

# Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answers sheet to answer the questions in this section.

## DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1–11 are based on the following passage.

### Peanut Power

Polystyrene packing peanuts—thousands of them. That's what surrounded members of a Purdue University research team, led by chemical engineering professor Vilas G. Pol, after they had finished unpacking new equipment for a laboratory facility. Packing peanuts are a standard part of shipments, **1** as their cushiony material ensures that items, such as glassware, are not damaged in transit. Because most curbside recycling services will not collect packing peanuts, less than 10 percent of them are recycled per year, and millions of

1

- A) NO CHANGE
- B) as their cushiony material ensures that items that are shipped,
- C) which are commonly used because their cushiony material ensures that items,
- D) as their cushiony material guarantees and ensures that items,

tons end up in landfills, where they take years to decay.

Pol and his team were hesitant to discard the packing peanuts and contribute to this history of waste. **2** Thus, more curbside recycling services should consider accepting packing peanuts.

Pol and his team determined that the peanuts were composed of carbon, hydrogen, and oxygen. They knew that reusable lithium-ion batteries, which are commonly used to power electronic devices, employ anodes made of carbon. A battery's anode attracts and stores ions—atoms bearing an electrical charge—when the battery is charging and releases the ions to generate electricity. By heating the peanuts and a catalyst to 1,100 °F for several hours in the presence of argon (an inert gas commonly found in Earth's atmosphere), **3** the carbon was isolated from the hydrogen and oxygen, which were released in the form of harmless water vapor. Further heating resulted in extremely thin microsheets of **4** carbon, that could be made into battery anodes.

2

Which choice best sets up the information that follows in the next paragraph?

- A) NO CHANGE
- B) Hence, many environmental scientists have sought to address this waste-management problem.
- C) As a result, the abundance of packing peanuts in today's landfills is cause for alarm.
- D) Instead, they resolved to use their chemical expertise to devise a solution.

3

- A) NO CHANGE
- B) Pol and his team were able to isolate the carbon
- C) the resulting chemical reaction isolated the carbon
- D) isolation of carbon was achieved

4

- A) NO CHANGE
- B) carbon—
- C) carbon
- D) carbon;

5 The vaporization process that separated the carbon from the hydrogen and oxygen left the surfaces of the carbon microsheets uneven and porous. According to Pol, openings in the surface made the anodes' absorption of ions more efficient; 6 on the other hand, the batteries charged faster. In addition, the anodes retained about 13 percent more 7 of them than do conventional 8 anodes which meant that the batteries could provide more electricity before needing to be recharged than conventional batteries can.

5

Which choice best sets up the main topic of the paragraph?

- A) Further research will be necessary to determine all the potential applications of Pol's method.
- B) The team presented its findings at the American Chemical Society's 2015 national meeting.
- C) The anodes of conventional lithium-ion batteries are usually made from graphite.
- D) The anodes produced by Pol and his team proved remarkably effective.

6

- A) NO CHANGE
- B) likewise,
- C) as a result,
- D) by the same token,

7

- A) NO CHANGE
- B) of these
- C) ions
- D) DELETE the underlined portion.

8

- A) NO CHANGE
- B) anodes; meaning
- C) anodes and this meant
- D) anodes, this meant

CONTINUE ➔

The process **9** as for recycling packing peanuts that Pol and his team developed is not all that complicated: it requires less time and energy than the **10** humdrum method of making lithium-ion batteries, which uses carbon in the form of graphite. Sherine Obare, a professor of chemistry at Western Michigan University familiar with the team's research, noted that Pol's method could be used to successfully recycle other polystyrene-based materials. This additional benefit attests to the future promise of the work being done in Pol's lab. **11** In fact, the process that Pol and his team devised would take several days fewer than the process currently used to make anodes for lithium-ion batteries.

**9**

- A) NO CHANGE
- B) for recycling
- C) in order to recycle
- D) from recycling

**10**

- A) NO CHANGE
- B) exemplary
- C) standard
- D) run-of-the-mill

**11**

Which choice provides the most effective conclusion for the passage?

- A) NO CHANGE
- B) Thus, lithium-ion batteries are more effective than the lithium batteries that preceded them.
- C) Furthermore, other researchers are experimenting with burning packing peanuts in order to use their heat to generate energy, a process known as thermal recycling
- D) For now, Pol and his team hope that this process will be widely adopted and will turn a ubiquitous waste product into a useful household item.

Questions 12–22 are based on the following passage and supplementary material.

#### The King of Daredevil Comedy

In 1922, silent-film actor and director Harold Lloyd was walking in downtown Los Angeles when he saw an unusual sight: a man climbing up the outside of a tall office building. A crowd was gathered, mesmerized by the spectacle. Lloyd **12** watched nervously until the climber, a daredevil named Bill Strother, made it to safety. **13** Having already made a few films in the vein of “thrill comedy,” **14** the event inspired Lloyd to create his most daring film yet, and he invited Strother to be involved. The result was *Safety Last!*, the most famous movie of Lloyd’s career and a marvel of creative filming.

12

- A) NO CHANGE
- B) had watched
- C) watches
- D) has watched

13

At this point, the writer is considering adding the following sentence.

[missing sentence]

]

Should the writer make this addition here?

- A) Yes, because it explains why Lloyd was nervous while watching Strother.
- B) Yes, because it makes a point that is elaborated on in the next sentence.
- C) No, because it contradicts a point made in the previous sentence.
- D) No, because it diverts the focus of the paragraph from Strother to the audience.

14

- A) NO CHANGE
- B) Lloyd was inspired
- C) it was Lloyd’s inspiration
- D) its inspiration led Lloyd

In the final scene of the movie, Lloyd's **15** character; a department store worker trying to impress his girlfriend—must climb the outside of a twelve-story building. Because modern-day composite filming techniques such as blue screen did not yet exist, let alone computer-generated special effects, Lloyd had to be creative with his stunts. He used a full-scale replica of two floors of Los Angeles's International Savings Building and set **16** them on the roofs of progressively taller buildings: **17** that is, he placed the replica on a platform atop a two-story building, then a seven-story building, then a thirteen-story building. The **18** hoax allowed Lloyd to climb only a few stories at a time while always perpetuating the illusion that he was climbing several stories higher.

15

- A) NO CHANGE
- B) character, a department store worker trying to impress his girlfriend,
- C) character, a department store worker trying to impress his girlfriend;
- D) character—a department store worker trying to impress his girlfriend

16

- A) NO CHANGE
- B) those
- C) these
- D) it

17

- A) NO CHANGE
- B) however,
- C) furthermore,
- D) instead,

18

- A) NO CHANGE
- B) trick
- C) cheat
- D) swindle

19 Lloyd was not the only silent-film actor to attempt such risky stunts. Rather than using fake backdrops or projections, he insisted on a real city background. The camera angles in the climbing shots are 20 focused very precisely, cutting out the platform and the rooftop of the lower building but showing views of the street and other buildings in the distance. For the long shots, Lloyd used footage that Strother filmed during his own climbs, adding to the illusion that the character really was 21 clinging the side of a skyscraper.

19

Which choice best introduces the topic of the paragraph?

- A) NO CHANGE
- B) The building where Lloyd filmed much of *Safety Last!* was at the top of a hill, making it seem especially tall.
- C) For publicity, Lloyd's character in *Safety Last!* scales the side of the store where he works.
- D) Lloyd was committed to making the stunt look as realistic as possible.

20

- A) NO CHANGE
- B) focused, very precisely,
- C) focused very precisely
- D) focused; very precisely

21

- A) NO CHANGE
- B) embracing
- C) clinging to
- D) adhering to

Lloyd, a comedian as well as a stunt performer, used the dangerous climb as an avenue for comedy. Each stop along the building presents perils for Lloyd's character: a mouse running up his leg, a net tangling around him, a disorienting camera flash, a flimsy clock face. **22** To that end, Lloyd does not fall from the building, but he does succeed in keeping the audience both in stitches and on the edge of their seats. The actor and director Orson Welles said of the climbing sequence, "As a piece of comic architecture, it's impeccable." Audiences had never before seen such a daring stunt on film, and when *Safety Last!* opened to wide acclaim on April Fools' Day in 1923, Lloyd earned the nickname "the King of Daredevil Comedy."

22

- A) NO CHANGE
- B) Of course,
- C) Otherwise,
- D) Thus,

**Questions 23–33 are based on the following passage.**

**Give Art a Sporting Chance**

Pierre de Coubertin, the French founder of the modern Olympic Games, was a proponent of Olympism—a philosophy of life that celebrates the mind as well as the body, the arts as well as athletics. To Coubertin, this philosophy had best been embodied in the ancient Greek competitions, which prominently featured artists as both performers and commentators. Determined to bring the ideal of Olympism to the modern games, Coubertin incorporated into the 1912 Olympics an arts competition called the Pentathlon of the Muses. **23** The Olympic decathlon, a series of ten track and field events, was also introduced in 1912.

Coubertin's pentathlon, which awarded Olympic medals for achievements in architecture, literature, music, painting, and sculpture, **24** and which was a part of every Olympic Games until 1948. Regrettably, these competitions ceased, due to a technicality: professional athletes were **25** prohibited from competing in the Olympic Games, and it was argued that professional artists (in other words, any artist who had ever sold a painting or sung for money) should be ineligible as well.

**26** Coubertin himself won a gold medal in literature in 1912.

23

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

- A) Kept, because it sets up the information that follows in the next paragraph.
- B) Kept, because it offers an important clue as to the origin of the term “pentathlon.”
- C) Deleted, because it mentions information that lacks relevance to the main topic of the passage.
- D) Deleted, because it does not indicate who was responsible for introducing the decathlon.

24

- A) NO CHANGE
- B) that
- C) and
- D) DELETE the underlined portion.

25

- A) NO CHANGE
- B) prohibitive of competition
- C) to be prohibited to compete
- D) being prohibited to competition

26

Which choice provides the most effective conclusion to the paragraph?

- A) NO CHANGE
- B) Some wonder whether this chapter in the history of the Olympic Games deserves more attention.
- C) Lacking eligible participants, the Pentathlon of the Muses was discontinued.
- D) Still, the participation of artists in the first modern Olympic arts competition was minimal.

[1] Although the ban against professionals competing in athletics has long since been **27** rescinded, and the International Olympic Committee (IOC)'s attempts to restore the arts competition **28** has been tepid at best. [2] In 2000, the IOC instituted a Sport and Art Contest to "foster an active synergy between the worlds of art and sport." [3] One commentator noted that the exhibition of winning entries "had the feel of little more than a photo contest at the local library." [4] Take the example of *Omnipotent Triumph*, a 2012 prizewinning work of sculpture by US artist Martin Linson. [5] Representing a Paralympic athlete triumphantly crossing the finish line, the sculpture **29** is a relatively small work made of bronze;

27

- A) NO CHANGE
- B) rescinded; yet,
- C) rescinded; thus,
- D) rescinded,

28

- A) NO CHANGE
- B) have been
- C) is being
- D) was

29

The writer wants to suggest that the sculpture was consistent with the philosophy of Olympism. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) evocatively fuses athletic and artistic achievement;
- C) memorably reflects Linson's distinctive approach to representing human anatomy;
- D) shows the athlete making the victory sign with his arms;

however, the lack of publicity about the competition **30**  
consigned Linson's work to virtual obscurity. **31**

Reinstituting the Pentathlon of the Muses as a high-profile Olympic competition would provide valuable international exposure for artists. If artists were to receive medals during the Olympic Games just as athletes do, and if the competitions were broadcast to the estimated four billion viewers tuning in worldwide, talented artists such as Linson **32** were reaching a much broader audience. The effect on artists would be considerable, but the greatest change would be the effect on viewers. Much as the Olympics' athletic competitions have inspired people around the world to **33** embrace sport and exercise, reinvigorated artistic competitions could promote enthusiasm for artistic achievements and restore Coubertin's ideal.

**30**

- A) NO CHANGE
- B) consigned and then relegated Linson's work
- C) consigned the sculpture by Linson—since not many people had heard about it—
- D) led

**31**

The writer wants to add the following sentence to the paragraph.

[ *missing sentence* ]

]

The sentence would most logically be placed after

- A) sentence 1.
- B) sentence 2.
- C) sentence 3.
- D) sentence 4.

**32**

- A) NO CHANGE
- B) had reached
- C) will reach
- D) would reach

**33**

- A) NO CHANGE
- B) envelop
- C) encompass
- D) admit

**Questions 34–44 are based on the following passage and supplementary material.**

**Finding Meaning at the Zoo**

For most zookeepers, the highlight of the workday is the time they spend interacting with animals. [34] Besides, zookeepers spend much of their time performing activities that do not involve contact with animals: cleaning cages, preparing food, and [35] they also conduct educational programs, to name a few. Still, most zookeepers report very high levels of job satisfaction. A major reason for their enthusiasm is that they regard zookeeping not just as a job but also as an expression of their identity and values.

34

- A) NO CHANGE
- B) As a result,
- C) In other words,
- D) However,

35

- A) NO CHANGE
- B) the conducting of
- C) conducting
- D) conduct

People who become zookeepers typically exhibit an early concern for animals. Before beginning their careers, many volunteer at animal shelters or veterinary clinics and then attend college to obtain a degree in zookeeping or a related field such as biology or ecology.<sup>36</sup> Most zookeepers identify closely with their profession and consider their work morally important. These findings about zookeepers are demonstrated in a study by business professors J. Stuart Bunderson and Jeffery Thompson. Bunderson and Thompson asked 982 zookeepers from 157 different zoos to respond to statements about their work using a scale of 1 to 7, with 1 signifying that the respondent strongly disagreed with the proposition and 7 that he or she strongly agreed. When presented with statements asserting that their personal identity is based on their profession, such as “The animal keeping profession’s successes are my successes,” zookeepers gave numerical responses averaging 5.21.

<sup>37</sup> Moreover, the average response did not reach 7 for

36

Which choice most effectively combines the underlined sentences?

- A) Two findings about zookeepers, which are that most identify closely with their profession and consider their work morally important, are demonstrated in a study by business professors J. Stuart Bunderson and Jeffery Thompson.
- B) A study by business professors J. Stuart Bunderson and Jeffery Thompson a study that focused on zookeepers, demonstrates that most zookeepers identify closely with their profession and consider their work morally important.
- C) As a study by business professors J. Stuart Bunderson and Jeffery Thompson demonstrates, most zookeepers identify closely with their profession and consider their work morally important.
- D) Most zookeepers, found in a study by business professors J. Stuart Bunderson and Jeffery Thompson to identify closely with their profession, also consider their work morally important.

37

Which choice most effectively uses information from the table to support a main finding of Bunderson and Thompson’s study?

- A) NO CHANGE
- B) The agreement rating for statements about occupational importance was lower than that for statements about work meaningfulness.
- C) Similarly, they expressed high levels of agreement with statements about their moral duty to do a good job, with responses averaging 5.49.
- D) Furthermore, their sense of duty to the zoo was only slightly greater than their willingness to sacrifice on its behalf—a difference of just 0.15.

CONTINUE

any category. The experience of Meghan **38** Nemes, a zookeeper at Capron Park Zoo in Attleboro, Massachusetts, shows how seriously zookeepers take their work.

"When my animal gets stressed, I get stressed," she says. This leads her to think constantly about how she can make the **39** animals' lives easier.

Zookeepers' Agreement Ratings of Statements about Their Occupation

Statement category	Mean rating
Occupational identification	5.21
Moral duty	5.49
Occupational importance	5.45
Work meaning fullness	5.82
Perceived duty to organization	5.67
Willingness to sacrifice	5.52

Adapted from J. Stuart Bunderson and Jeffery Thompson, "The Call of the Wild: Zookeepers, Callings, and the Double-Edged Sword of Deeply Meaningful Work." ©2009 by Johnson Graduate School, Cornell University

**38**

- A) NO CHANGE
- B) Nemes;
- C) Nemes—
- D) Nemes,

**39**

- A) NO CHANGE
- B) animals' live's
- C) animal's lives'
- D) animals lives

The wholehearted commitment of zookeepers to their profession can lead them to make sacrifices. In their study, Bunderson and Thompson gauged zookeepers' willingness to give up free time to perform important tasks at the zoo without additional pay; the responses, which averaged **40** 5.82, showed a widespread willingness to sacrifice for the job. Siobhán McCann, another zookeeper at Capron Park Zoo, exemplifies this **41** disposition, she says she is comfortable working weekends and holidays to care for the zoo's animals.

**42** On top of interacting with the zoo's visitors, zookeepers perform physically demanding tasks and often

40

Which choice provides accurate information from the table?

- A) NO CHANGE
- B) 5.45,
- C) 5.49,
- D) 5.52,

41

- A) NO CHANGE
- B) disposition; she says,
- C) disposition, she says,
- D) disposition: she says

42

Which choice provides the most effective transition from the previous paragraph?

- A) NO CHANGE
- B) In addition to working long and unusual hours,
- C) Though they enjoy many aspects of their jobs,
- D) Despite working with many types of animals,

accept pay that is low **43** relative to their educational achievements. Yet for many, a love of animals and a commitment to animal conservation **44** makes these sacrifices not just tolerable but meaningful.

**43**

Which choice is most consistent with the style of the passage as a whole?

- A) NO CHANGE
- B) even when they are super educated.
- C) despite their having a whole bunch of education.
- D) when compared with their attainments of an educational nature.

**44**

- A) NO CHANGE
- B) make
- C) is making
- D) has made

**STOP**

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.



## Math Test – No Calculator

**25 MINUTES, 20 QUESTIONS**

Turn to Section 3 of your answer sheet to answer the questions in this section.

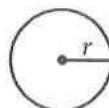
### DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

- The use of a calculator is not permitted.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

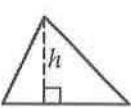


$$A = \pi r^2$$

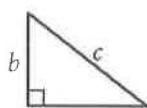
$$C = 2\pi r$$



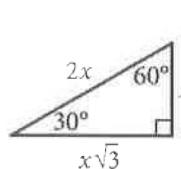
$$A = lw$$



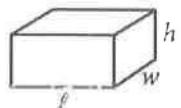
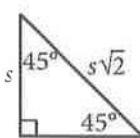
$$A = \frac{1}{2}bh$$



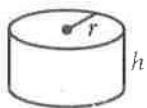
$$c^2 = a^2 + b^2$$



Special Right Triangles



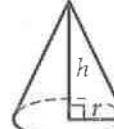
$$V = lwh$$



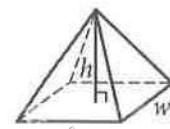
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

Tony spends \$80 per month on public transportation. A 10-ride pass costs \$12.50, and a single-ride pass costs \$1.50. If  $g$  represents the number of 10-ride passes Tony buys in a month and  $t$  represents the number of single-ride passes Tony buys in a month, which of the following equations best represents the relationship between  $g$  and  $t$ ?

- A)  $g + t = 80$
- B)  $g + t = 1.50 + 12.50$
- C)  $1.50g + 12.50t = 80$
- D)  $12.50g + 1.50t = 80$

2

$$T = 1,000 + 18h$$

In the equation above,  $T$  represents Brittany's total take-home pay, in dollars, for her first week of work, where  $h$  represents the number of hours she worked that week and 1,000 represents a sign-on bonus. If Brittany's total take-home pay was \$1,576, for how many hours was Brittany paid for her first week of work?

- A) 16
- B) 32
- C) 55
- D) 88

3

A clothing store is having a sale on shirts and pants. During the sale, the cost of each shirt is \$15 and the cost of each pair of pants is \$25. Geoff can spend at most \$120 at the store. If Geoff buys  $s$  shirts and  $p$  pairs of pants, which of the following must be true?

- A)  $15s + 25p \leq 120$
- B)  $15s + 25p \geq 120$
- C)  $25s + 15p \leq 120$
- D)  $25s + 15p \geq 120$

4

What is the solution to  $-3(x - 5) = -2x + 4$ ?

- A) 11
- B)  $\frac{19}{5}$
- C) -9
- D) -19



5

$$f(x) = x^3 + 3x^2 - 6x - 1$$

For the function  $f$  defined above, what is the value of  $f(-1)$ ?

- A) -11
- B) -7
- C) 7
- D) 11

6

Triangle  $ABC$  and triangle  $DEF$  are similar triangles, where  $\overline{AB}$  and  $\overline{DE}$  are corresponding sides. If  $DE=2AB$  and the perimeter of triangle  $ABC$  is 20, what is the perimeter of triangle  $DEF$ ?

- A) 10
- B) 40
- C) 80
- D) 120

7

There were no jackrabbits in Australia before 1788 when 24 jackrabbits were introduced. By 1920 the population of jackrabbits had reached 10 billion. If the population had grown exponentially, this would correspond to a 16.2% increase, on average, in the population each year. Which of the following functions best models the population  $p(t)$  of jackrabbits  $t$  years after 1788?

