrast	contrast ideas
first, second, then, next, after that, later, at last, finally, in conclusion	show steps in a process or time order
because	show a cause
as a result, consequently	show a result
therefore, thus	draw a conclusion

You can link two sentences using transitions in the following ways:

EXAMPLES

Begin the second sentence with a transition followed by a comma: Raquel has many hobbies. For example, she paints furniture and sews clothes.

Put the transition within the second sentence and set it off with commas: Raquel has many hobbies. She paints furniture, for example, and sews clothes.

Combine the two sentences into one. Put a semicolon before the transition and a comma after it: Raquel has many hobbies; for example, she paints furniture and sews clothes.

Transitions can also be used to link one paragraph to another, highlighting the relationship between the two paragraphs.

EXAMPLE

Top performance in sports depends on “mental economy.” Mental economy involves focusing the mind on the task at hand. When athletes think too much about what they’re doing or worry about the outcome, they interfere with the communication between the brain and the muscles.

In addition, athletes must strive for “physical economy.” Although athletes put forth a tremendous amount of effort, they must take care to pace themselves in order to conserve energy for the end of the event.

To decide which transition to use, see how the paragraph is organized and what you are trying to accomplish. For example, are you comparing two things? If so, you will want to use transitions that compare ideas. Similarly, when choosing transitions to introduce paragraphs, consider the organization of the entire essay.

GED® TEST TIP

When you use a transition at the beginning of a sentence, be sure you put a comma after the transition.

CONNECTING IDEAS ► PRACTICE 3

A. Directions: Rewrite each pair of sentences using a transition from the chart on page 142. Change the punctuation if necessary. Write your answers on a separate sheet of paper.

Example: We have worked very hard this year. Sales are at an all-time high.
We have worked very hard this year. As a result, sales are at an all-time high.

1. Our marketing efforts need to be enhanced. We will soon begin another marketing initiative.
2. Sales representatives say their jobs are extremely demanding. The salary is attractive.
3. The marketing director has instructed sales representatives to try some new ideas. Sales representatives can give away free samples.
4. A new ad campaign will be launched in just a few weeks. We expect sales to increase.

B. Questions 5 through 7 refer to the following paragraphs.

Library Cafes

(A)

(1) Until very recently, eating was not something that most people associated with libraries. (2) A patron would likely be chased out for munching on a sandwich in a corner. (3) Times are changing, and these days patrons can even buy coffee and a croissant in some public libraries.

(B)

(4) Following the lead of successful bookstores, libraries across the country are installing cafes. (5) Some library cafes have menus that offer just as much variety as a regular restaurant. (6) In addition, one of them offers 20 varieties of coffee, hot cider, and muffins. (7) These refreshments make going to the library more pleasant and may therefore increase library patronage.

(C)

(8) Having a cafe may benefit a library financially. (9) The income from the cafe adds to library revenues. (10) Also, as more people enjoy coming to the library, they may be more likely to approve tax increases for it.

5. Sentence 3: Times are changing, and these days patrons can even buy coffee and a croissant in some public libraries.

Which correction should be made to sentence 3?

- A. insert however after Times
- B. insert however, after the comma
- C. insert , however after these days
- D. insert , however after coffee

6. Sentences 5 and 6: Some library cafes have menus that offer just as much variety as those of a regular _____ one of them offers 20 varieties of coffee, hot cider, and muffins.

Choose the best option that correctly completes the sentence.

- A. restaurant, in addition,
- B. restaurant. For example,
- C. restaurant. Nevertheless,
- D. restaurant. Thus,

7. Sentence 8: Having a cafe may benefit a library financially.

Choose the best option that corrects the sentence.

- A. In addition, having a cafe
- B. On the other hand, having a cafe
- C. A cafe, by benefiting a library,
- D. Financially a cafe

Answers and explanations start on page 647.

Order of Operations

Key Ideas

- To evaluate an expression correctly, you must follow the order of operations.
- If an expression uses more than one set of grouping symbols, start with the inside set and work to the outside.
- The division bar may be used as a grouping symbol.

GED® TEST TIP

You can use the parentheses keys on your online calculator to help you follow the order of operations.

When a mathematical expression contains more than one operation, its value may depend upon the order in which the operations are performed. To avoid confusion, mathematicians have agreed to perform operations in a certain order.

The Order of Operations

1. Parentheses or any other grouping symbols that enclose operations
2. Exponents and roots
3. Multiplication and division, working from left to right
4. Addition and subtraction, working from left to right

Study the following example to see how to apply the order of operations. Notice that parentheses are used in two places in the expression; however, only the first set of parentheses encloses an operation.

Example 1: Evaluate the expression $\frac{(5 + 3)^2}{4} + 3(-1)$.

1. Perform the addition operation in parentheses. $\frac{(8)^2}{4} + 3(-1)$
2. Raise 8 to the second power. $\frac{64}{4} + 3(-1)$
3. Divide, then multiply. $16 + (-3)$
4. Add. 13

The value of the expression $\frac{(5 + 3)^2}{4} + 3(-1)$ is **13**.