- A)  $p(t) = 1.162(24)^t$
- B)  $p(t) = 24(2)^{1.162t}$
- C)  $p(t) = 24(1.162)^t$
- D)  $p(t) = (24 \cdot 1.162)^t$



8

Which of the following is equivalent to the sum of  $3x^4 + 2x^3$  and  $4x^4 + 7x^3$ ?

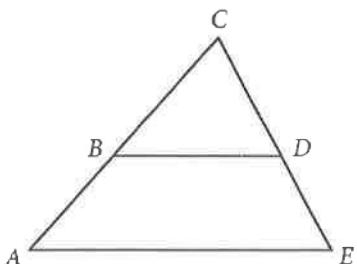
- A)  $16x^4$
- B)  $7x^6 + 9x^5$
- C)  $12x^4 + 14x^3$
- D)  $7x^4 + 9x^3$

9

The function  $f$  is defined by  $f(x) = x^2$ , and the function  $g$  is defined by  $g(x) = x^2 + 3$ . Which of the following translations of the graph of  $f$  in the  $xy$ -plane results in the graph of  $g$ ?

- A) A translation 3 units downward
- B) A translation 3 units upward
- C) A translation 3 units to the left
- D) A translation 3 units to the right

10



Note: Figure not drawn to scale.

In the figure above, segments  $AE$  and  $BD$  are parallel. If angle  $BDC$  measures  $58^\circ$  and angle  $ACE$  measures  $62^\circ$ , what is the measure of angle  $CAE$ ?

- A)  $58^\circ$
- B)  $60^\circ$
- C)  $62^\circ$
- D)  $120^\circ$

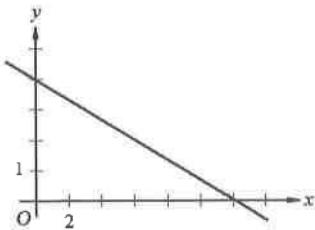


11

An oceanographer uses the equation  $s = \frac{3}{2}p$  to model the speed  $s$ , in knots, of an ocean wave, where  $p$  represents the period of the wave, in seconds. Which of the following represents the period of the wave in terms of the speed of the wave?

- A)  $p = \frac{2}{3}s$
- B)  $p = \frac{3}{2}s$
- C)  $p = \frac{2}{3} + s$
- D)  $p = \frac{3}{2} + s$

12

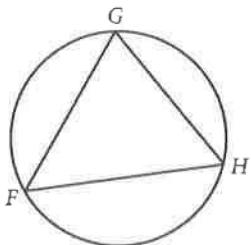


Which of the following could be an equation for the graph shown in the  $xy$ -plane above?

- A)  $y = -\frac{2}{3}x + 8$
- B)  $y = -\frac{3}{2}x + 4$
- C)  $y = -\frac{1}{3}x + 4$
- D)  $y = -\frac{4}{3}x + 8$



13



Note: Figure not drawn to scale.

Triangle  $FGH$  is inscribed in the circle above. If arc  $\widehat{FG}$  is congruent to arc  $\widehat{GH}$ , and the measure of  $\angle G$  is  $30^\circ$ , what is the measure of  $\angle H$ ?

- A)  $30^\circ$
- B)  $60^\circ$
- C)  $75^\circ$
- D)  $120^\circ$

14

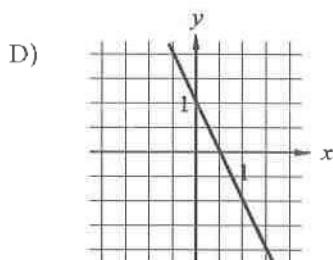
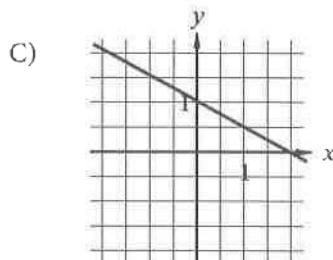
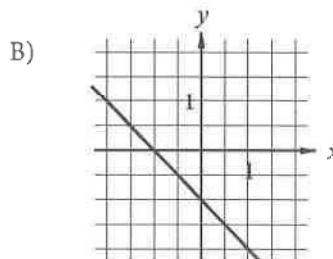
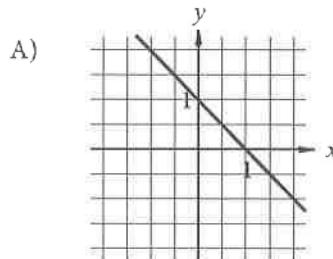
Which of the following is equivalent to  $\sqrt[4]{x^2 + 8x + 16}$ , where  $x > 0$ ?

- A)  $(x+4)^4$
- B)  $(x+4)^2$
- C)  $(x+4)$
- D)  $(x+4)^{\frac{1}{2}}$

15

$$ax + by = b$$

In the equation above,  $a$  and  $b$  are constants and  $0 < a < b$ . Which of the following could represent the graph of the equation in the  $xy$ -plane?



**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $\frac{7}{2}$ . (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer →  
in boxes.  
Grid in result.

Answer:  $\frac{7}{12}$

7	1	1	2
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 2.5

2	.	5
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Fraction line

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

2	1	3
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

.	6	6	6
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

2	0	1
0	0	0
1	1	1
2	2	2
3	3	3

2	0	1
0	0	0
1	1	1
2	2	2
3	3	3

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16

$$x + x = 9$$

What value of  $x$  satisfies the equation given?

17

$$\frac{11x - 33}{x - 3} = x$$

What is the solution to the equation above?

18

$$\begin{aligned}2x + 3y &= 31 \\3x - y &= 30\end{aligned}$$

If  $(x, y)$  is the solution to the system of equations above, what is the value of  $100x + 40y$ ?

19

If  $t > 0$  and  $(3t)^2 - 5(3t) - 14 = 0$ , what is the value of  $t$ ?

20

$$h(x) = x^3 + ax^2 + bx + c$$

The function  $h$  is defined above, where  $a$ ,  $b$ , and  $c$  are integer constants. If the zeros of the function are  $-5$ ,  $6$ , and  $7$ , what is the value of  $c$ ?

**STOP**

**If you finish before time is called, you may check your work on this section only.**

**Do not turn to any other section.**

**CONTINUE**



## Math Test – Calculator

**55 MINUTES, 38 QUESTIONS**

Turn to Section 4 of your answer sheet to answer the questions in this section.

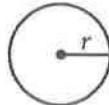
### DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

### NOTES

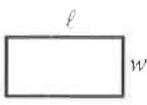
- The use of a calculator is **permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

### REFERENCE

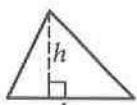


$$A = \pi r^2$$

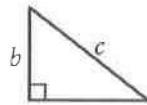
$$C = 2\pi r$$



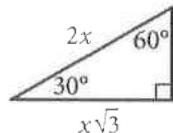
$$A = \ell w$$



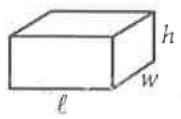
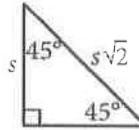
$$A = \frac{1}{2} bh$$



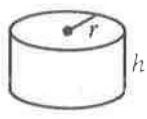
$$c^2 = a^2 + b^2$$



Special Right Triangles



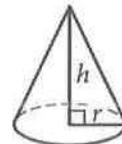
$$V = \ell wh$$



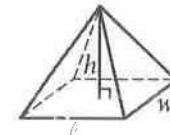
$$V = \pi r^2 h$$



$$V = \frac{4}{3} \pi r^3$$



$$V = \frac{1}{3} \pi r^2 h$$



$$V = \frac{1}{3} \ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.

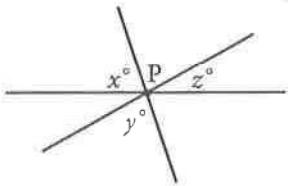


1

Makayla is planning an event in a 5,400-square-foot room. If there should be at least 8 square feet per person, what is the maximum number of people that could attend this event?

- A) 588
- B) 675
- C) 15,274
- D) 43,200

2



Note: Figure not drawn to scale.

In the figure, three lines intersect at point  $P$ . If  $x=65$  and  $y=75$ , what is the value of  $z$ ?

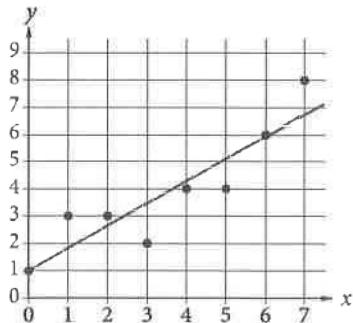
- A) 140
- B) 80
- C) 40
- D) 20

3

If  $\frac{1}{2}x - \frac{1}{6}x = 1$ , what is the value of  $x$ ?

- A) -4
- B)  $\frac{1}{3}$
- C) 3
- D) 6

4

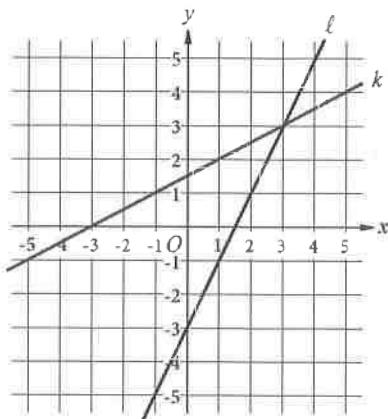


The scatterplot above shows eight data points in the  $xy$ -plane. A line of best fit is also shown for the data. If each data point is shifted 3 units upward and a new line of best fit for the shifted points is drawn, how will the value of the  $y$ -intercept of the new line compare with that of the line shown?

- A) It will increase.
- B) It will decrease.
- C) It will remain the same.
- D) There will no longer be a  $y$ -intercept.



5



Lines  $\ell$  and  $k$  in the  $xy$ -plane above are the graphs of the equations in a system. How many solutions does the system of equations have?

- A) None
- B) One
- C) Two
- D) More than two

6

Gerardo has 3 blue shirts and  $w$  white shirts in his closet, and these are the only shirts in his closet. If Gerardo selects a shirt at random from his closet, which of the following gives the probability that Gerardo will select a white shirt?

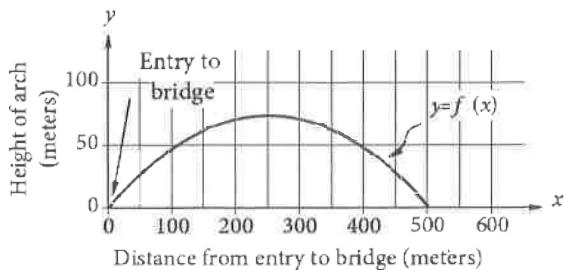
- A)  $\frac{w}{3+w}$
- B)  $\frac{3}{3+w}$
- C)  $\frac{w}{3}$
- D)  $\frac{3}{w}$



7

$$f(x) = -0.001160(x - 251.5)^2 + 73.37$$

The vertical height, in meters, of the upper arch of the Harbor Bridge in Sydney, Australia, above the roadway of the bridge can be modeled by the function above, where  $x$  is the horizontal distance along the roadway, in meters, from the entry to the bridge. The graph of  $y=f(x)$  is shown in the  $xy$ -plane below.



In the graph, the point  $(0, 0)$  represents the entry to the bridge. Which of the following points represents the exit from the bridge on the opposite end?

- A)  $(0, 73.37)$
- B)  $(0, 503.0)$
- C)  $(73.37, 0)$
- D)  $(503.0, 0)$

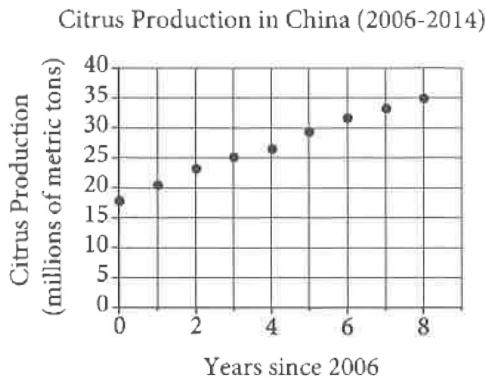
8

The graph of  $y=f(x)$  is a line in the  $xy$ -plane that passes through the point  $(0, 2)$  and has a slope of 5. Which of the following equations could define the function  $f$ ?

- A)  $f(x) = -\frac{1}{2}x + 5$
- B)  $f(x) = -\frac{1}{5}x + 2$
- C)  $f(x) = 2x + 5$
- D)  $f(x) = 5x + 2$



9



The scatterplot above shows the citrus production, in millions of metric tons, in China from 2006 through 2014. Which of the following could be the slope of a line of best fit for these data?

- A) 2.12
- B) 5.25
- C) 7.80
- D) 10.29

10

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

The function  $f$  is defined above. Which of the following is NOT an  $x$ -intercept of the graph of the function in the  $xy$ -plane?

- A)  $-4, 0$
- B)  $\left(-\frac{2}{3}, 0\right)$
- C)  $(1, 0)$
- D)  $\left(\frac{3}{2}, 0\right)$



**Questions 11 and 12 refer to the following information**

$t$	$C(t)$
1	8.5
2	11
3	13.5
4	16

The length  $C(t)$ , in inches, of a channel catfish in an Iowa river  $t$  years after the first year of life can be approximated by the linear function  $C$ . Some values of  $C(t)$  are given in the table above.

$$F(t) = 3t + 4$$

The length  $F(t)$ , in inches, of a flathead catfish in the same Iowa river  $t$  years after the first year of life can be approximated by the linear function  $F$ , defined by the equation above.

12

Which of the following equations could define  $C$  as a function of  $t$ ?

- A)  $C(t) = 2.5t + 6$
- B)  $C(t) = \frac{2}{5}t + 8.5$
- C)  $C(t) = 2.5t + 8.5$
- D)  $C(t) = \frac{2}{5}t + 8.1$

11

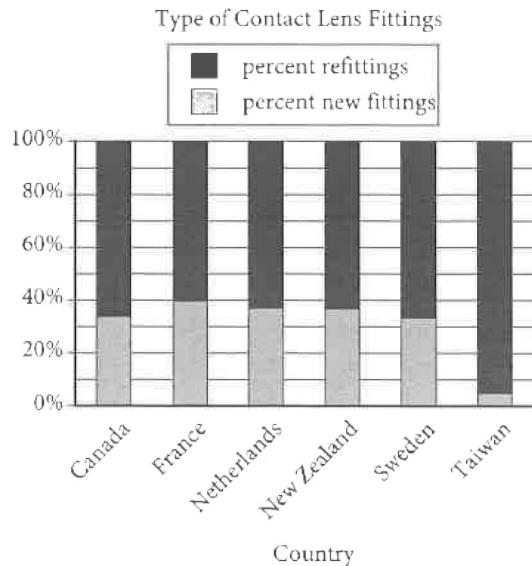
According to the model, which of the following is closest to the expected age, to the nearest whole year, of a flathead catfish that is 31 inches long?

- A) 10 years old
- B) 13 years old
- C) 98 years old
- D) 106 years old



Questions 13 and 14 refer to the following information

Country	Total fittings	Mean age
Canada	936	34.6
France	1,470	34.9
Netherlands	943	35.0
New Zealand	721	36.3
Sweden	436	36.3
Taiwan	1,574	26.6



The results of an international survey of contact lens fittings during a given time period are summarized in the table and bar graph above. The table shows the number of total fittings and the mean age, in years, of the patients who were fitted for contact lenses during the time period. The total fittings consisted of new contact lens fittings and refittings. The bar graph shows the percent of the patients who received new fittings and the percent who received refittings.

13

What is the range, in years, of the mean ages of the patients surveyed who had contact lens fittings in the countries shown?

- A) 8.0
- B) 8.4
- C) 9.7
- D) 10.3

14

Of the following, which best approximates the number of patients surveyed who received refittings in New Zealand?

- A) 274
- B) 358
- C) 447
- D) 585



15

A park ranger asked a random sample of visitors how far they hiked during their visit. Based on the responses, the estimated mean was found to be 4.5 miles, with an associated margin of error of 0.5 miles. Which of the following is the best conclusion from these data?

- A) It is likely that all visitors hiked between 4 and 5 miles.
- B) It is likely that most visitors hiked exactly 4.5 miles.
- C) It is not possible that any visitor hiked less than 3 miles.
- D) It is plausible that the mean distance hiked for all visitors is between 4 and 5 miles.

16

#### Observed Matings among Fruit Flies

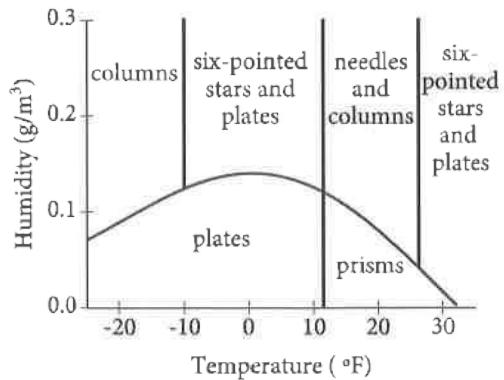
		Female fruit fly group		Total
		Female raised on starch	Female raised on maltose	
Male fruit fly group	Male raised on starch	22	9	31
	Male raised on maltose	8	20	28
	Total	30	29	59

The table above shows the observed mating frequencies among a group of fruit flies raised on either a starch medium or a maltose medium. What fraction of the observed matings were between fruit flies that were raised on the same medium?

- A)  $\frac{9}{31}$
- B)  $\frac{17}{59}$
- C)  $\frac{31}{59}$
- D)  $\frac{42}{59}$



17



The figure above shows a graph with six regions that correspond to temperature, in degrees Fahrenheit ( $^{\circ}\text{F}$ ), and humidity conditions, in grams of water vapor per cubic meter of air ( $\text{g}/\text{m}^3$ ), that will result in different snow crystal shapes when the crystals are grown in a laboratory. Based on the graph, which of the following is a combination of temperature and humidity at which prisms will be formed?

- A)  $5^{\circ}\text{F}$  and  $0.15 \text{ g}/\text{m}^3$
- B)  $15^{\circ}\text{F}$  and  $0.18 \text{ g}/\text{m}^3$
- C)  $20^{\circ}\text{F}$  and  $0.02 \text{ g}/\text{m}^3$
- D)  $30^{\circ}\text{F}$  and  $0.08 \text{ g}/\text{m}^3$

18

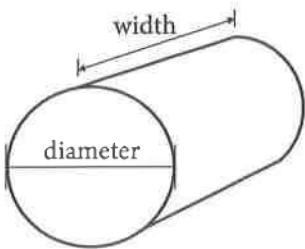
WA sample of 40 fourth-grade students was selected at random from a certain school. The 40 students completed a survey about the morning announcements, and 32 thought the announcements were helpful. Which of the following is the largest population to which the results of the survey can be applied?

- A) The 40 students who were surveyed
- B) All fourth-grade students at the school
- C) All students at the school
- D) All fourth-grade students in the county in which the school is located



**Questions 19 and 20 refer to the following information**

Ryan is comparing five different hay balers (machines that make bales of hay). The bales made are all in the shape of a cylinder, as shown below.



The price of each hay baler and the dimensions of the bales of hay it makes are shown in the table below.

Hay baler	Bale diameter range	Bale width	Price
A	32-51 in	46 in	\$19,800
B	35-60 in	46 in	\$27,900
C	35-72 in	46 in	\$32,000
D	35-65 in	62 in	\$37,500
E	32-72 in	62 in	\$46,900

20

Which of the following is closest to the percent by which the price of hay baler E exceeds the price of hay baler C?

- A) 18.9%
- B) 31.8%
- C) 40.5%
- D) 46.6%

19

Of the following, which ratio is closest to the width of bales made by hay baler A to the width of bales made by hay baler D?

- A) 0.74:1
- B) 1.35:1
- C) 1.74:1
- D) 17:1



21

$$\begin{aligned}x - y &= 1 \\x + y &= x^2 - 3\end{aligned}$$

Which ordered pair is a solution to the system of equations above?

- A)  $(1+\sqrt{3}, \sqrt{3})$
- B)  $(\sqrt{3}, -\sqrt{3})$
- C)  $(1+\sqrt{5}, \sqrt{5})$
- D)  $(\sqrt{5}, -1+\sqrt{5})$

22

The graph of the exponential function  $g$  in the  $xy$ -plane passes through the points  $(0, 1)$ ,  $(1, 4)$ , and  $(2, 16)$ . Which of the following is NOT true?

- A) A line can be drawn that does not intersect the graph of  $g$ .
- B) A line can be drawn that intersects the graph of  $g$  at exactly one point.
- C) A line can be drawn that intersects the graph of  $g$  at exactly two points.
- D) A line can be drawn that intersects the graph of  $g$  at exactly three points.

23

In a right triangle, the tangent of one of the two acute angles is  $\frac{\sqrt{3}}{3}$ . What is the tangent of the other acute angle?