In more complicated expressions, one set of grouping symbols may be nested within another set. To avoid confusion, you can also use brackets [] or braces { } to group operations. To evaluate an expression with more than one set of grouping symbols, work from the inside to the outside.

Example 2: Evaluate the expression $4[5(-4 + 3) + 2]$.

1. Perform the operation in the inner set of grouping symbols: $(-4 + 3)$. $4[5(-4 + 3) + 2]$
 $4[5(-1) + 2]$
2. Do the operations in the brackets. Since multiplication comes before addition in the order of operations, multiply 5 and -1 , then add 2. $4[-5 + 2]$
 $4[-3]$
3. Multiply 4 and -3 . -12

The division bar is also a grouping symbol. Before you divide, perform any operations shown above and below the bar.

Example 3: Evaluate the expression $\frac{15 + 25}{2(5)} + 6$.

1. Perform the operations above and below the fraction bar. $\frac{15 + 25}{2(5)} + 6$

2. Divide, then add. $\frac{40}{10} + 6$

$$4 + 6 = 10$$

ALGEBRA BASICS, EXPRESSIONS, AND POLYNOMIALS ► PRACTICE 4

A. Solve. You MAY NOT use a calculator.

- | | | |
|--|---|--|
| 1. $4(3) - 2 + (6 + 4 \cdot 2)$ | 6. $\frac{25}{(4 + 1)} \cdot 3 + (6 - 1)$ | 11. $(4 + 2)^2 + (7 - 2)^3$ |
| 2. $16 \div (10 - 6)^2$ | 7. $2^3 + (8 - 5)^2 - 3$ | 12. $7^2 \div (11 - 4) + (9 + 14)$ |
| 3. $5^2 - (5 - 7)(2)$ | 8. $(4 - 12)(-6) + (10 - 3)$ | 13. $2 \left[(17 - 11)^2 \cdot \frac{(15 - 5)}{2} \right]$ |
| 4. $3(-3) + (7 + 4)$ | 9. $30 \div 3(5 - 4)$ | 14. $(5^2 + 6 - 3) \div (16 - 3^2)$ |
| 5. $\frac{3^3}{5 - 2} - \frac{(4 - 2)^2}{2}$ | 10. $15 + (4)(3) - 2^2$ | 15. $150 - 4 \left[\frac{3 + 9}{4 - 1} \cdot (14 - 11)^2 \right]$ |

B. Choose the one best answer to each question.

Question 16 refers to the following information.

Susan is in charge of planning Midvale Hospital's parent education classes. She uses the table below to determine the cost of each class to the hospital.

Midvale Hospital Parenting Workshops	
Type of Workshop	Cost per Participant
Childbirth Classes	\$35 per couple
Infant Care	\$30 per person
Teaching Your Child to Read	\$60 per person

16. A local foundation has offered to pay 75% of the cost of infant care classes. The hospital will cover any remaining costs. There are 28 parents enrolled in the upcoming class. Which of the following expressions could be used to find the amount the hospital will pay?
- A. $(75)(28)(30)$
 B. $(28)(30) - (0.75)(30)$
 C. $(1 - 0.75)(28)(30)$
 D. $(1 - 0.75)(30) + 28$

17. In the expression

$$5 + 2 \left[7 \left(\frac{10^2}{10} \right) + (6 - 2)(3) \right],$$

what is the last operation you should perform to find the value of the expression?

- A. Subtract 2 from 6.
 B. Add 5.
 C. Multiply by 2.
 D. Find the square of 10.
18. Find the value of the expression $22 + 6[(14 - 5) \div 3(17 - 14)]$.
- A. 2.73
 B. 28
 C. 76
 D. 97

Answers and explanations begin on page 665.

Pythagorean Relationship

Key Ideas

- The hypotenuse is the longest side of a right triangle. It is found opposite the right angle.
- The sum of the squares of the legs of a right triangle equals the square of the hypotenuse.

GED® TEST TIP

Watch for right triangles with sides in a 3-4-5 or 5-12-13 ratio. These triangles often appear on math tests because the measures of the sides are all whole numbers.

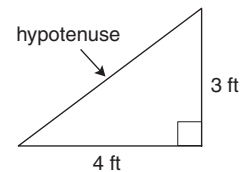
As you know, a right triangle has one right angle. The side directly across from the right angle, called the **hypotenuse**, is the longest side of the right triangle. The remaining sides, the rays of the right angle, are the **legs** of the triangle.

Thousands of years ago, people found a special relationship, called the **Pythagorean relationship**, among the sides of a right triangle. You can use this relationship to find the measure of any side of a right triangle if the other two side measures are known.

Pythagorean relationship $a^2 + b^2 = c^2$; a and b are legs, and c is the hypotenuse of a right triangle

In other words, the square of the hypotenuse is equal to the sum of the squares of the two legs of the right triangle.

Example 1: What is the length of the hypotenuse of the right triangle shown in the diagram?