- A)  $-\frac{\sqrt{3}}{3}$
- B)  $-\frac{3}{\sqrt{3}}$
- C)  $\frac{\sqrt{3}}{3}$
- D)  $\frac{3}{\sqrt{3}}$

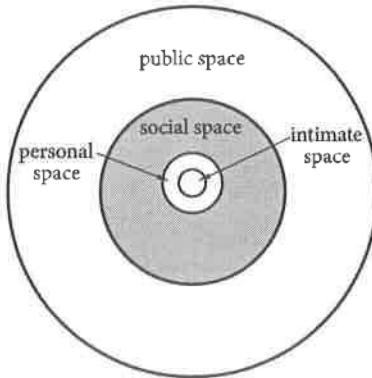
24

In the  $xy$ -plane, line  $\ell$  has a slope of 2. If line  $k$  is perpendicular to line  $\ell$ , which of the following could be an equation of line  $k$ ?

- A)  $-10x - 5y = 20$
- B)  $3x - 6y = 14$
- C)  $4x - 2y = 17$
- D)  $6x + 12y = 36$



25



Note: Figure not drawn to scale.

The diagram above represents Edward T. Hall's concept of space surrounding a person defined by four nonoverlapping regions. Intimate space is the region inside a circle of radius 1 foot. Personal space is the region within a circle of radius 4 feet but outside intimate space. Social space is the region within a circle of radius 12 feet but outside personal space. Public space is the region within a circle of radius 25 feet but outside social space. What is the area, in square feet, of the shaded region representing a person's social space?

- A)  $127\pi$
- B)  $128\pi$
- C)  $144\pi$
- D)  $625\pi$

26

Anita created a batch of green paint by mixing 2 ounces of blue paint with 3 ounces of yellow paint. She must mix a second batch using the same ratio of blue and yellow paint as the first batch. If she uses 5 ounces of blue paint for the second batch, how much yellow paint should Anita use?

- A) Exactly 5 ounces
- B) 3 ounces more than the amount of yellow paint used in the first batch
- C) 1.5 times the amount of yellow paint used in the first batch
- D) 1.5 times the amount of blue paint used in the second batch

27

$$ax - 4(3 + 2x) = -12$$

In the equation above,  $a$  is a constant. For what value of  $a$  does the equation have infinitely many solutions?

- A) -8
- B) -2
- C) 2
- D) 8



28

The wholesale price of a kilogram of lentils decreased by 1% from the previous month for six consecutive months. If  $x$  is the number of months since the price began to drop and  $y$  is the cost of a kilogram of lentils, which of the following equations could model the cost of lentils over this time period?

- A)  $y = 0.99x + 1.65$
- B)  $y = 1.01x + 1.65$
- C)  $y = 1.65(0.99)^x$
- D)  $y = 1.65(1.01)^x$

29

$$\frac{2}{x-2} + \frac{3}{x+5} = \frac{rx+t}{(x-2)(x+5)}$$

The equation above is true for all  $x > 2$ , where  $r$  and  $t$  are positive constants. What is the value of  $rt$ ?

- A) -20
- B) 15
- C) 20
- D) 60

30

If  $ax + a = 3$ , where  $a$  is a nonzero constant, which of the following must be equal to  $x + 1$ ?

- A) 3
- B)  $a$
- C)  $3a$
- D)  $\frac{3}{a}$

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Answer:  $\frac{7}{12}$

Write answer in boxes.

7	/	1	2
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Grid in result.

← Fraction line

Answer: 2.5

2	.	5
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7

.	6	6	6
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

.	6	6	7
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

Answer: 201 – either position is correct

2	0	1
0	0	0
1	1	1
2	2	2

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

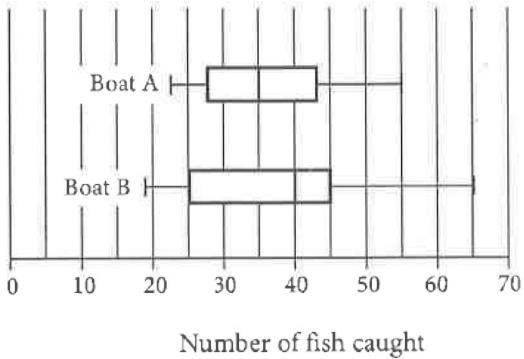


31

$$\sqrt{x+4} = 11$$

What value of  $x$  satisfies the equation above?

32



Number of fish caught

The box plots above summarize the distribution of the number of fish caught each day on two commercial fishing boats for a season. By how many fish does the median number of fish caught each day on Boat B exceed the median number on Boat A?

33

If  $a$  is the mean and  $b$  is the median of nine consecutive integers, what is the value of  $|a-b|$ ?

34

$$y = -16t^2 + 64t + 80$$

The equation above gives the height of an object above the ground,  $y$ , in feet,  $t$  seconds after it is launched from a platform. How many seconds after it is launched does the object reach the ground?



35

$$I = \frac{V}{R}$$

The formula above is Ohm's law for an electric circuit with current  $I$ , in amperes, potential difference  $V$ , in volts, and resistance  $R$ , in ohms. A circuit has a resistance of 500 ohms, and its potential difference will be generated by  $n$  six-volt batteries that produce a total potential difference of  $6n$  volts. If the circuit is to have a current of no more than 0.25 ampere, what is the greatest number,  $n$ , of six-volt batteries that can be used?

36

In the  $xy$ -plane, line  $k$  intersects the  $y$ -axis at the point  $(0, -6)$  and passes through the point  $(2, 2)$ . If the point  $(20, w)$  lies on line  $k$ , what is the value of  $w$ ?

37

In a science classroom, when labs are performed, students are seated at lab tables. If the teacher assigns 2 students to each lab table, 4 additional lab tables will be needed to seat all of the students. If the teacher assigns 4 students to each lab table, 4 lab tables will not be used. How many students are in the science class?

38

The number  $y$  is 20% greater than the number  $x$ . The number  $z$  is 20% less than  $y$ . The number  $z$  is how many times  $x$ ?

# STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

**CONTINUE**

# Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Out of Many, One Experience

On June 20, 1965, murmurs of excitement filled a Kingston, Jamaica, auditorium, where **1** way more people than were expected gathered for commencement

1

Which choice helps establish the tone and style of the passage?

- A) NO CHANGE
- B) an unusually large crowd
- C) a whole bunch of unexpected people
- D) an enormous crowd of an unparalleled nature

services at the University of the West Indies. **2** Along with the 400 graduates, many people had come to hear the words of that year's commencement speaker, the Reverend Dr. Martin Luther King Jr. **3** Furthermore, the Jamaican audience was familiar with Dr. King's ongoing campaign for civil rights in the United States through newspaper reports and television broadcasts, and the effect of seeing Dr. King ascend to the podium just feet away from where they stood was thrilling. The day's **4** preceding not only inspired the audience but also furthered Dr. King's aim of enhancing solidarity between the two countries.

**2**

At this point, the writer is considering adding the following sentence.

The university was established by royal charter in 1948.

Should the writer make this addition here?

- A) Yes, because it provides necessary historical context that sets up the passage's narrative.
- B) Yes, because it clarifies that commencement ceremonies were relatively new at the University of the West Indies.
- C) No, because it needlessly interrupts the discussion of Dr. King's visit with an irrelevant detail.
- D) No, because it merely repeats information about the University of the West Indies that is given elsewhere in the passage.

**3**

- A) NO CHANGE
- B) As a result,
- C) By contrast,
- D) DELETE the underlined portion, adjusting the capitalization as needed.

**4**

- A) NO CHANGE
- B) precedents
- C) proceedings
- D) procedures

Without even consulting **5** notes, Dr. King began to speak passionately about challenges common to Jamaica and the United States. At the time, both countries were on the cusp of great change. Jamaica, **6** which would have achieved independence from Great Britain less than three years earlier, was in the process of forming a **7** government. For both countries, the quest for political and social rights was laden with setbacks. Fixing his gaze on the graduating seniors, Dr. King declared that the present generation must recognize that “no nation can live alone: we are all interdependent.” He emphasized the need for a spirit of love and worldwide brotherhood **8** from facing the challenges of the future. For Dr. King, Jamaica’s newly minted national motto—“Out of Many, One People”—perfectly encapsulated this precept of unity.

**5**

- A) NO CHANGE
- B) notes;
- C) notes—
- D) notes.

**6**

- A) NO CHANGE
- B) which achieves
- C) which will have achieved
- D) having achieved

**7**

The writer is considering revising the underlined portion to the following.

government; the United States, meanwhile, was on the path to expanding civil rights for its citizens.

Should the writer make this revision?

- A) Yes, because it explains why the audience felt a strong connection to Dr. King’s words.
- B) Yes, because it provides support for the claim made in the previous sentence.
- C) No, because it does not follow logically from the first part of the sentence.
- D) No, because it interrupts the paragraph’s focus on Jamaican independence.

**8**

- A) NO CHANGE
- B) for the facing of
- C) in facing
- D) through facing

9 Dr. King spoke about unity that day. He also

inspired unity. Years later, when asked by reporters what they remembered most, many audience members cited the same moment in the speech. They all recalled that Dr. King had said, “If it falls to our luck to be street-sweepers, sweep the streets like Raphael painted pictures, like Michelangelo carved marble. . . . Sweep the streets so well that all the hosts of heaven and earth would have to pause and say, ‘Here lived a great street sweeper.’” For 10 people, building a new nation, these words were particularly meaningful. Everyone’s efforts had great worth; everyone had an important role to play.

The experience had a profound effect not only on 11 historians but also on Dr. King, who returned to Jamaica two years later when he needed a place to write his next book. In that work, *Where Do We Go from Here: Chaos or Community?*, Dr. King envisions a world in which all people are united, a world in which the communal spirit he found in Jamaica has been embraced by all nations.

9

Which choice most effectively combines the underlined sentences?

- A) Dr. King spoke about unity by inspiring it that day.
- B) Though speaking about unity that day, Dr. King actually inspired it.
- C) Speaking about unity, however, Dr. King also inspired it.
- D) Dr. King did not just speak about unity that day; he inspired it.

10

- A) NO CHANGE
- B) people building
- C) people building,
- D) people; building

11

Which choice provides the best transition from the discussion in the previous paragraph?

- A) NO CHANGE
- B) reporters
- C) the audience
- D) those who spoke with him

Questions 12–22 are based on the following passage.

### The Theater Duke

When Georg II—duke of a small German principality called **12** Saxe-Meiningen established—a local theater in 1866, he oversaw every aspect of each production. **13** This high degree of involvement was unusual: while many principalities had court theaters, a duke would usually appoint a director to oversee the plays. Georg not only supervised the plays but also exercised full artistic control over them. Directors at the time exerted little creative influence, giving actors free rein and reusing generic stage sets. In contrast, Georg advised actors, designed elaborate sets, and choreographed scenes, contributing to the development of greater stage realism and ultimately helping to establish the role of the modern director.

**14** Georg had recruited several little-known actors when the theater company visited Berlin to perform Shakespeare’s *Julius Caesar*, captivating the metropolitan audience. When the curtain rose at 7 p.m. on May 1, 1874, the audience was immediately amazed by the **15** productions’ elaborate sets and costumes, which Georg had modeled after Roman originals. Columns and

12

- A) NO CHANGE
- B) Saxe-Meiningen—established
- C) Saxe-Meiningen, established
- D) Saxe-Meiningen established

13

Which choice most effectively sets up the information that follows in the sentence?

- A) NO CHANGE
- B) Georg had been interested in the arts from a young age:
- C) At the time, Saxe-Meiningen was not a major cultural center:
- D) The duke maintained one of the best orchestras in Europe as well as an opera company:

14

Which choice provides the best transition from the previous paragraph?

- A) NO CHANGE
- B) It was the beginning of May
- C) Georg had to implement many staging changes
- D) Georg’s work as a director was on full display

15

- A) NO CHANGE
- B) productions elaborate sets
- C) production’s elaborate sets’
- D) production’s elaborate sets

decorative sculptures occupied the foreground of the **16** stage. As audience members marveled at the authentic-looking scenery, actors portraying Roman citizens streamed onto the stage, each bedecked in distinctive clothing, footwear, and **17** with headdresses. A trumpet then signaled the entrance of **18** Caesar. His glittering toga and armor made him instantly distinguishable. The audience members were so delighted that they broke into applause before a word was even uttered. “I could have believed myself back in ancient Rome,” one audience member said afterward.

16

The writer is considering revising the underlined portion to the following.

stage, while a backdrop painted with images of columns and fig trees provided the optical illusion of depth.

Should the writer make this revision?

- A) Yes, because it supports the claim in the previous sentence that the sets were modeled on Roman originals.
- B) Yes, because it further illustrates the spectacle that impressed audience members.
- C) No, because it unnecessarily repeats information about the columns already mentioned in the sentence.
- D) No, because it fails to provide a sufficient amount of detail about the backdrop.

17

- A) NO CHANGE
- B) wearing headdresses.
- C) in headdresses.
- D) headdresses.

18

Which choice most effectively combines the sentences at the underlined portion?

- A) Caesar: it was his glittering toga and armor that made him instantly distinguishable.
- B) Caesar being instantly distinguishable because of his glittering toga and armor.
- C) Caesar, who was instantly distinguishable by his glittering toga and armor.
- D) Caesar; instantly, his glittering toga and armor became distinguishable.

**19** The venue Georg's company used was quite different from those used in Shakespeare's time. For example, he set the stage for the climactic murder of Caesar by arranging the crowd of conspiring Romans in a circle surrounding Caesar, thereby suggesting the inescapability of the ruler's fate. He also carefully orchestrated the chaotic moments following the murder, when the crowd spins out of control. Georg split the crowd into smaller **20** units, he assigned individual dialogue and stage positions, thereby making the scene more realistic.

**19**

Which choice provides the best introduction to the paragraph?

- A) NO CHANGE
- B) Some audience members were less enthusiastic about the new style.
- C) Georg choreographed the play's action with equal intricacy.
- D) The play emphasizes Caesar's influence over the Roman people.

**20**

- A) NO CHANGE
- B) units, assigning
- C) units; assigning
- D) units, and assigning

“One feels oneself present at the beginnings of a revolution,” a theater critic **21** wondered of this climactic scene; the same can perhaps be said of Georg’s achievement overall. The play was a hit, launching the duke’s group on a seventeen-year tour, during which it delivered over 2,000 performances in venues throughout Europe. Inspiring directors around the continent to design and execute more unified, detailed productions, **22** the title Georg was dubbed with was “The Theater Duke.”

21

- A) NO CHANGE
- B) presumed
- C) sensed
- D) observed

22

- A) NO CHANGE
- B) Georg’s posthumous title was “The Theater Duke.”
- C) “The Theater Duke” was a title posthumously given to Georg.
- D) Georg was posthumously dubbed “The Theater Duke.”

**Questions 23–33 are based on the following passage and supplementary material.**

**Free to Sing**

For centuries Japanese bird enthusiasts have bred white-rumped munias, brown finches with tufts of white feathers, for **23** its plumage. Generations of this selective breeding have produced a new species: the Bengalese **24** finch; while existing only in captivity. Such breeding was intended to produce certain physical qualities in the domesticated finches, but it also had an unintended **25** consequence increased song complexity in the Bengalese finch **26** relative to that of the white-rumped munia.

**23**

- A) NO CHANGE
- B) one's
- C) their
- D) his or her

**24**

- A) NO CHANGE
- B) finch, which exists
- C) finch, it exists
- D) finch; existing

**25**

- A) NO CHANGE
- B) consequence: increased
- C) consequence; increased
- D) consequence. Increased

**26**

- A) NO CHANGE
- B) when compared with those of
- C) when compared with
- D) relative to

To explain this phenomenon, Tokyo ornithologist Kazuo Okanoya at first reasoned that finch song complexity was driven primarily by mate selection. He found that **27** female finches tend to choose males with loud, high-pitched, improvisational songs. These males are chosen over those with soft, low-pitched, predictable songs, so breeders selecting reproductively successful birds must also have selected the most dynamic singers. However, Berkeley anthropologist Terrence Deacon saw a contradiction in this idea: song complexity should occur when there is pressure to identify a mate of the same species; **28** after all, it should not occur among birds in captivity, where this pressure is lower. Deacon proposed instead that since white-rumped munias in more homogeneous groups lack pressure to find other white-rumped munias, random genetic mutations that result in song improvisation are allowed to propagate, leading to more complex songs.

To test this hypothesis, Okanoya's team tracked wild white-rumped munias in three areas in Taiwan. At each site, they **29** diagnosed flock composition (the percentage of observed flocks that were "mixed," containing white-rumped munias and another species, scaly-breasted munias) and measured the linearity of the munias' songs (a calculation based on the number of elements in a song, where 1 is simple and 0 is complex).

27

Which choice most effectively combines the sentences at the underlined portion?

- A) female finches tend to choose males with loud, high-pitched, improvisational songs over those with soft, low-pitched, predictable songs,
- B) males with loud, high-pitched, improvisational songs tend to be ones chosen by female finches over those with soft, low-pitched, predictable songs,
- C) loud, high-pitched, improvisational songs are sung by males that female finches tend to choose over those with soft, low-pitched, predictable songs,
- D) choosing males with loud, high-pitched, improvisational songs over those with soft, low-pitched, predictable songs is what female finches tend to do,

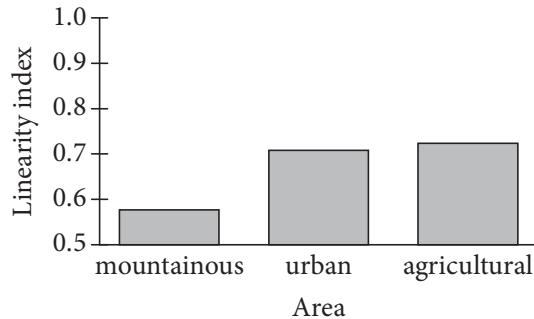
28

- A) NO CHANGE
- B) instead,
- C) therefore,
- D) similarly,

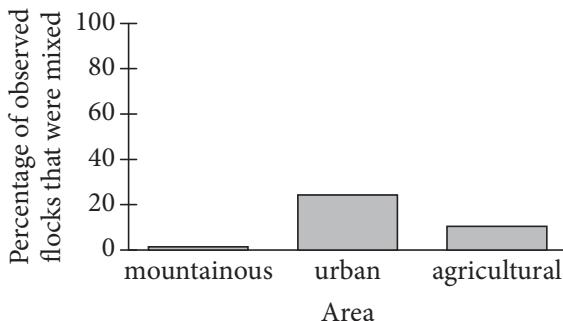
29

- A) NO CHANGE
- B) dissected
- C) traced
- D) analyzed

The linearity at the mountainous site was **30** more than 0.1 point lower than that at the urban site or the agricultural site, indicating greater song complexity. At the same time, **31** a lower percentage of flocks at the urban site were mixed than at the mountainous site. Together, these data suggest that higher song complexity is associated with greater flock uniformity.

**Figure 1**Munia Song Linearity  
in Three Areas in Taiwan**Figure 2**

Percentage of Observed Flocks that Were Mixed in Three Areas in Taiwan



Figures adapted from Hiroko Kagawa et al., "Ecological Correlates of Song Complexity in White-Rumped Munias: The Implication of Relaxation of Selection as a Cause for Signal Variation in Birdsong." ©2012 by John Benjamins Publishing Company.

**30**

Which choice best reflects the information presented in figure 1?

- A) NO CHANGE
- B) more than 0.2 point lower than that at the urban site or
- C) about the same as that at the urban site and
- D) exactly 0.7 point higher than that at the urban site and

**31**

Which choice best reflects the data presented in figure 2?

- A) NO CHANGE
- B) a greater percentage of flocks at the urban and agricultural sites were mixed than at
- C) over 40 percent of flocks were mixed at both the urban site and
- D) the percentage of flocks that were mixed grew slightly over time at

Okanoya's study **32** indicates that, song complexity is subject to the pressure of the birds' need to identify a mate of the same species; when this pressure is relaxed, song complexity increases rather than decreases. Such relaxation explains song complexity in the white-rumped munia's descendant, the domesticated Bengalese finch, and **33** provides intriguing support for the idea that birdsong can evolve through a complex interaction of selective pressures.

**32**

- A) NO CHANGE
- B) indicates that—
- C) indicates, that
- D) indicates that

**33**

The writer wants a conclusion that places the passage's discussion within a larger scientific context. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) suggests that white-rumped munias and other birds do not have to be domesticated to develop complex songs.
- C) proves that habitat has more to do with birdsong complexity than does any specific mating pressure.
- D) indicates that white-rumped munias have more complex songs than do other kinds of birds.

Questions 34–44 are based on the following passage.