1. The lengths of the legs are 3 ft and 4 ft. Let one leg equal a and the other equal b .

2. Solve for c . Substitute the values.

$$\begin{aligned} a^2 + b^2 &= c^2 \\ 3^2 + 4^2 &= c^2 \\ 9 + 16 &= c^2 \\ 25 &= c^2 \\ \sqrt{25} &= c \\ 5 &= c \end{aligned}$$

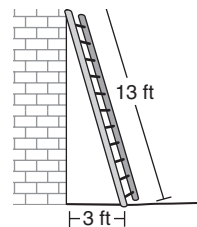
3. When one side of an equation equals a squared variable, isolate the variable by finding the square root of both sides.

The length of the hypotenuse is **5 feet**.

The Pythagorean relationship can also be used to solve for the length of a leg.

Example 2: If John places a 13-foot ladder 3 feet from the base of a wall, how far up the wall will the ladder reach to the nearest tenth foot?

The wall, ground, and ladder form a right triangle. The hypotenuse is 13 ft in length. One leg is 3 ft. You need to find the length of the other leg.



$$\begin{aligned} a^2 + b^2 &= c^2 \\ 3^2 + b^2 &= 13^2 \\ 9 + b^2 &= 169 \\ b^2 &= 160 \\ b &= \sqrt{160} \\ b &\approx 12.6 \end{aligned}$$

The ladder will extend **12.6 feet** up the wall.

Note: Most of the time, you will need to use your calculator for the final step when using the Pythagorean relationship. To find the square root of 160 on the TI-30XS MultiView™ calculator, press: $2nd$ x^2 160 enter (use \blacktriangleleft to convert the result from a radical to a decimal format).

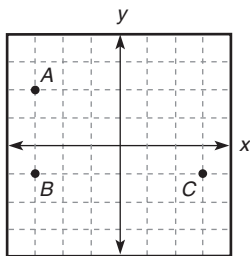
GEOMETRY ► PRACTICE 3

A. The lengths of two sides of a right triangle are given. Find the length of the remaining side to the nearest tenth unit. You may use a calculator.

- | | | |
|--|---|--|
| 1. leg a : 8 in
leg b : 8 in
hypotenuse c : ? in | 4. leg a : ? m
leg b : 3 m
hypotenuse c : 6 m | 7. leg a : 7 cm
leg b : 10 cm
hypotenuse c : ? cm |
| 2. leg a : 9 yd
leg b : 12 yd
hypotenuse c : ? yd | 5. leg a : 6 mm
leg b : ? mm
hypotenuse c : 10 mm | 8. leg a : 15 in
leg b : ? in
hypotenuse c : 30 in |
| 3. leg a : 1.5 cm
leg b : 2 cm
hypotenuse c : ? cm | 6. leg a : ? ft
leg b : 5 ft
hypotenuse c : 18 ft | 9. leg a : 4 km
leg b : 5 km
hypotenuse c : ? km |

B. Choose the one best answer to each question.

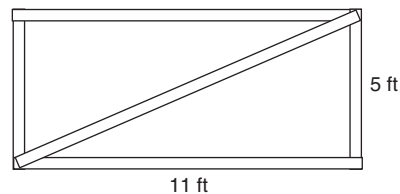
10. On a coordinate plane, points A , B , and C can be connected to form a right triangle.



What is the distance from A to C , to the nearest tenth unit? (*Hint*: Count units to find the lengths of the sides, and use the Pythagorean relationship to find the distance between the points.)

- A. 5.2
B. 6.7
C. 8.4
D. 10.1
11. The two shorter sides of a right triangle measure 18 ft and 24 ft. What is the measure in feet of the third side?
- A. 25
B. 28
C. 30
D. 42

12. Jan has built a rectangular frame out of wood to use for the bottom of a platform. He wants to add a diagonal brace as shown in the drawing below.



What will the length of the brace be, to the nearest tenth of a foot?

- A. 16.0
B. 13.7
C. 12.8
D. 12.1
13. The hypotenuse of a right triangle measures 39 inches. If one leg measures 15 inches, what is the measure of the other leg?
- A. 36
B. 24
C. 18
D. 12

Answers and explanations begin on page 675.

U.S. HISTORY

Industrialization, Immigration, and the Progressive Era

Key Ideas

- The U.S. underwent rapid industrialization starting in the mid-1800s.
- Immigrants came from many places to work in the expanding American industries.
- Rapid industrialization brought problems, which labor unions and reformers tried to solve, especially during the Progressive Era.

ON THE GED® TEST

The GED® Social Studies Test examines your ability to interpret graphs, charts, maps, and other visual sources of information.

In the mid-1800s, American industries, which had been growing steadily since the late 1700s, began a period of extremely fast growth. This rapid **industrialization** occurred for several interconnected reasons. With the addition of the vast western territories, the United States gained plentiful **natural resources**. Among these resources were materials, such as metals, needed to manufacture new products and machines, and fuels, such as coal, needed to run these machines. Another reason for rapid industrialization was the invention of many new machines and new industrial processes. With these new inventions and processes, manufactured goods could be produced more easily, more efficiently, and less expensively. A third reason for the rapid industrialization was the nation's booming population. The U.S. population more than doubled in the last 40 years of the 1800s. There were more people to buy more goods, spurring commerce and further industrial growth.

Rapid industrialization meant that many new factories were built in the mid- and late-1800s. Most were built in or near the nation's large cities, including New York, Boston, Chicago, Philadelphia, and Pittsburgh. These urban centers had large groups of people who could work in the factories and large groups of people who would buy the goods the factories produced.

U.S. factory jobs drew many **immigrants** to American cities. Although the United States has always been a "nation of immigrants," the late 1800s saw a sharp rise in the number of people moving here from foreign countries. The majority came from Europe, including Germany, Italy, Russia, and Eastern European countries. Many also came from Mexico and Central America. Asian immigration was declining because the government had passed laws barring Chinese from moving to the United States. However, thousands of Japanese came to this country, taking jobs in farm fields and mines.

America's factory workers, whether native- or foreign-born, worked very hard at grueling, dangerous work. Many received low pay for long hours on the job. Over time, workers began to unionize. By joining a **union**, workers pledged to work together for better and safer working conditions and higher wages. They called **strikes** when their employers cut their pay or refused to grant raises. Many of the laws we have today, including the eight-hour workday and the five-day workweek, came about through the bitter struggles for better working conditions that unions waged in the late 1800s and the early 1900s.

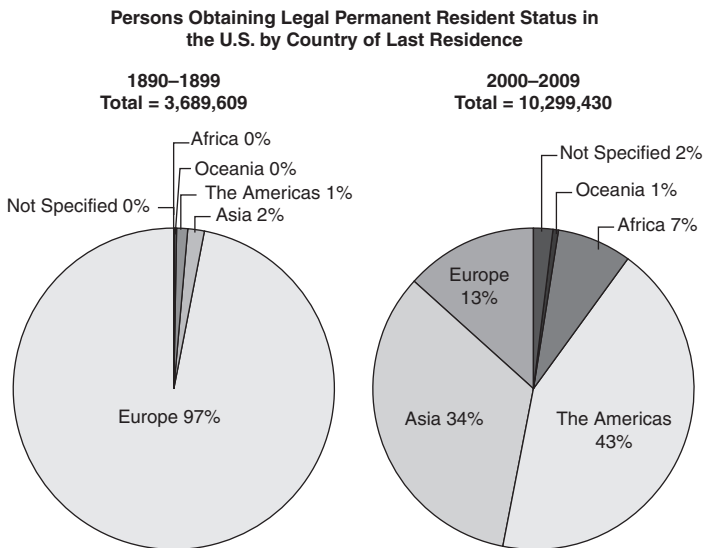
Unions weren't the only groups working to solve problems brought on by America's rapid industrialization. Some reformers worked to clean up slums, improve health care, and stop child labor. Others worked to preserve the nation's natural beauty by creating national parks. Still others worked to give more people a voice in government. For example, many women lobbied to gain the right to vote. In the early 1900s, groups were working toward so many sweeping social and political improvements that the time is called the **Progressive Era**.

U.S. HISTORY ► PRACTICE 3

Questions 1 through 4 are based on the information on page 434.

- Which of the following always occurs during a period of rapid industrialization?
 - the annexation of new territory
 - an increase in manufacturing
 - an increase in population
 - an increase in immigration
- Which event directly contributed to the growth of American industries in the mid-1800s?
 - the passage of the Chinese Exclusion Act, which banned Chinese immigration
 - the passage of the Sherman Antitrust Act, which helped prevent businesses from forming monopolies
 - the development of the Bessemer process, which made it easier to produce steel
 - the development of settlement houses to aid impoverished immigrants and city dwellers
- Based on the passage, which of the following would early union workers have valued the most?
 - productivity in the workplace
 - contact with people of all different backgrounds
 - cooperation with others to improve worker safety
 - the freedom to work whenever they pleased
- What was a strong ideal held by people working toward reforms during the Progressive Era?
 - efficiency
 - wealth
 - artistic beauty
 - fairness

Questions 5 and 6 refer to the following graphs.



- Which of the following best completes this statement? In the 1890s, the vast majority of persons gaining permanent legal residency came from Europe, whereas in the early 2000s, a majority of such persons came from _____.
 - Europe and Asia
 - Asia and the Americas
 - Africa, Oceania, and Europe
- You MAY use your calculator to answer this question. Based on the graphs, which of the following is true of the number of persons who came from Europe and gained legal permanent resident status?
 - In the 1890s, that number was roughly seven times what it was in the period of 2000–2009.
 - In the 1890s, that number was less than what it was in the period of 2000–2009.
 - In the 1890s, that number was roughly three times what it was in the period of 2000–2009.
 - In the 1890s, that number was the same as what it was in the period of 2000–2009.

Answers and explanations start on page 682.