### Eyes in the Sky

— 1 —

Precision agriculture, the use of technology and data analysis in farming, has a new tool at its disposal: the type of remote-controlled aerial vehicle commonly known as a drone. Farmers looking to increase efficiency might decide that drones, **34** which have already proven useful to the film industry, are just what they need.

— 2 —

Detailed data about crop health provided by drones can guide crucial decisions for farmers such as when

**35** to irrigate and whether to use chemical treatments?

Agricultural drones come equipped with a video or still-image camera that farmers can use to observe the condition of their crops. Some drone companies **36** also offer analysis services: they can combine digital files from drones into color-coded maps that mark zones indicating differences in growth rates or the prevalence of weeds, pests, or weather damage. With these maps, a farmer can irrigate and apply herbicides, pesticides, and fertilizers to each part of a field according to its specific needs.

34

Which choice provides supporting information about drones that is further developed in the passage?

- A) NO CHANGE
- B) along with training in how to operate them properly,
- C) with the critical information they provide about harvests,
- D) despite criticism about them from consumer advocates,

35

- A) NO CHANGE
- B) to irrigate and whether to use chemical treatments.
- C) should they irrigate, and should they use chemical treatments?
- D) should they irrigate, and should they use chemical treatments.

36

Which choice most effectively sets up the information provided in the next part of the sentence?

- A) NO CHANGE
- B) stand to make a considerable profit:
- C) make drones that can be controlled by mobile apps:
- D) focus only on specialty crops:

— 3 —

Drones compare favorably with image-capturing satellites and piloted aircraft, other technologies that are used to gain aerial views. Drones are less expensive, provide finer-grained images, **37** and they fly low to the ground, can take pictures even on cloudy days. Jean Hediger, whose family operates a 3,400-acre organic grain farm in Colorado, can attest to the advantages of the technology. Hediger **38** acquired a drone after losing half of her harvest in one year to weeds. She estimates that identifying problems faster with timely crop data and using less weed killer **39** will save her tens of thousands of dollars in future **40** years. Considerably more than the \$7,000 she paid for the drone and any potential costs associated with reviewing images.

**37**

- A) NO CHANGE
- B) and
- C) and therefore
- D) and, because they

**38**

Which information about Hediger provides the most effective transition between the previous sentence and the following sentence in the paragraph?

- A) NO CHANGE
- B) considered acquiring a drone from Corey Jacobs, who runs a farm in Indiana.
- C) has expressed frustration with federal regulations on drones.
- D) enjoys having an aerial view of her farm.

**39**

- A) NO CHANGE
- B) had saved
- C) are saving
- D) have saved

**40**

- A) NO CHANGE
- B) years—considerably
- C) years, this is considerably
- D) years; considerably

— 4 —

Pilots who fly planes for crop dusting and other purposes **41** experience disquiet regarding the presence of drones in the airspace above farms. Drones might be accidentally flown into nearby tall objects such as cell phone towers. Objections to drones may be **42** engaged with regulations that require drone operators to keep drones within sight at all times and that require lights on drones to ensure they are visible.

41

- A) NO CHANGE
- B) stew over
- C) get all worked up about
- D) worry about

42

- A) NO CHANGE
- B) addressed
- C) encountered
- D) refuted

— 5 —

Despite these challenges, it is important for drones **43** being integrated into the agricultural system. If they are used effectively, drones hold the promise of making farms more productive and cost effective while minimizing waste in water and chemical treatments, which could benefit farmers, consumers, and the environment alike.

**Question 44 asks about the previous passage as a whole.**

43

- A) NO CHANGE
- B) in being
- C) to be
- D) be

**Think about the previous passage as a whole as you answer question 44.**

44

The writer wants to insert the following sentence.

Any discussion of agricultural drones must acknowledge the potential safety concerns surrounding their use.

To make the passage most logical, the sentence should be placed at the beginning of paragraph

- A) 2.
- B) 3.
- C) 4.
- D) 5.

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



# Math Test – No Calculator

**25 MINUTES, 20 QUESTIONS**

Turn to Section 3 of your answer sheet to answer the questions in this section.

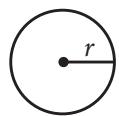
## DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. For questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

1. The use of a calculator is not permitted.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

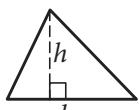


$$A = \pi r^2$$

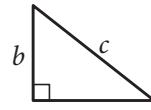
$$C = 2\pi r$$



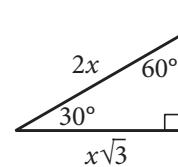
$$A = \ell w$$



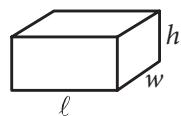
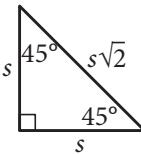
$$A = \frac{1}{2}bh$$



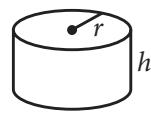
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



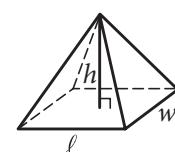
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

Juliet rented a car for one day from a company that charges \$80 per day plus \$0.15 per mile driven. If she was charged a total of \$98 for the rental and mileage, for how many miles of driving was Juliet charged? (Assume there is no tax.)

- A) 15
- B) 120
- C) 533
- D) 633

2

$$(2x + 6) + (x^2 + 2x + 1)$$

Which of the following polynomials is equivalent to the expression above?

- A)  $x^2 + 5$
- B)  $x^2 + 7$
- C)  $4x^2 + 7$
- D)  $x^2 + 4x + 7$

3

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

For the function  $f$  defined above, what is the value of  $f(1)$ ?

- A) 3
- B) 2
- C) 0
- D) -1

4

Which of the following is an equation of the line in the  $xy$ -plane that has slope 2 and passes through the point  $(0, 3)$ ?

- A)  $y = 2x + 3$
- B)  $y = 2x - 3$
- C)  $y = 2(x + 3)$
- D)  $y = 2(x - 3)$

5

$$\sqrt{x} + 4 = 12$$

Which of the following is the solution to the equation above?

- A) 8
- B) 16
- C) 64
- D) 140



6

If  $7(2x - 5) - 2(2x - 5) = 4(x + 5)$ , what is the value of  $x$ ?

A) 1

B)  $\frac{15}{2}$

C)  $\frac{65}{6}$

D) 65

8

$$V = \frac{M}{D}$$

The formula above relates volume  $V$ , mass  $M$ , and density  $D$ . What is density in terms of volume and mass?

A)  $D = \frac{1}{MV}$

B)  $D = \frac{M}{V}$

C)  $D = \frac{V}{M}$

D)  $D = MV$

7

$$x^4 - 8x^2 + 16$$

Which of the following is equivalent to the expression above?

A)  $(x - 2)^2(x + 2)^2$

B)  $(x^2 + 4)(x + 2)(x - 2)$

C)  $(x - 2)^4$

D)  $(x - 4)^4$

9

For a ride, a taxi driver charges an initial fare of \$3.00 plus \$0.40 for each  $\frac{1}{5}$  of a mile driven. If the total charge for a ride is \$27.00, what is the distance traveled, in miles?

A) 3

B) 8

C) 12

D) 15



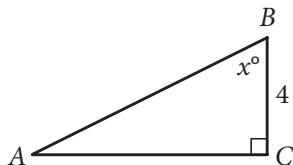
10

$$\frac{1}{2}mv^2 = mgh$$

Torricelli's law is given by the equation above, where  $m$  represents the mass,  $h$  represents the height,  $v$  represents the velocity, and  $g$  is a constant. According to the equation from Torricelli's law, which of the following is equivalent to the velocity,  $v$ ?

- A)  $2gh$
- B)  $\frac{1}{2}ghm^2$
- C)  $\sqrt{2gh}$
- D)  $\sqrt{\frac{1}{2}mgh}$

11



Note: Figure not drawn to scale.

In the right triangle above,  $x = 60$ . What is the length of side  $\overline{AB}$ ?

- A) 7
- B) 8
- C) 9
- D) It cannot be determined from the information given.

12

$$4v^2 + 6v + 1 = 0$$

Which of the following values is a solution to the equation above?

- A)  $\frac{-3 + \sqrt{5}}{4}$
- B)  $\frac{-3 + \sqrt{13}}{4}$
- C)  $\frac{3 + \sqrt{5}}{4}$
- D)  $\frac{3 + \sqrt{13}}{4}$

13

$$C(t) = 50.25t + 228.75$$

The average cost per square foot, in dollars, of a condominium in City X can be modeled by the function  $C$  defined above, where  $t$  is the number of years after 2001 and  $0 \leq t \leq 8$ . In the function, what does the number 50.25 represent?

- A) The average cost per square foot, in dollars, of a condominium in 2001
- B) The average cost per square foot, in dollars, of a condominium in 2009
- C) The approximate increase in years for each dollar increase in the average cost per square foot of a condominium
- D) The approximate increase in the average cost per square foot, in dollars, of a condominium for each additional year after 2001



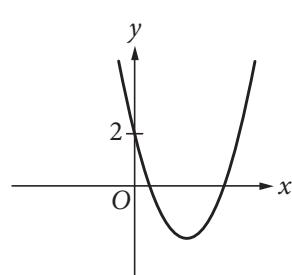
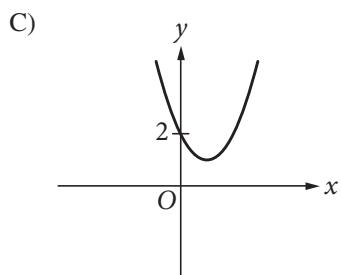
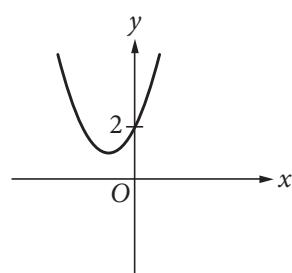
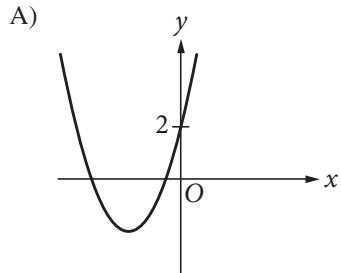
14

What is the sum of the complex numbers  $6 + 5i$  and  $8 + 3i^2$ ? (Note:  $i = \sqrt{-1}$ )

- A)  $11 + 5i$
- B)  $14 - 2i$
- C)  $14 + 8i^3$
- D)  $17 + 5i$

15

Which of the following could be the graph of  $y = x^2 + 2x + 2$ ?



**DIRECTIONS**

**For questions 16–20,** solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $\frac{7}{2}$ . (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

**Answer:  $\frac{7}{12}$**

7	/	1	2
---	---	---	---

Write answer in boxes. →

Grid in result. ← Fraction line

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

**Answer: 2.5**

2	.	5
---	---	---

← Decimal point

**Acceptable ways to grid  $\frac{2}{3}$  are:**

2	/	3
---	---	---

.	6	6	6
---	---	---	---

.	6	6	7
---	---	---	---

**Answer: 201 – either position is correct**

2	0	1
---	---	---

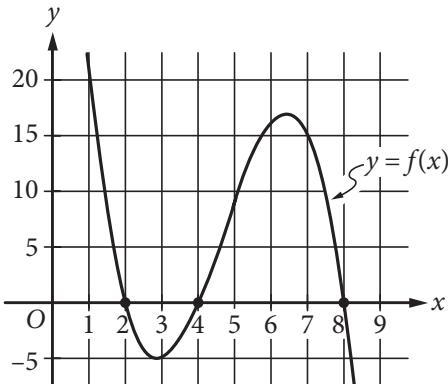
2	0	1	
---	---	---	--

**NOTE:**

You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



16



The graph of the cubic function  $f$  is shown in the  $xy$ -plane above. If  $f(a) = 0$ , where  $a$  is a constant, what is one possible value of  $a$ ?

17

$$5(x + a) + 3(x^2 - a) = 3x^2 + 5x + 4$$

In the equation above,  $a$  is a constant. If the equation is true for all values of  $x$ , what is the value of  $a$ ?

18

$$3m + 2p = 24$$

$$m + p = 10$$

If  $(m_1, p_1)$  is the solution to the system of equations above, what is the value of  $p_1$ ?

19

$$4x - 5y = 2$$

The graph of the equation above in the  $xy$ -plane is a line. What is the  $x$ -coordinate of the  $x$ -intercept of the line?

20

$$(x - 6)^2 + (y - 3)^2 = 25$$

The graph in the  $xy$ -plane of the equation above is a circle. If the circle is translated downward  $a$  units such that the circle is tangent to the  $x$ -axis, the equation becomes  $(x - 6)^2 + (y - 3 + a)^2 = 25$ . What is the value of  $a$ ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**



# Math Test – Calculator

**55 MINUTES, 38 QUESTIONS**

Turn to Section 4 of your answer sheet to answer the questions in this section.

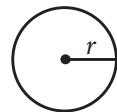
## DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. For questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

1. The use of a calculator is permitted.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

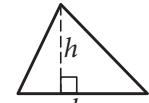
## REFERENCE



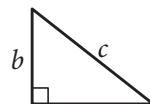
$$\begin{aligned}A &= \pi r^2 \\C &= 2\pi r\end{aligned}$$



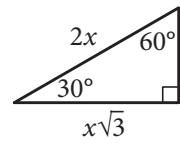
$$A = \ell w$$



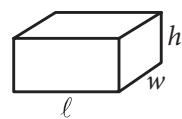
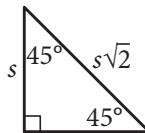
$$A = \frac{1}{2} bh$$



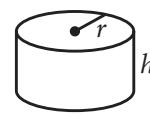
$$c^2 = a^2 + b^2$$



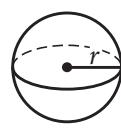
Special Right Triangles



$$V = \ell wh$$



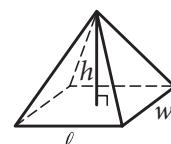
$$V = \pi r^2 h$$



$$V = \frac{4}{3} \pi r^3$$



$$V = \frac{1}{3} \pi r^2 h$$



$$V = \frac{1}{3} \ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



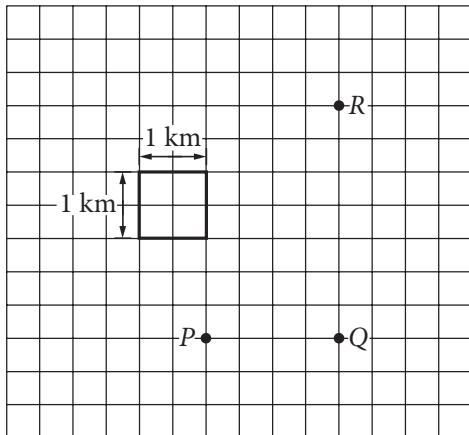
1

$$5(x - 3) = 10x + 5$$

What value of  $x$  satisfies the equation above?

- A) -4
- B) 1
- C) 5
- D) 15

2



A student walks  $x$  kilometers (km) along a straight path from point  $P$  to point  $Q$ . Then the student walks  $y$  km along a straight path from point  $Q$  to point  $R$ . What is the total distance,  $x + y$ , in km, that the student walks?

- A) 2.0
- B) 3.5
- C) 5.5
- D) 8.0

3

If  $y = x + \frac{1}{2}$  and  $z = 2x - 3$ , which of the following is equivalent to  $y + yz$ ?

- A)  $2x^2 - x - 1$
- B)  $2x^2 - x - 2$
- C)  $2x^2 - x - \frac{1}{2}$
- D)  $2x^2 - 2x - \frac{3}{2}$

4

An electric company charges Jerome \$0.05 per kilowatt-hour (kWh) of energy he uses in his house. If Jerome was charged \$36 by the electric company, how many kilowatt-hours of energy did Jerome use?

- A) 0.0014
- B) 1.8
- C) 180
- D) 720



5

A scientist conducted an experiment and selected a random sample of runners from a list of all high school track participants from a certain city. The scientist randomly assigned each runner to one of two treatment groups, and the results of the experiment were found to be statistically significant. To which of the following populations can the results of the experiment be safely generalized?

- A) All high school athletes
- B) All high school track participants from the city
- C) All high school track participants from the country
- D) All runners

6

Which of the following equivalent forms of the function  $f(x) = 4x^2 + 4x - 24$  is the most suitable to indicate the  $x$ -coordinates of the  $x$ -intercepts of the graph of  $y = f(x)$  in the  $xy$ -plane?

- A)  $f(x) = 4(x^2 + x - 6)$
- B)  $f(x) = 4(x - 2)(x + 3)$
- C)  $f(x) = 2(x - 2)(2x + 6)$
- D)  $f(x) = (2x - 4)(2x + 6)$

7

Raymond's weekly income consists of a base salary for a 40-hour workweek plus overtime pay. The overtime pay is paid at an hourly rate for the time that Raymond works in addition to his 40-hour workweek. Raymond's weekly income, in dollars, can be represented by the expression  $800 + 30x$ , where  $x$  is the total number of hours Raymond works over 40 hours. Which of the following is the best interpretation of the number 800 in this context?

- A) Raymond's base weekly salary, in dollars
- B) Raymond's total overtime pay for the workweek, in dollars
- C) The total number of hours in a year that Raymond works in addition to his normal 40-hour workweeks
- D) Raymond's hourly wage, in dollars per hour, for time worked in addition to his normal 40-hour workweek

8

A city with 120,000 residents is voting on a proposal that would eliminate overnight parking of vehicles on the city's streets. An independent company randomly surveys 1,200 residents to see whether or not residents would support this proposal. The outcome of the survey shows that 60% of the residents surveyed approve of the proposal with a margin of error of 2%. Which of the following statements is a plausible conclusion from the outcome of the survey?

- A) Exactly 60% of city residents approve eliminating overnight parking.
- B) There are 72,000 city residents who approve eliminating overnight parking.
- C) About 2% of the city residents do not approve eliminating overnight parking.
- D) Between 58% and 62% of the city residents approve eliminating overnight parking.



9

On November 1st, there were 2,500 boxes in a warehouse. On December 1st, there were 15% fewer boxes in the warehouse than there were on November 1st. On January 1st, there were 20% more boxes in the warehouse than there were on December 1st. How many boxes were in the warehouse on January 1st?

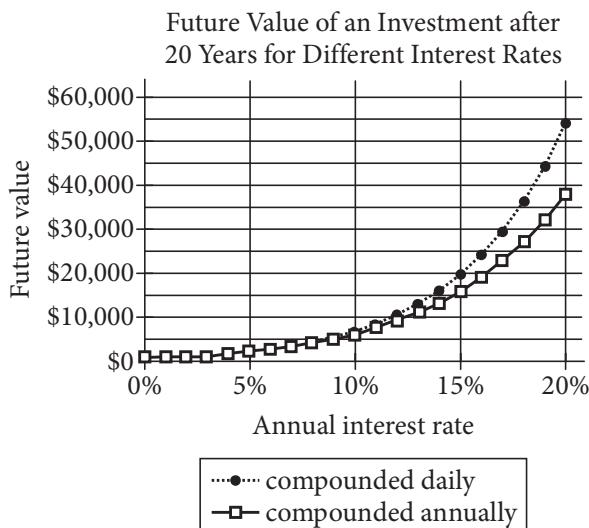
- A) 1,700
- B) 2,125
- C) 2,550
- D) 2,625

10

Jonathan needs to earn at least \$175 next week and can work at most 20 hours. He earns \$10 per hour at his lawn service job and \$8 per hour at his job at the gym. Which of the following systems of inequalities represents this situation in terms of the number of hours he will work at his lawn service job,  $\ell$ , and the number of hours he will work at his job at the gym,  $g$ , next week?

- A)  $10\ell + 8g \leq 175$   
 $\ell + g \leq 20$
- B)  $10\ell + 8g \leq 175$   
 $\ell + g \geq 20$
- C)  $10\ell + 8g \geq 175$   
 $\ell + g \leq 20$
- D)  $10\ell + 8g \geq 20$   
 $\ell + g \geq 175$

11



An initial investment of \$1,000 is made at a constant annual interest rate. The graphs above show the corresponding future value  $v$ , in dollars, of the investment for different annual interest rates,  $r$ , after 20 years. One graph shows the value when the interest is compounded daily, and the other graph shows the value when the interest is compounded annually. Which of the following statements is true?

- A) As  $r$  increases at a constant rate,  $v$  increases more rapidly if interest is compounded annually rather than daily.
- B) As  $r$  increases at a constant rate,  $v$  increases more rapidly if interest is compounded daily rather than annually.
- C) As  $r$  increases at a constant rate, the difference in interest compounded daily and interest compounded annually increases at a constant rate.
- D) If  $r = 15\%$  and interest is compounded annually, a \$1,000 investment will be worth \$20,000 after 20 years.