ECONOMICS

The U.S.
Economic System**Key Ideas**

- The U.S. economy is built on principles of laissez-faire capitalism.
- The U.S. economy moves through cyclical phases of growth, slowdown, recession, and recovery.
- Saving and investing contribute to the economy by making money available for businesses to grow.

ON THE GED® TEST

A short reading passage may accompany a graphic, such as a map. Some questions may require you to use information from both the passage and the graphic.

In the United States, the economic activity of individual people and businesses primarily determines our economic health and growth. We make our own decisions about how to save and spend most of our income. We can accept employment as we choose, become **entrepreneurs** and build businesses of our own, and seek education and training to whatever level best serves our goals. These freedoms are based on **laissez-faire capitalism**, the ideas of 18th-century economist Adam Smith, who believed that if individuals are free to act in their own best interests economically, the sum total of their actions will be in the best interests of the society as a whole.

Throughout the history of the United States, **free enterprise** and **competition** have played important roles in the development of our economy. Businesses have incentives to grow larger—either by expanding their **capacity** or by integrating a broader set of functions into their **operations**—in order to make more **profit**. However, businesses are expected to compete with each other on the merits of their products and operations. Businesses are not allowed to form **monopolies**—single companies that control whole industries; they also are not allowed to form **oligopolies**—tight-knit groups of companies that control whole industries.

Because the U.S. economy is not under government control, no one can predict or control exactly how the economy will behave. Our economy tends to move through a **business cycle** with identifiable phases, but the length and strength of a cycle and its phases vary greatly. The first phase of a cycle is the growth phase, in which businesses invest and expand optimistically. At some point, growth is slowed or stopped by one or more factors—limited resources, limited production capacity, tight employment, or market **saturation**—and the economy enters a slowdown phase. As businesses lay off workers, stop investing their capital, and cut back production, the economy enters a **recession** or **depression** phase. Unemployment rises, consumer spending slows down, and businesses act very conservatively, holding down wages and prices, avoiding risks, and managing cash flow tightly. Eventually, the economy moves into a recovery phase, perhaps initiated by a government action. Recovery may be slow or uneven across economic sectors, but eventually the economy moves into a new growth phase. **Inflation**, in which the combined price of goods and services grows faster than the purchasing power of the currency, is only partly related to these business cycle phases.

Banking and investment services, like most U.S. industries, are conducted on principles of free enterprise. A major role of **banks** and **savings and loan associations** is to create pools of savings in order to make money available as credit to businesses and consumers. **Stock exchanges** have a similar purpose; they allow investors to purchase shares of stock, which represent part ownership of a business. Both saving and investing make funds available for businesses to use to grow. When people invest in stock, they take risks because the value of the stock depends on the success of the business. However, the potential **return** is generally much higher than the **interest rate** on a savings account.

ECONOMICS ► PRACTICE 2

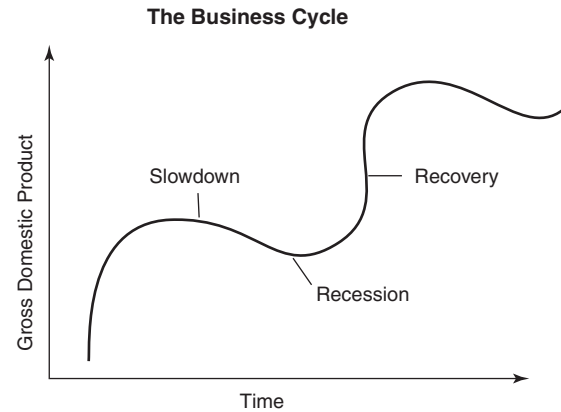
- Based on the information on page 460, why are monopolies not permitted in the United States?
 - Monopolies are too efficient.
 - Monopolies are part of laissez-faire capitalism.
 - Monopolies result from free enterprise.
 - Monopolies shut out competition.
- According to the passage, _____ is one characteristic of a recession.
 - increased job growth
 - large investments of capital
 - increased consumer spending
 - rising unemployment
- Private ownership of property (land or buildings) is a key characteristic of the free enterprise system. Owning property gives people a strong incentive to take care of it and use it productively.

What is the basis for this incentive?

- Property owners have a stake in the future value of the property.
 - Property owners work harder than tenants do.
 - Property owners are given tax incentives by the federal government.
 - Property owners must pay real estate taxes to local government.
- Which of the following investments carries the most risk?
 - opening a savings account at a local bank
 - buying a certificate of deposit at a savings and loan institution
 - buying stock in a new company, such as an Internet startup
 - buying stock in an established company, such as Microsoft

Question 5 refers to the following paragraph and graph.

At different times during the business cycle, the gross domestic product—the total value of goods and services produced in a year—rises and falls.



- Which of the following conclusions is supported by the paragraph and the graph?
 - High points in the business cycle are generally followed by recoveries.
 - Low points in the business cycle are generally followed by slowdowns.
 - During recessions, the rate of unemployment drops.
 - Despite ups and downs, the gross domestic product generally increases over time.
- Based on the passage on page 460, what do saving and investing in stocks have in common?
 - They provide capital for businesses to grow.
 - They provide a sure rate of return.
 - They pay a fixed rate of interest.
 - They are without risk.