**Questions 12–14 refer to the following information.**

For gym class, Shayla completed a 4-mile walking and running exercise. She ran for  $7t$  miles and she walked for  $3\left(\frac{13}{15} - t\right)$  miles, where  $t$  is the total amount of time, in hours, Shayla spent running. The equation  $7t + 3\left(\frac{13}{15} - t\right) = 4$  models this situation.

12

Which of the following is the best interpretation of the value 7 in the equation that models this situation?

- A) Shayla walked at a speed of 7 miles per hour.
- B) Shayla ran at a speed of 7 miles per hour.
- C) Shayla walked for 7 minutes.
- D) Shayla ran for 7 minutes.

13

What is the value of  $t$  in the equation that models this situation?

- A)  $\frac{7}{50}$
- B)  $\frac{7}{20}$
- C)  $\frac{31}{60}$
- D)  $\frac{13}{15}$

14

What was the total distance that Shayla spent walking and running, in kilometers?  
(Use 1 mile = 1.61 kilometers)

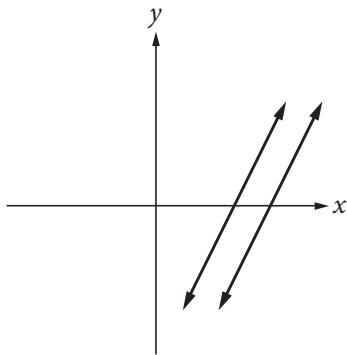
- A) 0.40
- B) 4.00
- C) 6.44
- D) 10.53



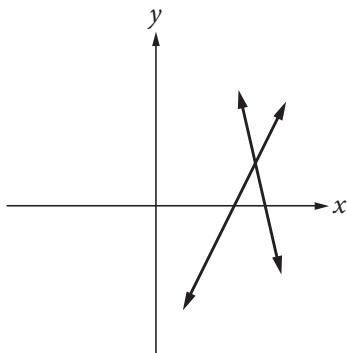
15

Which of the following is a graph of a system of equations with no solution?

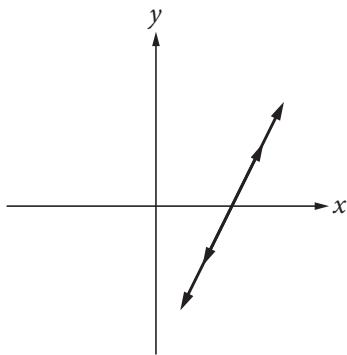
A)



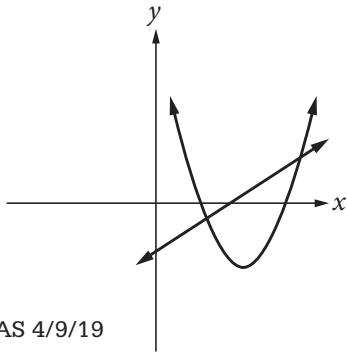
B)



C)



D)



16

$$P = P_0 + \rho gh$$

The equation above gives the total pressure,  $P$ , on an object submerged in a fluid, where  $P_0$  is the pressure at the fluid's surface,  $\rho$  is the density of the fluid,  $g$  is the acceleration due to gravity, and  $h$  is the depth to which the object is submerged. What is  $h$  in terms of  $P$ ,  $P_0$ ,  $\rho$ , and  $g$ ?

A)  $\frac{\rho g}{P - P_0}$

B)  $\frac{P - P_0}{\rho g}$

C)  $\frac{P + P_0}{\rho g}$

D)  $P + P_0 + \rho g$

17

If  $4x^2 + bx + 9 = 0$ , where  $b$  is a constant, has exactly one solution, what is a possible value of  $b$ ?

A) 72

B) 36

C) 12

D) 6



18

	Female	Male	Total
Blue eyes	2	4	6
Brown eyes	8	6	14
Green eyes	1	5	6
Total	11	15	26

Sierra recorded the gender and eye color of all the students in her biology class. The results are shown in the table above. If a male student is selected at random from Sierra's biology class, what is the probability that he will have brown eyes?

- A)  $\frac{2}{3}$
- B)  $\frac{2}{5}$
- C)  $\frac{3}{7}$
- D)  $\frac{3}{13}$

19

Kelly enlarged the area of a photograph to 250% of its original size. The original dimensions of the photograph were 5 inches by 7 inches. What is the area of the enlarged photograph, in square inches?

- A) 71.25
- B) 87.5
- C) 218.75
- D) 3,000

20

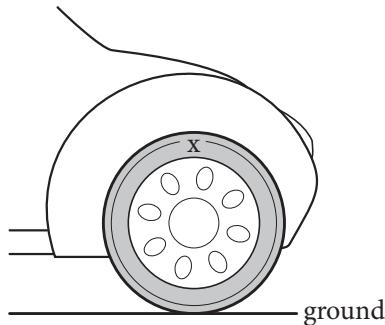
$$\sqrt{x-3} = 3 - \sqrt{x}$$

If  $x$  is the solution to the equation above, what is the value of  $\sqrt{x-3}$ ?

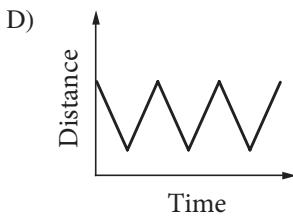
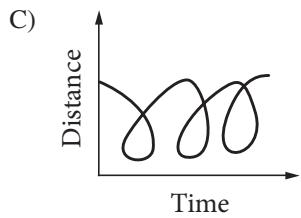
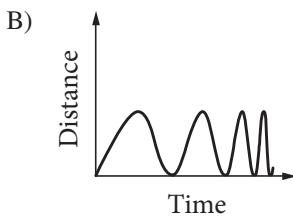
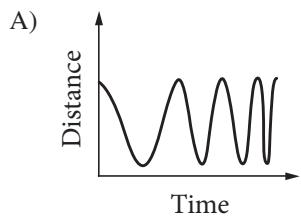
- A) 1
- B)  $\sqrt{\frac{3}{2}}$
- C)  $\sqrt{3}$
- D) 3



21

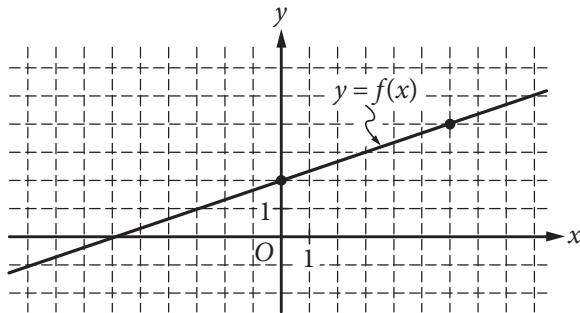


In the figure above, X is a mark on the side of a tire of a car at rest. The car, starting from rest, will experience an acceleration for some period of time. Which of the following graphs could represent the distance between the mark X and the ground after the car starts to accelerate and the tire makes its first few revolutions?



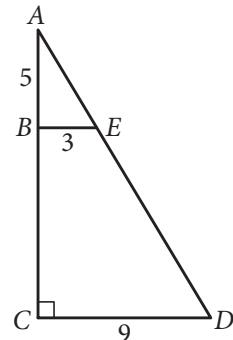


22



- The graph of the function  $f$  is shown in the  $xy$ -plane above. The function  $f$  is defined by the equation  $f(x) = \frac{a}{b}x + c$  for positive constants  $a$ ,  $b$ , and  $c$ , where  $\frac{a}{b}$  is a fraction in lowest terms. Which of the following orders  $a$ ,  $b$ , and  $c$  from least to greatest?
- A)  $a < b < c$   
 B)  $a < c < b$   
 C)  $b < c < a$   
 D)  $c < a < b$

23



In the figure above,  $\triangle ACD$  is a right triangle and  $\overline{BE}$  is parallel to  $\overline{CD}$ . What is the perimeter of  $\triangle ACD$  to the nearest tenth of a unit?

- A) 29.7  
 B) 36.0  
 C) 41.5  
 D) 50.9

24

In the  $xy$ -plane, the graph of a linear equation of the form  $y = mx + b$  and the graph of an exponential equation of the form  $y = ab^x$  both contain points  $(1, 3)$  and  $(2, 4)$ . If the point  $(r, s)$  is on the graph of the linear equation and the point  $(r, t)$  is on the graph of the exponential equation, where  $0 < r < 4$  and  $s > t$ , which of the following must be true?

- A)  $0 < r < 1$   
 B)  $1 < r < 2$   
 C)  $2 < r < 3$   
 D)  $3 < r < 4$



25

Two independent surveys asked random samples of 500 people about the distances they commute to work each day. The results of the surveys are detailed in the table below.

Daily Commuting Distance

Survey	Mean (miles)	Standard deviation (miles)
A	13.9	1.5
B	15.1	1.5

Which statement is true based on the results of these surveys?

- A) There is a greater variation in the distribution of the distances people commute to work in Survey A.
- B) There is a greater variation in the distribution of the distances people commute to work in Survey B.
- C) The variation in the distribution of the distances people commute is the same in both surveys.
- D) It is impossible to determine the variation in the distribution of the distances people commute because the means are different.

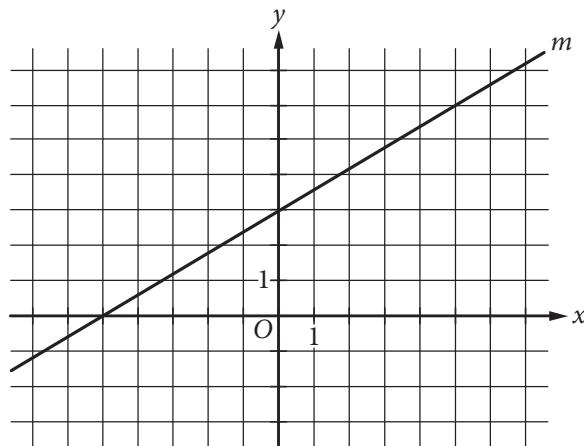
26

During an ice age, the average annual global temperature was at least 4 degrees Celsius lower than the modern average. If the average annual temperature of an ice age is  $y$  degrees Celsius and the modern average annual temperature is  $x$  degrees Celsius, which of the following must be true?

- A)  $y = x - 4$
- B)  $y \leq x + 4$
- C)  $y \geq x - 4$
- D)  $y \leq x - 4$



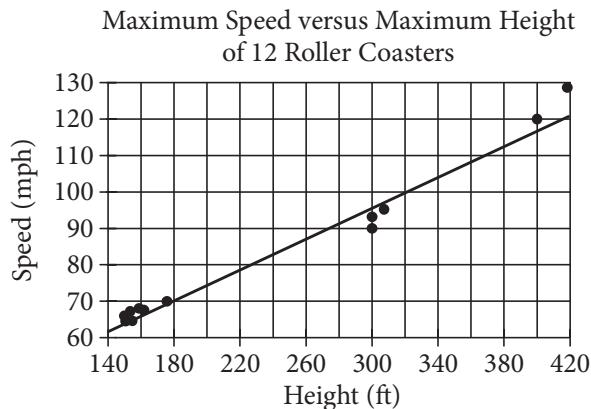
27



In the  $xy$ -plane above, line  $m$  is perpendicular to line  $\ell$  (not shown). Which of the following could be an equation of line  $\ell$ ?

- A)  $5x + 3y + 3 = 0$
- B)  $5x - 3y + 3 = 0$
- C)  $3x - 5y + 15 = 0$
- D)  $3x + 5y - 15 = 0$

28



The scatterplot above shows the maximum height  $h$ , in feet (ft), and maximum speed  $s$ , in miles per hour (mph), of 12 roller coasters as well as the line of best fit for the data. Of the following, which best represents an equation for the line of best fit?

- A)  $s = 0.21h + 32$
- B)  $s = 0.43h + 32$
- C)  $s = 0.21h + 62$
- D)  $s = 0.43h + 62$



29

Selena created a scale model of an airplane where 1 centimeter on the model equals 6 meters on the airplane. The wingspan of the model is 10.7 centimeters. Selena wants to make a new model where a scale of 1 centimeter on the model equals 3 meters on the airplane. Which of the following best describes how the wingspan of the new model will compare to the wingspan of the first model?

- A) The wingspan of the new model will be 3 centimeters shorter than the first model.
- B) The wingspan of the new model will be 3 centimeters longer than the first model.
- C) The wingspan of the new model will be  $\frac{1}{2}$  as long as the wingspan of the first model.
- D) The wingspan of the new model will be 2 times as long as the wingspan of the first model.

30

Hongbo sold  $x$  cell phones in 2013. The number of cell phones he sold in 2014 was 128% greater than in 2013, and the number of cell phones he sold in 2015 was 29% greater than in 2014. Which of the following expressions represents the number of cell phones Hongbo sold in 2015?

- A)  $(0.29)(1.28x)$
- B)  $(0.29)(2.28x)$
- C)  $(1.29)(1.28x)$
- D)  $(1.29)(2.28x)$

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $\frac{7}{2}$ . (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

**Answer:  $\frac{7}{12}$**

7	/	1	2
---	---	---	---

Write answer in boxes. →

Grid in result. ← Fraction line

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

**Answer: 2.5**

2	.	5
---	---	---

← Decimal point

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
---	---	---

.	6	6	6
---	---	---	---

.	6	6	7
---	---	---	---

**Answer: 201 – either position is correct**

2	0	1
---	---	---

2	0	1	
---	---	---	--

**NOTE:**  
You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



31

Anna was 99 centimeters tall the day she turned 3 years old, and she was 106.5 centimeters tall the day she turned 4 years old. If Anna's height increases by the same amount each year between the ages of 2 and 8, how many centimeters tall will she be the day she turns 7 years old?

32

Cars Registered in Town X

Car color	Percent of registered cars
Black	13%
Blue	7%
Gray	7%
Silver	28%
White	32%
Other	13%

The table above shows the distribution of color for the 4000 cars registered in Town X. Based on the table, how many more white cars than black cars are registered in Town X?

33

$$\begin{aligned}3x + 2y &= 16 \\6x + 2y &= 28\end{aligned}$$

If the system of equations above has solution  $(x, y)$ , what is the value of  $x + y$ ?



**Questions 37 and 38 refer to the following information.**

A contractor purchased two slabs of granite, both in the shape of a right rectangular prism. The table below shows some information about the two slabs.

	Length	Width	Thickness	Mass
Slab 1	100 centimeters	20 centimeters	8 centimeters	44,000 grams
Slab 2	125 centimeters		8 centimeters	

37

What is the density, in grams per cubic centimeter, of Slab 1?

38

Slab 2 has a ratio of length to width of 5 to 2. How many centimeters wide is Slab 2?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

# Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a “NO CHANGE” option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

**Question 1-11 are based on the following passage.**

### Dinosaur Disaster

Roughly 65 million years **1** ago, dinosaurs along with 65 to 70 percent of other plant and animal species on Earth, became extinct. This massive wave of extinctions—which makes the end of the Cretaceous geologic period—has long fascinated **2** scientists, their proposal of numerous explanations for it. The most well known of these is the Alvarez hypothesis, which holds that a gigantic asteroid struck the planet, causing climate change and ecosystem collapse.

1

- A) NO CHANGE
- B) ago, dinosaurs, along with
- C) ago dinosaurs, along with,
- D) ago dinosaurs along with,

2

- A) NO CHANGE
- B) scientists; proposing
- C) scientists, and they have proposed
- D) scientists, they have proposed

2

2

The Alvarez hypothesis first emerged in 3 1980. In that year, scientists Luis and Walter Alvarez noted the high level of iridium, an element that is rare on Earth but abundant in asteroids, in layers of rock from the Cretaceous period. They proposed that iridium could be evidence of a massive asteroid strike. This hypothesis gained additional support in the 1990s, after researchers determined that a 110-mile-wide crater near the town of Chicxulub, Mexico, was likely caused by an asteroid strike at the end of the Cretaceous period. The asteroid's impact would have ejected a tremendous amount of iridium-containing dust into the atmosphere, blocking sunlight 4 and resulting in global cooling and a darkness that would have halted photosynthesis. These sudden environmental shifts would have rapidly driven many species to extinction, 5 a conclusion supported by sharp declines in the levels of plankton and pollen in the fossil record after the asteroid strike.

3

Which choice best combines the sentences at the underlined portion?

- A) the year 1980, the year when
- B) 1980, in which year
- C) 1980, when
- D) 1980; it was then that

4

- A) NO CHANGE
- B) with results being
- C) and resulting to
- D) with results in

5

The writer is considering deleting the underlined portion, adjusting the punctuation as needed. Should the underlined portion be kept or deleted?

- A) Kept, because it raises an objection to the Alvarez hypothesis that is discussed in more detail in the rest of the passage.
- B) Kept, because it provides evidence of the sudden environmental shifts mentioned earlier in the sentence.
- C) Deleted, because it describes effects of the asteroid impact that have already been discussed in sufficient detail.
- D) Deleted, because it shifts the overall focus of the passage by discussing extinctions of life-forms other than dinosaurs.

2

2

The Alvarez hypothesis, however, is **6** challenged by research that suggests gradual environmental changes, caused by volcanic eruptions occurring before the asteroid collision, had already stressed dinosaur populations. **7** Finally, a range of volcanoes in western India called the Deccan Traps is thought **8** to have been the site of several huge eruptions near the end of the Cretaceous period. According to Princeton University geologist Gerta Keller, climate-altering gas and dust clouds from these volcanic eruptions could have caused most of the extinctions during this period. **9** leaving the few surviving dinosaur species to be eliminated by the asteroid impact.

6

Which choice best maintains the tone established in the passage?

- A) NO CHANGE
- B) badgered
- C) defied
- D) besieged

7

- A) NO CHANGE
- B) Furthermore,
- C) In fact,
- D) However,

8

- A) NO CHANGE
- B) to have been the sight
- C) to have been the cite
- D) too have been the site

9

- A) NO CHANGE
- B) and leaving
- C) to leave
- D) but leaving

**10** In a 2010 article, dozens of scientists reaffirmed the Chicxulub asteroid as the most likely cause of the Cretaceous extinctions, but the available evidence on dinosaur extinctions suggests that environmental changes from these eruptions could have made dinosaurs more vulnerable to the devastation caused by the asteroid strike. The impact of the Chicxulub asteroid continues to be viewed as the event that ended the age of the dinosaurs. **11** But the actual number of species that became extinct at the end of the Cretaceous period has been a subject of debate.

**10**

Which choice most logically introduces the information in the rest of the sentence?

- A) NO CHANGE
- B) Most researchers dispute Keller's hypothesis that the Deccan eruptions directly caused the majority of the Cretaceous extinctions,
- C) Keller made a controversial claim that the Chicxulub asteroid struck too early in the Cretaceous period to be a major cause of extinctions.
- D) Layers of lava from the Deccan eruptions contain numerous fossils that have been of interest to scientists,

**11**

The writer wants to reinforce the assertion in the previous sentence in a way that reflects the main ideas of the passage. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Not all dinosaurs became extinct at that time, though: all modern species of birds are thought to be descended from the dinosaurs that survived.
- C) But whether it did so by itself or was, as geologist Paul Renne puts it, "the final straw, but not the sole cause" will likely inspire research and debate for years to come.
- D) The emphasis on dinosaurs can be misleading, however, because so many other plant and animal species became extinct at the same time.

Question 12-22 are based on the following passage.

### Not-So-Ancient Poetry

In the late 1700s, readers across Europe [12] got a big kick out of a series of poems purportedly written by Ossian, a legendary Scottish poet and storyteller from the third century. [13] Ossian was said to have worked in the oral rather than the written tradition, and the French general Napoleon Bonaparte so admired the poems [14] to where he commissioned two paintings of Ossian to be hung in his summer palace. There was just one problem: the poems were largely the invention of their so-called translator, James Macpherson.

Macpherson was a Scottish [15] Highlander who grew up listening to songs and stories in the Gaelic language. When he began his career as a schoolteacher in Ruthven, Scotland, he set about collecting the tales and ballads of the region. A friend persuaded him to translate the Gaelic poem "The Death of Oscar" into English, and in 1760 Macpherson published his translation, along with translations of several other poems, in a volume entitled *Fragments of Ancient Poetry*.

12

Which choice is most consistent with the style used throughout the passage?

- A) NO CHANGE
- B) were tickled pink by
- C) got a rush from
- D) were thrilled by

13

Which choice provides a supporting example that is most similar to the other example in the sentence?

- A) NO CHANGE
- B) Literary critics compared Ossian to the revered poets Homer and Dante,
- C) The poems of Ossian feature well-known characters from other Gaelic poems,
- D) Ossian himself appears in the poems as a narrator,

14

- A) NO CHANGE
- B) so that
- C) which
- D) that

15

- A) NO CHANGE
- B) Highlander, he grew
- C) Highlander; growing
- D) Highlander, he had grown

The *Fragments* immediately captured the public's imagination. Equally captivating was Macpherson's hint in the preface that an epic poem (a poem chronicling heroic deeds of great significance to a culture) might be recovered through further study of ancient manuscripts and oral traditions in the Highlands. Excited patrons provided Macpherson with funds to undertake a research **16** trip, they were not disappointed. **17** In spite of their contributions, Macpherson published two epic poems, *Fingal* and *Temora*, which recounted the feats of ancient Gaelic warriors. Macpherson claimed that the poems had been written by Ossian.