Answers and explanations start on page 687.

Cell Processes and Energy

Key Ideas

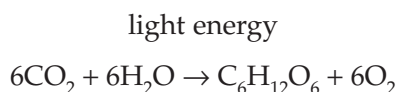
- In photosynthesis, plants use light energy to form glucose from carbon dioxide and water. Oxygen is a byproduct.
- In cellular respiration, glucose is broken down in the presence of oxygen to release energy. Carbon dioxide is a byproduct.
- These two processes help maintain oxygen and carbon dioxide levels in the atmosphere.

ON THE GED® TEST

About 40% of the questions on the Science Test are about life science topics.

All cells need energy to carry out the life functions, such as growth and reproduction. Green plants, some algae, and some bacteria use energy from sunlight to make food in a process called **photosynthesis**.

In photosynthesis, plants use sunlight to power chemical reactions that convert carbon dioxide gas and water into oxygen and the simple sugar **glucose**. In the first stage of photosynthesis, light energy is captured by chloroplasts inside plant cells. Chloroplasts contain **chlorophyll**, a pigment that gives plants their green color. Chlorophyll absorbs light energy for photosynthesis. In the second stage, water (H₂O) that the plant gets from the soil and carbon dioxide (CO₂) that the plant gets from the air undergo a complex series of chemical reactions inside the chloroplasts. The products of these reactions are oxygen (O₂) and glucose (C₆H₁₂O₆). Plant cells use the energy that is stored in glucose to power cell processes. Photosynthesis can be summarized in the chemical equation shown below:



In words, this means: carbon dioxide plus water, in the presence of light energy, yields glucose plus oxygen.

As a result of photosynthesis, energy is stored in sugars and other **carbohydrates** in the plant. To meet their energy needs, other organisms eat plants or eat organisms that eat plants. When energy is needed in a cell, carbohydrates are broken down to release the energy in a process called **cellular respiration**. In this process, oxygen from the air reacts with glucose from food to yield carbon dioxide, water, and energy. Cellular respiration can be summarized in the following chemical equation:



In words, this means: glucose plus oxygen yields carbon dioxide, water, and energy.

If you examine the two equations, you will notice that the products of photosynthesis are the raw materials of cellular respiration, and the products of cellular respiration are the raw materials of photosynthesis. These two processes are part of a cycle. Plants release oxygen, a waste product of photosynthesis, into the atmosphere. Animals breathe in the oxygen and use it in cellular respiration. They breathe out carbon dioxide, a waste product of cellular respiration. The carbon dioxide is then used by plants in photosynthesis, and the cycle repeats. Between them, photosynthesis and cellular respiration help keep the amounts of oxygen and carbon dioxide in the atmosphere fairly constant.

LIFE SCIENCE ► PRACTICE 2

Questions 1 through 3 are based on the information on page 510.

1. Which of the following are the products of cellular respiration?

- A. glucose and light energy
- B. carbon dioxide and oxygen
- C. glucose, oxygen, and energy
- D. carbon dioxide, water, and energy

2. A horticulturist wants to grow large, healthy plants by maximizing the rate of photosynthesis.

Which of the following actions would be most likely to get the results she wants?

- A. increasing the amount of light the plants receive each day
- B. increasing the amount of oxygen the plants receive each day
- C. decreasing the amount of oxygen the plants receive each day
- D. decreasing the amount of carbon dioxide the plants receive each day

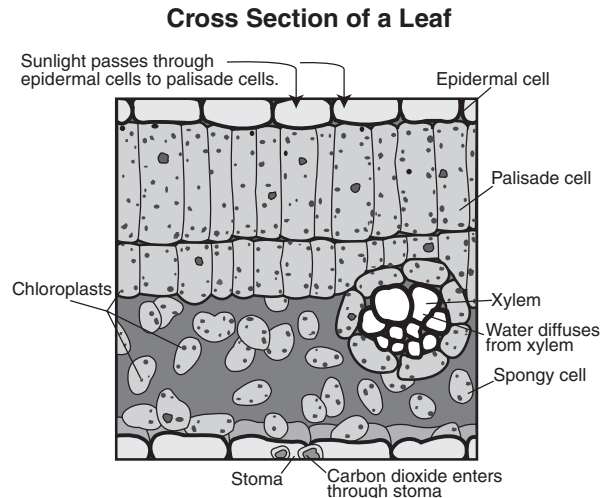
3. Carbon dioxide is one of the “greenhouse gases” that help keep Earth warm by trapping radiated heat in the atmosphere. Global warming is thought to be caused in part by increased amounts of carbon dioxide in the atmosphere.

Which of the following would help reduce the level of carbon dioxide in the atmosphere and thus perhaps slow the global warming trend?

- A. increasing the population of domestic animals
- B. increasing the number of green plants
- C. increasing the harvest of trees
- D. increasing the amount of glucose in our food

Questions 4 and 5 refer to the following information and diagram.

In most plants, photosynthesis takes place primarily in the palisade cells of leaves.