**18** The influential English author Samuel Johnson demanded to see the original **19** manuscripts, that Macpherson had translated. When Macpherson refused, Johnson accused him of fraud and undertook a trip to Scotland to debunk Macpherson's claims. Johnson provided a formal account of his suspicions in his 1775 travel book, *A Journey to the Western Islands of Scotland*.

**16**

- A) NO CHANGE
- B) trip, meanwhile,
- C) trip, and
- D) trip: whereas

**17**

- A) NO CHANGE
- B) Because of this,
- C) In the years that followed,
- D) To everyone's dismay,

**18**

At this point, the writer wants to include an effective transition from the previous paragraph to the rest of the passage. Which choice best accomplishes this goal?

- A) The Scottish poet Robert Burns may have been influenced by Ossian.
- B) However, a controversy soon arose over the poems.
- C) Readers assumed that Macpherson was telling the truth.
- D) Macpherson's poems were written in English, not the original Gaelic.

**19**

- A) NO CHANGE
- B) manuscripts that
- C) manuscripts that;
- D) manuscripts that,

2

2

The public remained divided between those who believed in the poems' authenticity and those who agreed with Johnson that the poems were a hoax. **20** Today it is believed that Macpherson created the Ossian texts by combining poetry and stories he had heard on his travels with **21** invented material of his own invention. Having set out to find an epic poet in the Highlands, he created one by attributing these amalgamated works to the mythic Ossian. Although many modern critics do not share Johnson's hostility toward Macpherson, Johnson was ultimately correct in thinking that poems such as *Fingal* and *Temora* are better understood as the work of an eighteenth-century poet **22** than as a third-century one.

20

The writer is considering adding the following sentence.

The Ossian incident is mentioned only briefly in James Boswell's 1791 biography *Life of Johnson*.

Should the writer make this addition here

- A) Yes, because it offers additional context about how important the incident was in Johnson's life.
- B) Yes, because it introduces an appropriate supporting detail to the discussion of Ossian's poetry.
- C) No, because it fails to establish Boswell's views on the legitimacy of Ossian.
- D) No, because it blurs the focus of the paragraph by introducing extraneous information regarding Johnson.

21

- A) NO CHANGE
- B) material that he invented
- C) made-up material
- D) material

22

- A) NO CHANGE
- B) than those of
- C) than as that of
- D) compared with

TestD

**Question 23-33 are based on the following passage and supplementary material.**

### USPS: You Can Bank On It

In 2014 the Office of Inspector General of the United States Postal Service (USPS) released a report containing a surprising **23** recommendation: post offices should offer their customers banking services such as refillable debit cards, check cashing, and **24** offering small loans. Although the idea may seem strange at first, postal banking has benefited people in many parts of the world and could do so in the United States as well.

A postal banking system would rely on the existing network of post offices to provide essential financial services to residents throughout the United States. **25** In some countries, such as Brazil, post offices partner with commercial banks. In others, such as Japan, the postal service itself acts as a full-scale bank, offering loans and savings accounts. The diverse array of successful postal banking systems around the world shows that post offices can provide many of the same services **26** like banks.

23

- A) NO CHANGE
- B) recommendation post offices should offer:
- C) recommendation, post offices should offer
- D) recommendation—post offices should offer:

24

- A) NO CHANGE
- B) to offer small
- C) small
- D) offer small

25

Which choice provides the best transition from the previous sentence to the sentences that follow in the paragraph?

- A) In a country as large as the United States, the post office network is quite extensive and wide reaching.
- B) Such systems already exist in fifty countries and provide services to about one billion people.
- C) According to a 2014 survey by the Pew Charitable Trusts, about 70 percent of those surveyed were indifferent to the idea of post offices offering financial services.
- D) If implemented, people could cash checks, buy stamps, and mail packages all in the same place: the post office.

26

- A) NO CHANGE
- B) of banks.
- C) that banks provide.
- D) with those offered by banks.

2

2

There is a real need for an institution to fill this role in several parts of the United States because **27** people have increasingly been looking to switch from nationwide bank branches to smaller, independent banks. An average of more than 2,300 bank branches closed in the United States each year **28** in the time period between the years 2010 and 2013, leaving customers in many parts of the country living in “bank deserts,” areas

27

Which choice most effectively introduces a main claim of the paragraph?

- A) NO CHANGE
- B) many branches of nationwide banks have closed in recent years.
- C) people who relocate frequently want to do their banking at a familiar branch.
- D) the USPS is trying to increase its customer base.

28

- A) NO CHANGE
- B) in the period of time between
- C) for those years between
- D) between



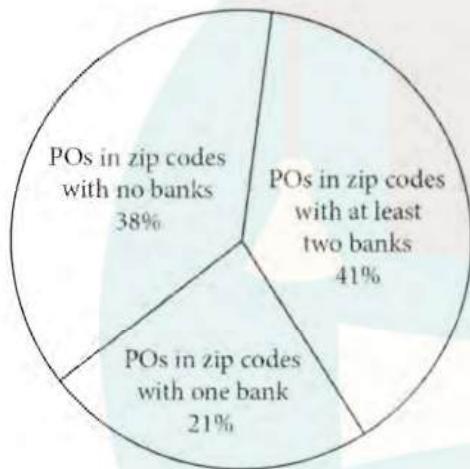
TestDaily

without local banks. The USPS is ideally suited to

**29** undertake this lack of access because many post offices—**30** more than half of them, in fact—are located in zip codes with fewer than two bank branches.

**31** Approximately 60 percent of post offices are located in zip codes with one or more banks.

Percent of Post Offices (POs) in Zip Codes Containing  
No Banks, One Bank, or At Least Two Banks  
(excludes post offices with unique zip codes)



Adapted from US Postal Service Office of Inspector General, "Providing Non-Bank Financial Services for the Underserved." Published in 2014.

**29**

- A) NO CHANGE
- B) answer
- C) address
- D) sanction

**30**

Which choice provides accurate information from the chart?

- A) NO CHANGE
- B) almost all of them, as it happens—
- C) roughly 40 percent of them—
- D) but, overall, only about 20 percent of them—

**31**

The writer wants to conclude the paragraph with accurate, relevant information from the chart that most effectively reinforces the point the writer is making. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Forty-one percent of post offices are located in zip codes with at least two bank branches.
- C) Post offices in zip codes with no banks actually outnumber post offices in zip codes with at least two banks.
- D) Thirty-eight percent of post offices are located in zip codes with no bank branches at all.

Although postal banking is effective in other

**32** countries, many post offices are located in regions where banks are critically needed, some critics of the proposal contend that post offices are ill equipped to act as banks. Postal banking would indeed significantly expand the range of the USPS's duties. **33** However, as Inspector General David C. Williams, notes, US post offices currently offer many similar products: "The post office already sells money orders, runs a huge cash retail business, sells insurance on parcels, and cashes Treasury checks." Even postal banking itself has a precedent in the United States: from 1911 to 1967, the Postal Savings System allowed people to hold savings accounts at their local post offices.

Offering financial services would represent a significant transformation of the USPS, but there is every reason to believe it would be a change for the better. With many citizens now living in bank deserts, offering such services would represent a significant investment in US communities.

32

- A) NO CHANGE
- B) countries and
- C) countries, however,
- D) countries—

33

- A) NO CHANGE
- B) However as Inspector General, David C. Williams, notes
- C) However as Inspector General David C. Williams, notes
- D) However, as Inspector General David C. Williams notes,

Question 34-44 are based on the following passage.

### Costume Curators in the Digital Age

Bridging art and popular culture, costume exhibits have enabled museums to attract media attention and new audiences. Such exhibits are created and overseen by costume **34** curators. The term "costume curators" refers to professionals who oversee the acquisition, maintenance, and display of clothing collections at museums. Costume curators must have a deep knowledge of their collections and must study the materials, construction, and historical significance of the pieces. Also, they must share this knowledge with the public in accessible and entertaining ways. In recent years, some curators have used new technologies such as modeling software and digital displays to study and exhibit their collections. This has allowed curators to bring costumes to life in ways that were **35** previously and formerly impossible.

34

Which choice most effectively combines the sentences at the underlined portion?

- A) curators; strictly speaking, they are
- B) curators—that is to say, "costume curators" are
- C) curators; these are
- D) curators,

35

- A) NO CHANGE
- B) previously
- C) at one point previously
- D) formerly in the past

TestDaily

One of the first costume exhibits to benefit **36** from these technological developments was the 2014 *Charles James: Beyond Fashion* show at the Metropolitan Museum of Art (Met). Early in their preparations, Met curators Harold Koda and Jan Glier Reeder drew on new technologies to **37** reach people who could not visit the exhibit in person. James, one of the most respected clothing designers of the twentieth century, created sculptural dresses using many layers of unconventional materials. The curators used X-rays and computer models to study the layers of mesh, feathers, cotton, and horsehair that **38** makes up James's "Clover Leaf" gown, which would be one of the centerpieces of their show.

Having come to a fuller understanding of James's work, **39** how to present it in the best way to museum visitors was what the curators had to determine. James's

**36**

- A) NO CHANGE
- B) in
- C) off of
- D) DELETE the underlined portion.

**37**

Which choice best sets up the discussion of Koda and Reeder's work that follows in the paragraph?

- A) NO CHANGE
- B) push the boundaries of the creative display of costumes.
- C) achieve a better understanding of James's clothing.
- D) adapt the exhibition space to the digital age.

**38**

- A) NO CHANGE
- B) make
- C) will make
- D) would make

**39**

- A) NO CHANGE
- B) museum visitors would have it presented to them in the best way the curators could determine.
- C) the curators had to determine the best way to present it to museum visitors.
- D) it had to be presented to museum visitors in the best way the curators could determine.

dresses presented the curators with one of their most common professional challenges: **40** marketing the exhibit to increase museum admissions. Clothing in museums would quickly fall apart if it were handled frequently, but traditional displays of costumes on mannequins make it difficult for visitors to **41** see how a piece is constructed. Koda and Reeder solved this dilemma by designing computer animations that showed visitors the separate pieces that make up dresses such as the "Clover Leaf" gown, the way these pieces fit together, and the ways the finished dresses fit when they are worn. By doing so, the curators could give museumgoers a sense of their own excitement at being able to see inside James's designs. **42**

**40**

Which choice best introduces the discussion that follows in the paragraph?

- A) NO CHANGE
- B) keeping the exhibit in line with the designers original vision.
- C) securing enough funding to maintain the clothing.
- D) displaying fragile pieces to the public.

**41**

- A) NO CHANGE
- B) see how is a piece constructed.
- C) see: how is a piece constructed?
- D) see, in what way is a piece constructed?

**42**

At this point, the writer is considering adding the following sentence.

Also featured in the show was James's "Taxi" wrap dress, which stands in contrast to the "Clover Leaf" gown due to its simple design and the ease with which it can be put on.

Should the writer make this addition here?

- A) Yes, because it offers a second example of the pieces in the exhibit.
- B) Yes, because it provides an effective transition to the next paragraph.
- C) No, because it would be better placed elsewhere in the passage.
- D) No, because it is not related to the paragraph's focus on the curators' methods.

2

2

According to Valerie Steele, chief curator of the Museum at the Fashion Institute of Technology, a costume curator's **43** job is to, "tell the story of the meaning of the clothes." New technologies have allowed costume curators to tell their stories in more compelling ways, **44** and other exhibit teams at the Met would do well to imitate the costume curators' approach.

43

- A) NO CHANGE
- B) job is; to
- C) job, is to
- D) job is to

44

The writer wants a conclusion that supports the main discussion of the passage. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) but given the rapid evolution of technology in the twenty-first century, the use of digital technologies in costume curatorship has hardly reached its apex.
- C) making clothing exhibitions such as *Charles James: Beyond Fashion* some of the most popular and exciting museum shows in recent memory.
- D) and they have opened up the possibilities for showcasing Charles James's unique vision through other artistic media.



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# STOP

If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.

3



3

# Math Test – No Calculator

**25 MINUTES, 20 QUESTIONS**

Turn to Section 3 of your answer sheet to answer the questions in this section.

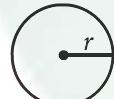
## DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

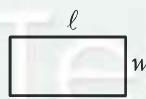
## NOTES

1. The use of a calculator is **not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

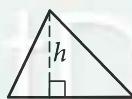
## REFERENCE



$$\begin{aligned} A &= \pi r^2 \\ C &= 2\pi r \end{aligned}$$



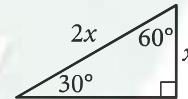
$$A = \ell w$$



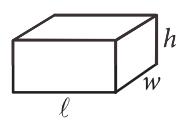
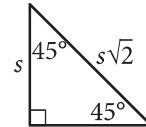
$$A = \frac{1}{2}bh$$



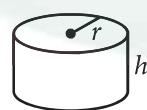
$$c^2 = a^2 + b^2$$



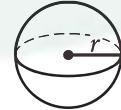
Special Right Triangles



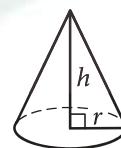
$$V = \ell wh$$



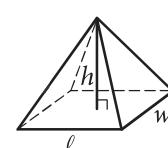
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.

3



3

1

$$ax = 5$$

In the equation above,  $a$  is a constant. For which of the following values of  $a$  will the equation have no solution?

- A) 0
- B) 1
- C) 5
- D) 10

2

If  $3(3x + 5) = 2x - 8$ , what is the value of  $x$ ?

- A)  $-\frac{23}{7}$
- B)  $-\frac{15}{7}$
- C)  $-\frac{13}{7}$
- D)  $\frac{7}{11}$

3

$x$	$h(x)$
2	1
4	7
6	13
8	19

For the linear function  $h$ , the table above shows several values of  $x$  and their corresponding values of  $h(x)$ . Which of the following defines  $h$ ?

- A)  $h(x) = 2x - 3$
- B)  $h(x) = 3x - 5$
- C)  $h(x) = 4x - 7$
- D)  $h(x) = 4x - 9$

4

Terrence's car contains 8 gallons of fuel. He plans to drive the car  $m$  miles using the fuel currently in the car. If the car can drive 20 miles per gallon of fuel, which inequality gives the possible values of  $m$ ?

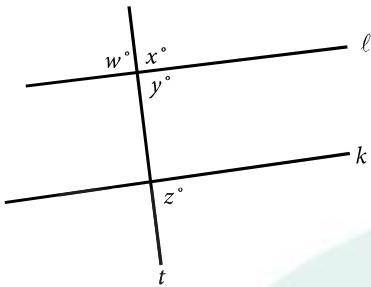
- A)  $m \leq (8)(20)$
- B)  $m \geq (8)(20)$
- C)  $8 \leq 20m$
- D)  $8 \geq 20m$

3



3

5



Note: Figure not drawn to scale.

In the figure above, line  $t$  intersects lines  $\ell$  and  $k$ . Which of the following statements, if true, would imply that lines  $\ell$  and  $k$  are parallel?

- A)  $w = y$
- B)  $w = z$
- C)  $x = z$
- D)  $x + y = 180$

6

Blood volume,  $V_B$ , in a human can be determined

using the equation  $V_B = \frac{V_p}{1-H}$ , where  $V_p$  is the

plasma volume and  $H$  is the hematocrit (the fraction of blood volume that is red blood cells). Which of the following correctly expresses the hematocrit in terms of the blood volume and the plasma volume?

- A)  $H = 1 - \frac{V_p}{V_B}$
- B)  $H = \frac{V_B}{V_p}$
- C)  $H = 1 + \frac{V_B}{V_p}$
- D)  $H = V_B - V_p$

7

$$\frac{2(x+1)}{x+5} = 1 - \frac{1}{x+5}$$

What is the solution to the equation above?

- A) 0
- B) 2
- C) 3
- D) 5

3



3

8

$$2x^2 - 2 = 2x + 3$$

Which of the following is a solution to the equation above?

- A) 2
- B)  $1 - \sqrt{11}$
- C)  $\frac{1}{2} + \sqrt{11}$
- D)  $\frac{1 + \sqrt{11}}{2}$

9

$$2x^3 + 11x^2 + 5x$$

Which of the following is NOT a factor of the polynomial above?

- A)  $x$
- B)  $x + 5$
- C)  $2x + 1$
- D)  $2x + 5$

10

The graph in the  $xy$ -plane of the linear function  $f$  contains the point  $(3, 4)$ . For every increase of 5 units in  $x$ ,  $f(x)$  increases by 3 units. Which of the following equations defines the function?

- A)  $f(x) = -\frac{5}{3}x + 9$
- B)  $f(x) = -\frac{3}{5}x + \frac{29}{5}$
- C)  $f(x) = \frac{3}{5}x + \frac{11}{5}$
- D)  $f(x) = \frac{5}{3}x - 1$

3



3

11

$x$	$p(x)$
-2	5
-1	0
0	-3
1	-1
2	0

The table above gives selected values of a polynomial function  $p$ . Based on the values in the table, which of the following must be a factor of  $p$ ?

- A)  $(x - 3)$
- B)  $(x + 3)$
- C)  $(x - 1)(x + 2)$
- D)  $(x + 1)(x - 2)$

12

$$g(x) = 2^x - 2$$

The function  $g$  is defined by the equation above. Which of the following points in the  $xy$ -plane is an  $x$ -intercept of the graph of the equation  $y = g(x)$ ?

- A)  $(-1, g(-1))$
- B)  $(0, g(0))$
- C)  $(1, g(1))$
- D)  $(2, g(2))$

3

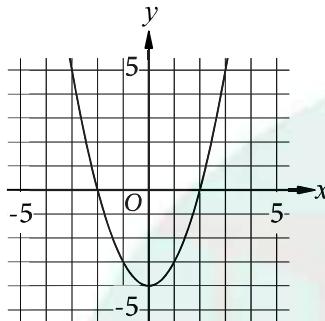
3

13

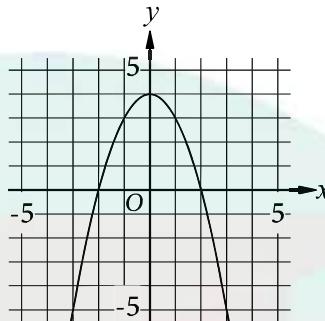
$$y = -x^2 + 4x$$

Which of the following is the graph in the  $xy$ -plane of the given equation?

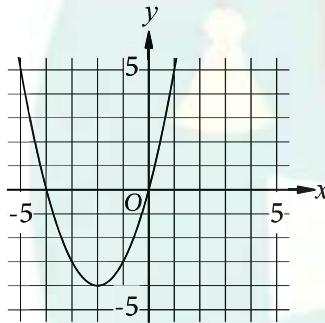
A)



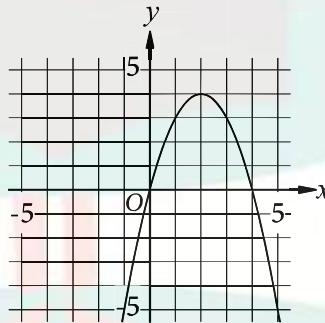
B)



C)



D)



14

$$i^2 + (-i)^2$$

In the complex number system, what is the value of the given expression? (Note:  $i = \sqrt{-1}$ )

- A) -2
- B) 0
- C) 2
- D)  $2i$

15

The dimensions of a right rectangular prism are 4 inches by 5 inches by 6 inches. What is the surface area, in square inches, of the prism?

- A) 30
- B) 74
- C) 120
- D) 148

3



3

**DIRECTIONS**

For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $\frac{7}{2}$ . (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write →  
in boxes.

Grid in  
result.

Answer:  $\frac{7}{12}$

7	/	1	2
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Fraction  
line

Answer: 2.5

2	.	5
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Decimal  
point

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8

.	6	6	6
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8

.	6	6	7
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8

Answer: 201 – either position is correct

2	0	1
0	0	0
1	1	1
2	2	2

2	0	1
0	0	0
1	1	1
2	2	2

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

3



3

16

$$\begin{aligned}3x + y &= 29 \\x &= 2\end{aligned}$$

If  $(x, y)$  is the solution to the given system of equations, what is the value of  $y$ ?

18

$$h(t) = -16t^2 + 48t + 72$$

If air resistance is ignored, the function  $h$  defined above models the height above ground, in feet, of a toy rocket  $t$  seconds after it is launched from the roof of building. Based on the model, what is the height above ground, in feet, of the toy rocket 1 second after launch?

17

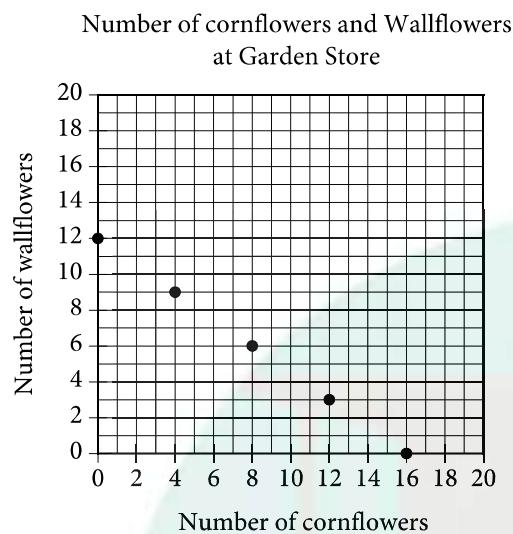
A pizza parlor sells pizza slices for \$3 each and calzones for \$4 each. A group of friends spent \$51 on pizza slices and calzones at the parlor. If they bought 6 calzones, how many pizza slices did they buy?

3



3

19



The points plotted in the coordinate plane above represent the possible numbers of wallflowers and cornflowers that someone can buy at the Garden the Store in order to spend exactly \$24.00 total on the two types of flowers. The price of each wallflower is the same and the price of each cornflower is the same. What is the price, in dollars, of 1 cornflower?  
 (Disregard the \$ sign when gridding your answer.  
 For example, if your answer is \$9.87, grid 9.87)

20

If  $\frac{\sqrt{x^5}}{\sqrt[3]{x^4}} = x^{\frac{a}{b}}$  for all positive values of  $x$ , what is the value of  $\frac{a}{b}$ ?

TestDaily

**STOP**

**If you finish before time is called, you may check your work on this section only.**  
**Do not turn to any other section.**



No Test Material On This Page

TestDaily

4



4

# Math Test – Calculator

**55 MINUTES, 38 QUESTIONS**

Turn to Section 4 of your answer sheet to answer the questions in this section.

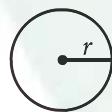
## DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

1. The use of a calculator is permitted.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

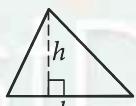


$$A = \pi r^2$$

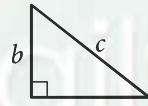
$$C = 2\pi r$$



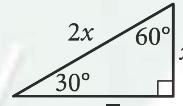
$$A = lw$$



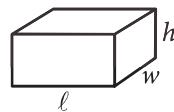
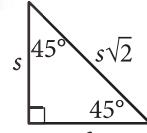
$$A = \frac{1}{2}bh$$



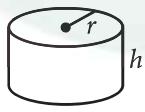
$$c^2 = a^2 + b^2$$



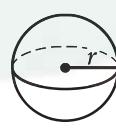
Special Right Triangles



$$V = lwh$$



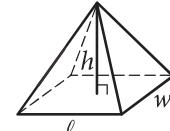
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



4

4

1

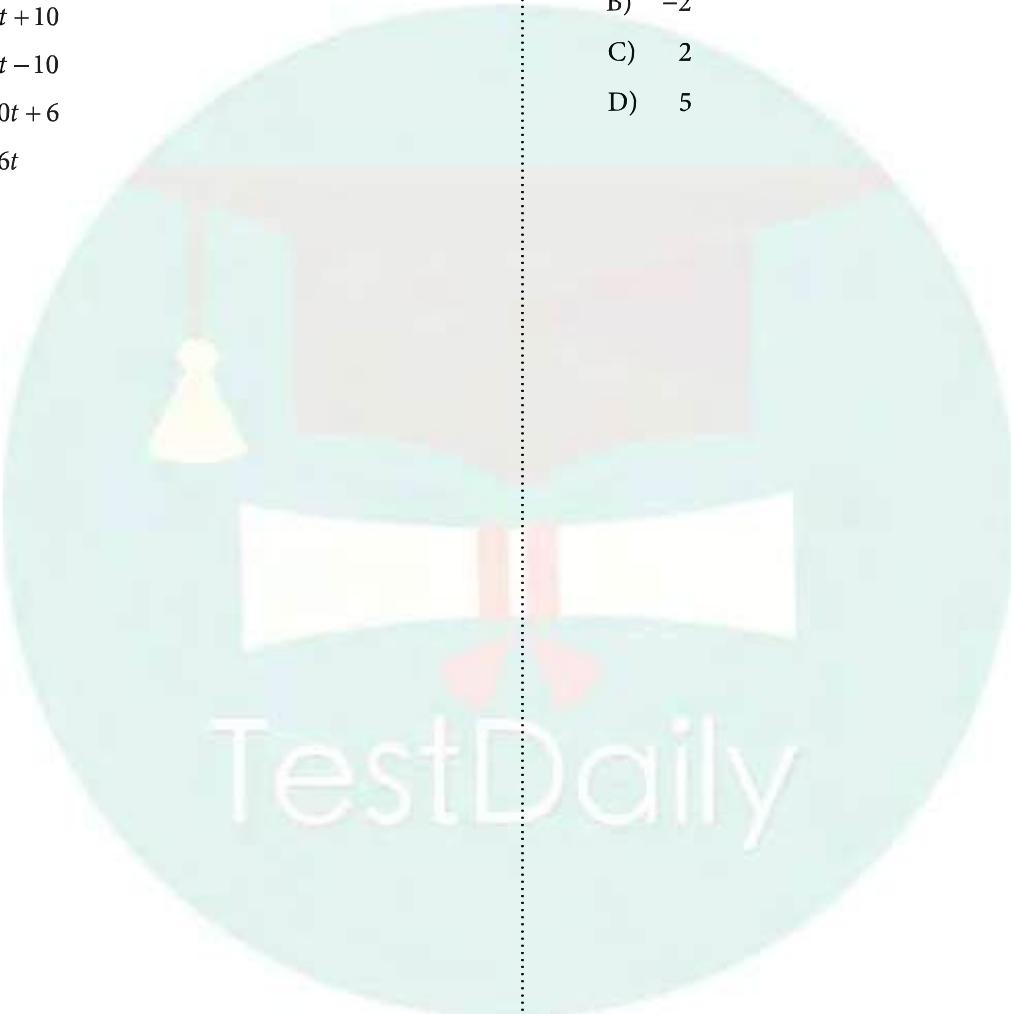
A care-sharing service charges \$6 per hour to rent a car plus a \$10 fee for insurance. Which of the following gives the total cost  $c$ , in dollars, of a rental that lasts  $t$  hours?

- A)  $c = 6t + 10$
- B)  $c = 6t - 10$
- C)  $c = 10t + 6$
- D)  $c = 16t$

2

If  $y = x^2 + ax + a$ , where  $a$  is a constant, and  $y = 11$  when  $x = 1$ , what is the value of  $a$ ?

- A) -5
- B) -2
- C) 2
- D) 5

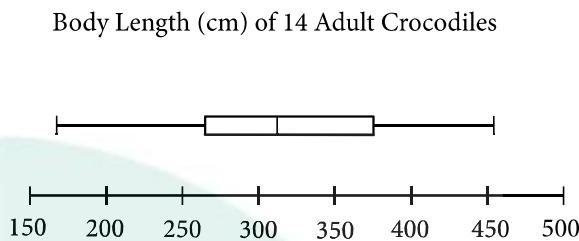
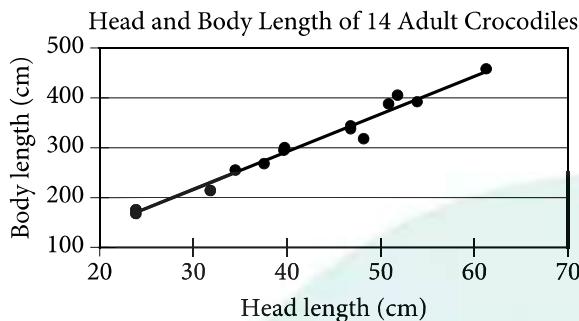
A large circular watermark in the center of the page features the words "TestDaily" in a white, sans-serif font. Above the text, there is a stylized illustration of a graduation cap (mortarboard) with a tassel on the left, and two diplomas or certificates tied with red ribbons on the right.



4

4

Questions 3–5 refer to the following information.



The scatterplot above represents the head lengths, in centimeters (cm), and body lengths, in cm, of 14 adult crocodiles. The line of best fit for the data is also shown. The box plot above summarizes the body lengths of the 14 crocodiles.

3

For an adult crocodile with a head length of 30 cm, which of the following is closest to the body length, in cm, predicted by the line of best fit?

- A) 180
- B) 215
- C) 250
- D) 275

5

Based on the box plot, of the following, which is the best estimate of the median body length, in cm, of the 14 adult crocodiles?

- A) 260
- B) 300
- C) 320
- D) 370

4

Based on the line of best fit, of the following, which is the best estimate of the increase in predicted body length, in cm, for every 10 cm increase in head length?

- A) 25
- B) 75
- C) 125
- D) 150



4

4

6

If  $5x - 7 = 13$ , what is the value of  $10x - 14$ ?

- A) 4
- B) 8
- C) 26
- D) 65

7

$x$	$y$
1	4
3	12
5	20
40	$k$

In the table above, the ratio of  $y$  to  $x$  for each ordered pair is constant. What is the value of  $k$ ?

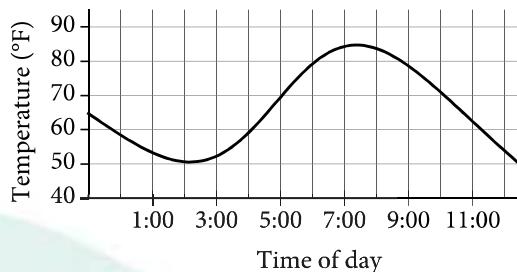
- A) 28
- B) 36
- C) 80
- D) 160

8

Which of the following expressions is equivalent to  $2a^2(a + 3)$ ?

- A)  $5a^3$
- B)  $8a^5$
- C)  $2a^3 + 3$
- D)  $2a^3 + 6a^2$

9



The graph above shows the temperature in a room during a day when the thermostat malfunctioned. For which of the following two-hour periods was the difference between the maximum and minimum temperatures greatest?

- A) 1:00 to 3:00
- B) 3:00 to 5:00
- C) 5:00 to 7:00
- D) 7:00 to 9:00

10

$$P(t) = 250 + 10t$$

The population of snow leopards in a certain area can be modeled by the function  $P$  defined above, where  $P(t)$  is the population  $t$  years after 1990. Of the following, which is the best interpretation of the equation  $P(30) = 550$ ?

- A) The snow leopard population in this area is predicted to be 30 in the year 2020.
- B) The snow leopard population in this area is predicted to be 30 in the year 2030.
- C) The snow leopard population in this area is predicted to be 550 in the year 2020.
- D) The snow leopard population in this area is predicted to be 550 in the year 2030.



4

4

11

In the  $xy$ -plane, which of the following changes to the graph of the equation  $y = x^2 + 3$  will result in the graph of the equation  $y = (x^2 + 3) - 6$ ?

- A) A shift 6 units to the left
- B) A shift 6 units to the right
- C) A shift 6 units upward
- D) A shift 6 units downward

12

Tanya earns \$13.50 per hour at her part-time job. When she works  $z$  hours, she earns  $13.50z$  dollars. Which of the following expression gives the amount, in dollars, Tanya will earn if she works  $3z$  hours?

- A)  $3(13.50z)$
- B)  $3 + 13.50z$
- C)  $3z + 13.50z$
- D)  $13.50(z + 3)$

13

United States Presidents from 1789 to 2015

Ages	Number
40–44	2
45–49	7
50–54	13
55–59	11
60–64	7
65–69	2

The table above gives the number of United States presidents from 1789 to 2015 whose age at the time they first took office is within the interval listed. Of those presidents who were at least 50 years old when they first took office, what fraction were at least 60 years old?

- A)  $\frac{10}{43}$
- B)  $\frac{10}{34}$
- C)  $\frac{10}{24}$
- D)  $\frac{25}{34}$



4

4

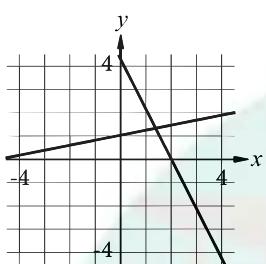
14

$$x + 5y = 5$$

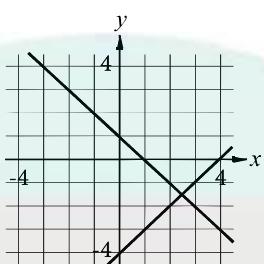
$$2x - y = -4$$

Which of the following graphs in the  $xy$ -plane could be used to solve the system of equations above?

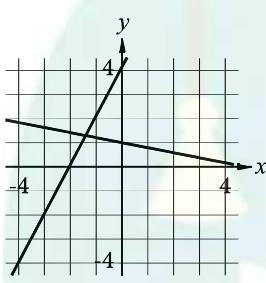
A)



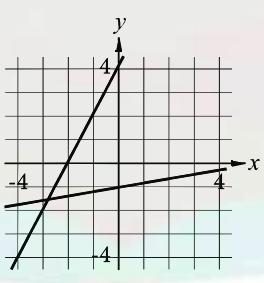
B)



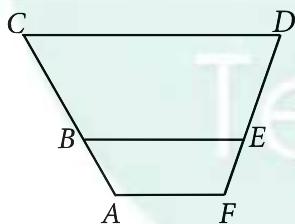
C)



D)



15



In the figure above,  $\overline{AF}$ ,  $\overline{BE}$ , and  $\overline{CD}$  are parallel. Points  $B$  and  $E$  lie on  $\overline{AC}$  and  $\overline{FD}$ , respectively. If  $AB=9$ ,  $BC=18.5$ , and  $FE=8.5$ , what is the length of  $\overline{ED}$ , to the nearest tenth?

- A) 16.8
- B) 17.5
- C) 18.4
- D) 19.6



4

4

**Questions 16 and 17 refer to the following information.**

Club Participation in the 2014–2015 School Year

Class	Drama	Robotics	Chess	Band	Total
Juniors	21	15	10	18	64
Seniors	27	20	21	17	85
Total	48	35	31	35	149

Of all juniors and seniors who attended a particular high school during the 2014–2015 school year, 149 participated in the clubs listed in the table above. Each of the 149 students participated in only one of the four school clubs listed. The table shows the distribution of the 149 students by class and club participation.

16

The band was composed of freshmen, sophomores, juniors, and seniors. If 30% of the students in the band were juniors, how many students were in the band?

- A) 49
- B) 54
- C) 56
- D) 60

17

Of the number of juniors and seniors in the drama club, the 25% who walked to school represents  $\frac{1}{8}$  of the total number of juniors and seniors who walked to school. How many juniors and seniors walked to school?

- A) 96
- B) 60
- C) 24
- D) 12



4

4

18

A bag containing 10,000 beads of assorted colors is purchased from a craft store. To estimate the percent of red beads in the bag, a sample of beads is selected at random. The percent of red beads in the bag was estimated to be 15%, with an associated margin of error of 2%. If  $r$  is the actual number of red beads in the bag, which of the following is most plausible?

- A)  $r > 1,700$
- B)  $1,300 < r < 1,700$
- C)  $200 < r < 1,500$
- D)  $r < 1,300$

19

$x$	$f(x)$
0	$c$
1	$2c$
2	$3c$

For the linear function  $f$ , the table above gives some values of  $x$  and their corresponding values  $f(x)$ , where  $c$  is a constant. Which of the following equations defines  $f$ ?

- A)  $f(x) = x + c$
- B)  $f(x) = x + 3c$
- C)  $f(x) = cx + c$
- D)  $f(x) = 3cx + 3c$

20

$$\frac{1}{x^2 + 10x + 25} = 4$$

If  $x$  is a solution to the given equation, which of the following is a possible value of  $x + 5$ ?

- A)  $\frac{1}{2}$
- B)  $\frac{5}{2}$
- C)  $\frac{9}{2}$
- D)  $\frac{11}{2}$



4

4

21

The graph of a line in the  $xy$ -plane has a positive slope and intersects the  $y$ -axis at a point that has a negative  $y$ -coordinate. Which of the following could be an equation of the line?

- A)  $-3x + 2y = -5$
- B)  $-3x + 2y = 5$
- C)  $3x + 2y = -5$
- D)  $3x + 2y = 5$

22

$$f(x) = -500x^2 + 25,000x$$

The revenue  $f(x)$ , in dollars, that a company receives from sales of a product is given by the function  $f$  above, where  $x$  is the unit price, in dollars, of the product. The graph of  $y = f(x)$  in the  $xy$ -plane intersects the  $x$ -axis at 0 and  $a$ . What does  $a$  represent?

- A) The revenue, in dollars, when the unit price of the product is \$0
- B) The unit price, in dollars, of the product that will result in maximum revenue
- C) The unit price, in dollars, of the product that will result in a revenue of \$0
- D) The maximum revenue, in dollars, that the company can make

23

The graph of the equation  $ax + ky = 6$  is a line in the  $xy$ -plane, where  $a$  and  $k$  are constants. If the line contains the points  $(-2, -6)$  and  $(0, -3)$ , what is the value of  $k$ ?

- A) -2
- B) -1
- C) 2
- D) 3

24

From 2005 through 2014, the number music CDs sold in the United States declined each year by approximately 15% of the number sold the preceding year. In 2005, approximately 600 million CDs were sold in the United States. Of the following, which best models  $C$ , the number of millions of CDs sold in the United States,  $t$  years after 2005?

- A)  $C = 600(0.15)^t$
- B)  $C = 600(0.85)^t$
- C)  $C = 600(1.15)^t$
- D)  $C = 600(1.85)^t$



4

4

25

$$g(t) = -0.34(t - 5.51)^2 + 8.26$$

The function  $g$  above models the growth rate of a certain plant, in millimeters per day (mm/day), in terms of the watering time  $t$ , in minutes per day (min/day). What is the meaning of  $(5.51, g(5.51))$  in this context?

- A) The watering time of 5.51 min/day results in a plant growth rate of  $g(5.51)$  mm/day.
- B) The plant growth rate of 5.51 mm/day results in a watering time of  $g(5.51)$  min/day.
- C) The watering time increases by  $g(5.51)$  min/day for every 5.51 mm/day increase in growth rate.
- D) The growth rate increases by  $g(5.51)$  mm/day for every 5.51 min/day increase in watering time.

26

A psychologist designed and conducted a study to determine whether playing a certain educational game increases middle school students' accuracy in adding fractions. For the study, the psychologist chose a random sample of 35 students from all of the students at one of the middle schools in a large city. The psychologist found that students who played the game showed significant improvement in accuracy when adding fractions. What is the largest group to which the results of the study can be generalized?

- A) The 35 students in the sample
- B) All students at the school
- C) All middle school students in the city
- D) All students in the city

27

A manufacturer determined that right cylindrical containers with a height that is 4 inches longer than the radius offer the optimal number of containers to be displayed on a shelf. Which of the following expresses the volume,  $V$ , in cubic inches, of such containers, where  $r$  is the radius, in inches?

- A)  $V = 4\pi r^3$
- B)  $V = \pi(2r)^3$
- C)  $V = \pi r^2 + 4\pi r$
- D)  $V = \pi r^3 + 4\pi r^2$

28

For the function  $f$ , if  $f(3x) = x - 6$  for all values of  $x$ , what is the value of  $f(6)$ ?

- A) -6
- B) -4
- C) 0
- D) 2



4

4

29

In the system of equation below,  $a$  and  $c$  are constant.

$$\begin{aligned}\frac{1}{2}x + \frac{1}{3}y &= \frac{1}{6} \\ ax + y &= 6\end{aligned}$$

If the system of equation has an infinite number of solutions  $(x, y)$ , what is the value of  $a$ ?

- A)  $-\frac{1}{2}$
- B) 0
- C)  $\frac{1}{2}$
- D)  $\frac{3}{2}$

30

A researcher surveyed 200 adults selected at random from the city of Aldley and 300 adults selected at random from the suburbs of Aldley. Each person surveyed was asked whether he or she owns a car. Some of the results are shown in the partially completed table below.

	Owns car	Does not own car	Total
City of Aldley	80	120	200
Suburbs of Aldley	$x$	$y$	300

The researcher found that an adult surveyed in the suburbs of Aldley is twice as likely to own a car as an adult surveyed in the city of Aldley. Of the following, which could be the value of  $x$ ?

- A) 120
- B) 160
- C) 210
- D) 240

4



4

**DIRECTIONS**

**For questions 31–38,** solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write →  
answer  
in boxes.

Grid in  
result.