4. Fill in the blank using one word from the diagram.

A (n) _____ is an opening in the lower surface of the leaf through which gases such as carbon dioxide can pass.

5. Chloroplasts are structures found within some of the cells in a leaf. They help in the process of photosynthesis. In the diagram, they are represented by small gray spots on the cells.

Which of the following statements is supported by the information in the diagram?

- A. Palisade cells provide a means of transporting water through a plant.
- B. Most of a leaf's chloroplasts are found in its palisade cells.
- C. The spongy cells are soft, like a sponge.
- D. The epidermis blocks light from reaching the palisade cells.

Answers and explanations start on page 696.

Structure of Earth

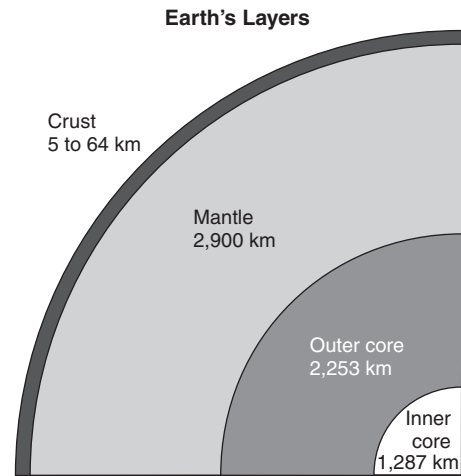
Key Ideas

- Earth is made up of three main layers: the crust, mantle, and core.
- The theory of plate tectonics explains how the seafloor spreads, major landforms are created, and the continents move.
- At the margins between plates, plates move away from or toward each other, or they slide past each other.

GED® TEST TIP

When you read a multiple-choice question, try to answer it before you read the choices. If one of the choices is similar to your answer, it is probably correct.

Earth is almost spherical, flattened at the poles, and bulging at the equator. It is composed of three main layers: the crust, the mantle, and the core. Earth's outer layer, its solid **crust**, is made of granite, basalt, gabbro, and other types of rock. Under the oceans, the crust is 3 to 6.8 miles thick; under the continents, the crust is from 12 to 40 miles thick. Below the crust is the molten **mantle**; it consists of silica and metal-rich minerals. The **core** has two layers: the outer core, which is mostly liquid iron, and the inner core, which is mostly solid iron. Extreme heat and pressure characterize the core.



The **theory of plate tectonics** explains phenomena of Earth's crust: seafloor spreading, the formation of major landforms, and the movement of continents. According to this theory, Earth's crust is made up of **tectonic plates** that fit together like a crude jigsaw puzzle. These plates move relative to one another at a rate of up to 15 centimeters (6 inches) a year. At the boundaries between plates, major landforms such as mountain ranges, volcanoes, ocean trenches, and mid-ocean ridges form, and earthquakes occur. There are three types of plate boundaries, or **margins**.

- At a **constructive margin**, two plates are moving apart and new crust is forming. Molten material from the mantle below wells up in the space between the plates, hardens, and forms new crust, usually at a mid-ocean ridge. For example, at the Mid-Atlantic Ridge, new crust is forming, causing the seafloor to spread and grow by about 5 centimeters (2 inches) a year.
- At a **destructive margin**, two plates are colliding and crust is being destroyed. When a continental plate collides with an oceanic plate, the denser oceanic crust may be forced under the other plate, forming a deep trench. When two plates consisting of continental crust collide, the crust crumples to form mountain ranges such as the Andes.
- At a **transform**, or **conservative margin**, two plates are sliding by one another, and no crust is created or destroyed. For example, the San Andreas fault in California is the boundary between the North American plate and the Pacific plate, which is sliding northwest, causing many earthquakes.

As the plates move, they carry the continents with them. Scientists believe that a single large continent, **Pangaea**, existed about 250 million years ago. It gradually broke apart, and over millions of years the pieces (which are today's continents) drifted into the locations they are in today.

EARTH AND SPACE SCIENCE ► PRACTICE 1

1. What does the theory of plate tectonics explain?

- A. changes in Earth's crust
- B. changes in Earth's mantle
- C. changes in the composition of Earth's layers
- D. why there is extreme heat and pressure in Earth's core

2. One similarity between Earth's inner and outer cores is that both (1)_____, although the two are different because the inner core (2)_____ while the outer core (3)_____.

Blank (1)	Blank (2)	Blank (3)
consist primarily of iron	is mostly gaseous	is mostly gaseous
consist primarily of granite	is mostly liquid	is mostly liquid
consist primarily of silica	is mostly solid	is mostly solid

3. The Japan Trench off the coast of Japan is part of the boundary between an oceanic plate called the Pacific plate and a continental plate called the Eurasian plate. At the trench, the Pacific plate is forced beneath the Eurasian plate, causing earthquakes in Japan.

The Japan Trench is an example of which type of crustal feature?

- A. a tectonic plate
- B. a mid-ocean ridge
- C. a constructive margin
- D. a destructive margin

4. Which of the following provides evidence that the present-day continents were once one large continent that broke apart?

- A. Australia is a large, continent-sized island.
- B. Eurasia is the largest land mass on Earth today.
- C. Australia and Antarctica are located in the Southern Hemisphere.
- D. The west coast of Africa seems to fit into the east coast of the Americas.

5. Which of the following is implied by the fact that seafloor spreading at the Mid-Atlantic Ridge is causing the Atlantic Ocean to widen by about 5 centimeters a year?

- A. The Mid-Atlantic Ridge is thousands of miles long.
- B. The Mid-Atlantic Ridge is the largest underwater structure in the Atlantic Ocean.
- C. The continents of North America and Europe are moving apart.
- D. The continents of North America and Europe are growing larger at the Mid-Atlantic Ridge.

6. Which of the following is a theory rather than a fact?

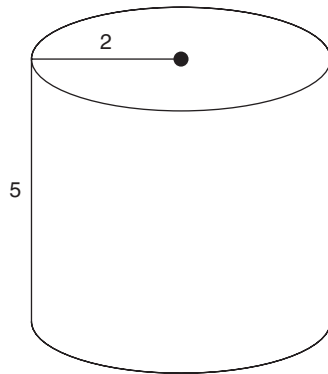
- A. The San Andreas fault is the boundary between the North American and Pacific plates.
- B. A single large landmass called Pangaea existed about 250 million years ago.
- C. The Earth's crust is composed of rocks like granite, basalt, and gabbro.
- D. Earthquakes often occur along tectonic plate boundaries.

Answers and explanations start on page 699.

21. In a certain state, the legislature has 100 seats. In 2010, party x held 54 seats. In the 2012, election, the party gained two seats. If, in the 2014 election, party x loses 6 seats, but gains 2 seats in the 2016 election, what will the absolute change in the number of seats held by party x from 2010 to 2016 be?

Write your answer in the box below.

22. What is the surface area of the cylinder below?

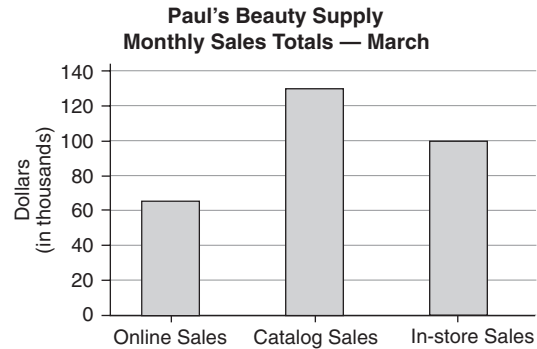


- A. 20π
- B. 28π
- C. 32π
- D. 50π

23. $\frac{2x^2 - 6x - 36}{2x - 12} =$

- A. $x - 6$
- B. $x - 3$
- C. $x + 3$
- D. $x^2 + 3x + 18$

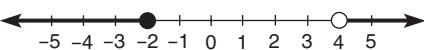
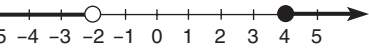
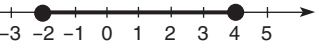
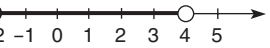
24. Customers of Paul's Beauty Supply can make purchases online, from a catalog, or in the store.



About how much more did the company make from catalog sales than from online sales in March?

- A. \$35,000
- B. \$65,000
- C. \$130,000
- D. \$195,000

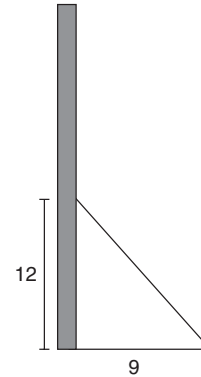
25. Which of the following is a graph of the inequality $-2 \leq x < 4$?

- A. 
- B. 
- C. 
- D. 

26. At what point does the line with the equation $y = 2x + 3$ intersect with the line with the equation $y = -\frac{1}{2}x - 7$?

- A. $(-4, -5)$
- B. $(0, -7)$
- C. $(0, 3)$
- D. $(2, 7)$

27. A pole is supported by a cable as shown. The cable is attached to the ground 9 feet from the base of the pole, and it is attached to the pole 12 feet above the ground.



Which of the following expressions could be used to find the length of the cable?

- A. $9^2 + 12^2$
- B. $12^2 - 9^2$
- C. $\sqrt{9^2 + 12^2}$
- D. $\sqrt{12^2 - 9^2}$

28. Meg is an interior designer who is looking to place two chairs against an accent wall. She has four different chairs from which to choose, each a different color: yellow, red, green, and blue. How many different combinations of chairs can Meg use in her design?

Write your answer in the box below.

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CAREN VAN SLYKE is a nationally recognized expert on the GED® Test. She has been involved in GED® Test preparation for more than 30 years—as an instructor, national teacher trainer, writer, and editor. She is founder and president of Learning Unlimited, which has developed dozens of study materials for the GED® Test. Caren and the Kaplan content team have developed this study guide to meet the challenges of the new GED® Test launched in 2014.

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