Answer:  $\frac{7}{12}$

Fraction  
line

7	/	1	2
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 2.5

Decimal  
point

2	.	5
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

.	6	6	6
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

2	0	1
0	0	0
1	1	1
2	2	2
3	3	3

2	0	1
0	0	0
1	1	1
2	2	2
3	3	3

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



4

4

31

Pure beeswax has a density of 0.555 ounce per cubic inch. An online company sells pure beeswax at a price of \$8.00 per ounce. What is the selling price, in dollars per cubic inch, for pure beeswax purchased from this company? (Disregard the \$ sign when gridding your answer. For example, if your answer is \$1.37, grid 1.37)

32

2, 10, 3, 7, 6

The mean of the list of numbers above is what fraction of the sum of the five numbers?

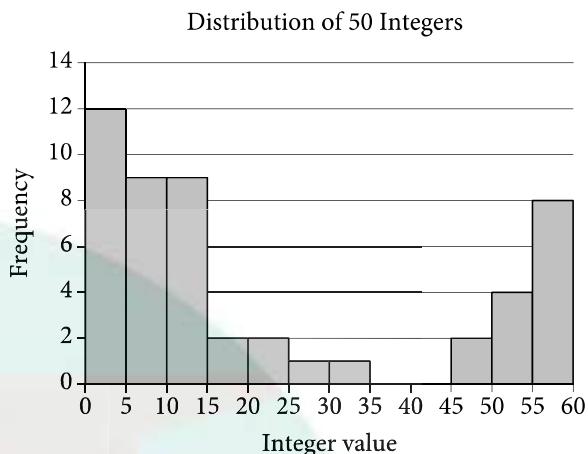
33

The equation  $(x + 6)^2 + (y + 3)^2 = 121$  defines a circle in the  $xy$ -plane. What is the radius of the circle?

34

A baker is gathering the ingredients required to make 15 batches of oatmeal cookies and 1 cake. The cake will require one-quarter bag of flour. The baker needs a total of more than 3 but less than 4 bags of flour. What is one possible value for the fraction of one bag of flour required for each batch of cookies?

35



The histogram summarizes the distribution of a data set composed of 50 integers. The first bar represents the number of integers that are at least 0 but less than 5. The second bar represents the number of integers that are at least 5 but less than 10, and so on. What is a possible value of the median of the data set?

36

$$K = \frac{200v^2}{2}$$

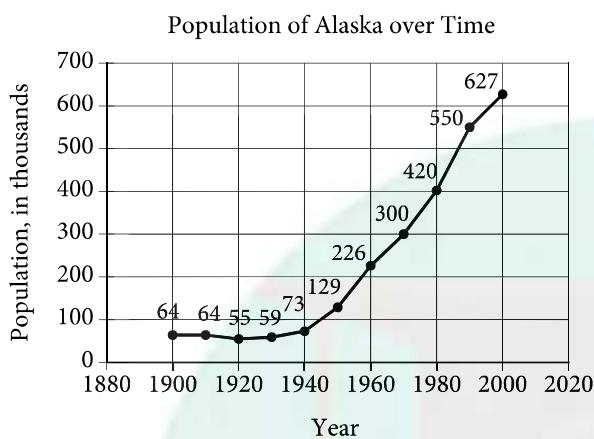
In the equation above, the kinetic energy,  $K$ , of a 200-gram object is given in terms of its speed,  $v$ . If the equation is rewritten in the form  $v = a\sqrt{K}$ , where  $a$  is a positive constant, what is the value of  $a$ ?



4

4

**Questions 37 and 38 refer to the following information.**



The line graph above shows the population, in thousands, of people living in Alaska every 10 years from 1900 to 2000.

37

What was the population of Alaska, in thousands, in 1990?

38

The ratio of the population of Alaska in 1980 to the population of Alaska in 1970 can be written as  $a : 1$ . What is the value of  $a$ ?

**STOP**

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**

# Writing and Language Test

35 MINUTES, 44 QUESTIONS

Turn to Section 2 of your answer sheet to answer the questions in this section.

## DIRECTIONS

Each passage below is accompanied by a number of questions. For some questions, you will consider how the passage might be revised to improve the expression of ideas. For other questions, you will consider how the passage might be edited to correct errors in sentence structure, usage, or punctuation. A passage or a question may be accompanied by one or more graphics (such as a table or graph) that you will consider as you make revising and editing decisions.

Some questions will direct you to an underlined portion of a passage. Other questions will direct you to a location in a passage or ask you to think about the passage as a whole.

After reading each passage, choose the answer to each question that most effectively improves the quality of writing in the passage or that makes the passage conform to the conventions of standard written English. Many questions include a "NO CHANGE" option. Choose that option if you think the best choice is to leave the relevant portion of the passage as it is.

Questions 1-11 are based on the following passage.

### Movable books: The precursors to Pop-Ups

Toward the end of the Middle Ages, Europe saw the advent of numerous inventions that revolutionized the technology of the day. As early as the fifteenth century, books were designed with ingenious devices that allowed a reader to discover more on a page than what

1

Which choice most clearly introduces the main topic of the passage?

- A) NO CHANGE
- B) Throughout the ages, artists have expressed themselves through various types of media.
- C) Bookmakers have long imagined ways to challenge the concept of books as static objects.
- D) Books have seemingly endless interpretations that vary from reader to reader.

first met the eye. Some pages contained flaps that could be peeled back to reveal hidden

2 illustrations, others incorporated discs that rotated, showing information through windows cut into the page. At the height of their popularity, books with moving pieces contained elements such as tabs that linked dynamic parts on a page, interconnected slats of paper that morphed one illustration into another as they were pulled, and 3 illustrations indicative of skilled artisanship.

2

- A) NO CHANGE
- B) illustrations, while others
- C) illustrations others
- D) illustrations with others

3

Which choice gives a supporting example that is most similar to the two examples already in the sentence?

- A) NO CHANGE
- B) elaborate foldout displays
- C) themes that appealed to children
- D) clever poetry alongside the illustrations

## | 2

One of the early masters of the movable book **4** were German artist and illustrator Lothar Meggendorfer (1847-1925). Meggendorfer invented a way of connecting individual pieces of an illustration with tiny hidden rivets and springs so they could all be moved together. **5** For example, when a reader pulls one tab in Meggendorfer's book *Always Jolly*, a **6** naturalists' arm swings a butterfly net downward just as the butterfly takes off from a **7** flower. This causes the would-be lepidopterist's mouth to drop open and his eyes to look up in dismay.

## 2 |

4

- A) NO CHANGE
- B) was
- C) are
- D) has been

5

At this point, the writer is considering adding the following sentence

Printing techniques similar to those used for the illustrations in movable books were used by late-nineteenth-century European textile artisans to produce printed fabrics.

Should the writer make this addition here?

- A) Yes, because it sets up the example of the butterfly net in the next sentence.
- B) Yes, because it provides an additional example of the hidden parts in movable books.
- C) No, because it diverges from the paragraph's focus on Meggendorfer's books.
- D) No, because it contradicts a description of pop-up books earlier in the passage

6

- A) NO CHANGE
- B) naturalists' arm swing's
- C) naturalists arm swings
- D) naturalist' s arm swings

7

Which choice most effectively combines the sentences at the underlined portion?

- A) flower, causing
- B) flower; it causes
- C) flower, something that causes
- D) flower; as a result, this causes

The book starts with a warning to children to be gentle when pulling the tabs because they are made of only paper: “And therefore, I advise, / That care and caution should be paid, / Lest woe and grief arise.” The rest of the book consists of eight poems **8** in agreement with eight movable figures, including a lion who reiterates the warning to handle the book carefully. With his mouth opening and closing, displaying his **9** fangs. The line assures any children reading the book that he intends them no harm; rather, it is the reader who “May tear the Lion in your play, / By being rough to him one day.”

Movable books were works of art, made largely by hand and assembled from specialized materials by skilled artisans. Meggendorfer created a model of each book in its entirety. Once he was satisfied with the arrangement of the moving pieces and other details, he **10** is providing the artisans with elaborately detailed instructions for how to assemble each page. The illustrations were produced through a refined printing process that resulted in beautiful colors and great detail; however, the labor-intensive production kept the price of the books too high for any but the wealthiest patrons. Fortunately, these incredible feats of engineering and artistry can still be seen—moving—in videos on the Internet. **11** The Internet is an excellent tool for learning about and sharing important feats from history.

8

- A) NO CHANGE
- B) instantaneous with
- C) accompanied by
- D) in step with

9

- A) NO CHANGE
- B) fangs, the
- C) fangs; the
- D) fangs—the

10

- A) NO CHANGE
- B) had provided
- C) provided
- D) provides

11

Which choice provides the most effective conclusion to the paragraph and the passage as a whole?

- A) NO CHANGE
- B) Much historical footage, such as the 1969 Moon landing, is also preserved on the Internet.
- C) Through modern technology, the ingenuity of an inventor who used almost nothing but paper and imagination has been preserved.
- D) Modern engineers continue to draw inspiration from Meggendorfer’s movable books.

Questions 12-22 are based on the following passage.

#### Monopolizing “The Landlord’s Game”

Monopoly is one of the best known board games in the world, having been licensed in at least 114 countries and produced in more than 47 languages since its introduction by Parker Brothers in 1935. Monopoly players use colorful play **12** money, to buy and develop properties on a game board. Other players who land on the properties are charged rent, **13** uplifting the property owner, who can then buy and develop more properties. **14** Initially, one player bankrupts all the others and wins the game. By rewarding players who are successful in **15** taking money from the other players and using that money to make even more, Monopoly seems to celebrate the cutthroat, winner-take-all competition that many associate with modern capitalism. However, Elizabeth Magie, the creator of the game on which Monopoly was based, **16** wanted to change the world.

12

- A) NO CHANGE
- B) money to buy and develop properties
- C) money to buy and develop properties,
- D) money, to buy and develop properties,

13

- A) NO CHANGE
- B) glorifying
- C) improving
- D) enriching

14

- A) NO CHANGE
- B) Meanwhile,
- C) Moreover,
- D) Eventually,

15

- Which choice best sets up the claim that is made later in the sentence?
- A) NO CHANGE
  - B) acquiring both of the game’s “Get Out of Jail Free” cards and using them strategically,
  - C) rolling “doubles” and moving around the board rapidly,
  - D) avoiding the other players’ developed properties and landing on the underdeveloped ones.

16

- Which choice provides the most logical transition from the information in this paragraph to the description of Magie in the next paragraph?
- A) NO CHANGE
  - B) had something very different in mind.
  - C) espoused certain beliefs about capitalism.
  - D) shared her game with friends and acquaintances.

Magie was a follower of Henry George, an economist who taught that private ownership of resources common to all, such as land, is both unjust and detrimental: such a system enables a lucky few (the landlords) to prosper, while all others (the tenants) are exploited and impoverished. The purpose of “The landlord’s Game,” which Magie patented in 1904, was to spread George’s ideas: as she explained, the game was a “practical demonstration of the present system of land-grabbing with all its usual outcomes and consequences.” Although George and Magie were dismissed by many as anticapitalist radicals,<sup>17</sup> however a look at the history of Monopoly suggests that she may have had a point—one that still resonates today.

17

- A) NO CHANGE
- B) but
- C) nonetheless
- D) DELETE the portion

In addition to the “winner-take-all” concept familiar to Monopoly players, Magie’s original game featured a second set of rules allowing players to share the 18 game’s property’s, bringing equal benefits to all.

19 Players also created alternate versions of the game, modifying game boards to suit their own interests. But all this variety came to an end in the 1930s. An unemployed salesman named Charles 20 Darrow sensed a moneymaking opportunity, designing a game board of his own, penned a single set of standard rules, and enlisted the help of a printer to have boards made quickly. In 1935 Parker Brothers purchased the rights to Darrow’s Monopoly and paid off the holders of patents

18

- A) NO CHANGE
- B) game’s properties
- C) games’ properties
- D) games property’s

19

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

- A) Kept, because it provides an additional example of the variety associated with the game.
- B) Kept, because it supports a claim about Magie made in a previous sentence.
- C) Deleted, because it repeats information about the game’s history from earlier in the passage.
- D) Deleted, because it distracts from the paragraph’s focus on the standardization of the game.

20

- A) NO CHANGE
- B) Darrow, sensing a moneymaking opportunity, designed a game board of his own, penned
- C) Darrow, sensing a moneymaking opportunity, designed a game board of his own, penning
- D) Darrow, sensing a moneymaking opportunity, designed a game board of his own, penned

**| 2**

for any similar games. The deal made millions for Parker Brothers and Darrow and about \$500 for **21** Magie effectively illustrating the very point her game was attempting to teach. It is a lesson worth reflecting on as the global economy continues to produce **22** ridiculous remuneration for a few, and for most everyone else, the “usual outcomes and consequences.”

**2 |****21**

- A) NO CHANGE
- B) Magie–effectively
- C) Magie; effectively
- D) Magie. Effectively

**22**

- A) NO CHANGE
- B) big money
- C) great wealth
- D) stacks of cash

Questions 23-33 are based on the following passage and supplementary material.

### Insulation Work Is Heating Up

The goal of reducing energy costs has brought fresh attention to a feature of buildings that usually goes unseen: insulation, the layer of material inside **23** walls; under floors and around pipes that helps prevent heat loss. According to the Environmental Protection Agency, updating a building's insulation and adjusting the amount used can lower energy costs by about 15 percent. Homeowners, business owners, and **24** in municipalities they are not only upgrading the insulation of existing buildings but also installing new types of insulation in new eco-friendly buildings. Their efforts are creating opportunities for insulation workers.

23

- A) NO CHANGE
- B) walls under floors
- C) walls, under floors,
- D) walls, under floors;

24

- A) NO CHANGE
- B) also municipalities
- C) those of municipalities
- D) municipalities

There are two main types of insulation workers: floor, ceiling, and wall insulators, who install insulation in private residences, and mechanical insulators, who work primarily in commercial buildings. The US Bureau of Labor Statistics expects both types to see **25** lots of jobs happening in the coming years. The number of floor, ceiling, and wall insulator jobs is anticipated to **26** rise from 23,300 to 29,400 between 2012 and 2022—a gain of 26 percent. Mechanical insulator jobs should see even greater gains, with a 47 percent increase in jobs by 2022. The expected growth rate of **27** insulation jobs as a whole, at 38 percent, is more than triple the 10.8 percent by which all other occupations are projected to grow.

Employment Projections for Insulation Workers,  
2012-2022

Type of insulation worker	2012 employment (thousands)	2022 projected employment (thousands)	Percent increase, 2012-2022 (projected)
Floor, ceiling, and wall	23.3	29.4	26%
Mechanical	28.9	42.4	47%
Total*	52.1	71.7	38%

\*Totals may appear incorrect due to rounding

Adapted from US Bureau of Labor Statistics, Employment Projections. Published in 2014

25

Which choice is most consistent with the tone and style of the passage?

- A) NO CHANGE
- B) all these jobs
- C) job growth
- D) the burgeoning of employment

26

Which choice provides accurate information from the table to support the passage's argument?

- A) NO CHANGE
- B) decline from 42,400 to 29,400
- C) climb to a total of 42,400
- D) increase by 23,300

27

Which choice provides information from the table accurately?

- A) NO CHANGE
- B) some other insulation jobs,
- C) insulation jobs in commercial buildings,
- D) insulation jobs in homes,

Employment Projections for Insulation Workers,  
2012-2022

Type of insulation worker	2012 employment (thousands)	2022 projected employment (thousands)	Percent increase, 2012–2022 (projected)
Floor, ceiling, and wall	23.3	29.4	26%
Mechanical	28.9	42.4	47%
Total*	52.1	71.7	38%

\*Totals may appear incorrect due to rounding

Adapted from US Bureau of Labor Statistics, Employment Projections. Published in 2014

Indeed, the number of jobs for insulation workers may ultimately increase even more than projected because the field is changing in ways that provide additional opportunities. For example, many customers, especially those working on new building projects, are requesting nontoxic insulation materials made from renewable resources. For years, workers have used a sprayable polyurethane foam that is relatively inexpensive and easy to apply.

28 Meanwhile, this foam is made from a nonrenewable resource, petroleum, and has been deemed 29 unsuitable for use by environmentally conscious building groups. These groups are instead recommending cotton denim insulation, which 30 is made from industrial 31 scraps; or cellulose insulation, composed of recycled paper and natural fibers. Both of these materials are safe, low in toxins, and sustainable 32 They are less difficult to remove from homes than polyurethane foam, requiring specialized equipment and additional workers to mix and apply the materials.

28

Which choice creates the clearest transition from the previous sentence?

- A) NO CHANGE
- B) Therefore,
- C) However,
- D) DELETE the underlined portion, adjusting the capitalization as needed.

29

- A) NO CHANGE
- B) unseasonable
- C) incoherent
- D) inauspicious

30

- A) NO CHANGE
- B) are
- C) were
- D) was

31

- A) NO CHANGE
- B) scraps, or
- C) scraps;
- D) scraps,

32

Which choice most effectively sets up the information that follows in the sentence?

- A) NO CHANGE
- B) Cellulose insulation can be installed with a spray
- C) They are not necessarily as energy efficient as polyurethane foam,
- D) They are also more labor-intensive to install,

It seems likely that workers who are skilled in installing these new materials will be in great demand in the coming years. Devin O'Brien, owner of a New York insulation **33** company—says bio-based insulation materials and eco-friendly buildings are “the future of the industry.” It's a future that looks very bright for insulation workers

33

- A) NO CHANGE
- B) company,
- C) company;
- D) company

Questions 34–44 are based on the following passage

**Neither Wind nor Ice nor Gloom of Night**

On April 11, 1934, the staff at Mount Washington Observatory in New Hampshire began to experience meteorological conditions that were extraordinary, even in a place that bills itself as the “home of the world’s worst weather.” Rising high above the other peaks in the Presidential Range at the nexus of several storm paths, Mount Washington routinely experiences hurricane-force winds, below-zero **34** temperatures: and year-round snow. Still, as two intense systems—a high-pressure system over the Atlantic Ocean and a low-pressure system over the Great Lakes—converged near the summit, the observers knew that **35** he or she might witness a unique weather event.

34

- A) NO CHANGE
- B) temperatures;
- C) temperature,
- D) temperature—

35

- A) NO CHANGE
- B) one
- C) those
- D) they

The observatory workers woke up on April 11 to clear skies, **36** facing the first day since crew member Robert Stone had been taken down the mountain for medical attention for his bruised hip. A steep pressure difference developed over a very short **37** distance; driving winds to extreme speeds and contributing to the formation of a foot-thick layer of rime (a type of ice). **38** The staff members waited to see if conditions would continue to deteriorate, and the observatory's anemometer, a pinwheel-like apparatus used for measuring wind speed, had previously **39** malfunctioned because of excessive winds and accumulations of ice. With a new anemometer that was electrically heated and tightly anchored to the roof, the scientists now had a device that could withstand an extreme storm.

36

Which choice best sets up the information that follows in the paragraph?

- A) NO CHANGE
- B) but conditions worsened later in the day as the two weather systems collided and encountered a formidable barrier in the Presidential Range.
- C) and the finding they would make that day would lead to the recognition that a permanent weather station should be housed on Mount Washington
- D) the same conditions they had observed the day before, something relatively unusual for Mount Washington in April.

37

- A) NO CHANGE
- B) distance: driving
- C) distance, driving
- D) distance. Driving

38

Which choice provides the most effective transition from the previous sentence to the information that follows in this sentence?

- A) NO CHANGE
- B) Such conditions had interfered with weather observations in the past:
- C) The safety of the staff members was of the utmost concern at the time, as
- D) Throughout the day, the pressure fell and the wind speed began to increase:

39

- A) NO CHANGE
- B) malfunctioned before
- C) malfunctioned, failing to operate correctly,
- D) malfunctioned at another point in time

[1] As the wind speed rose to 136 miles per hour (mph), the researchers wondered whether the intensifying winds would reach record speeds [2] At 4:00 a.m. on April 12, one researcher, Wendell Stephenson, woke from a short nap to find that the anemometer reading had fallen to 105 mph [3] Stephenson could tell from the noise outside that the wind had gotten stronger while he was asleep, and he reasoned that the anemometer, despite its improved design, was not working properly. [4] He put on his winter gear, picked up a club used for dislodging ice, and **40** has opened the door to go outside. [5] Back inside, **41** his efforts, he learned, had been successful; the readings now showed that the wind speed was approaching the previous site record of 164 mph. [6] In fact, that record was shattered: at 1:21 p.m., the station recorded a new world-record wind speed of 231 mph. **42**

40

- A) NO CHANGE
- B) opening
- C) opened
- D) to open

41

- A) NO CHANGE
- B) his efforts had been successful, which he learned;
- C) success, he learned, had been the outcome of his efforts;
- D) he learned that his efforts had been successful:

42

To improve the cohesion and flow of this paragraph the writer wants to add the following sentence  
The wind knocked him to ground, but he was able to regain his footing and make his way to the anemometer to remove the accumulated ice.

The sentence would most logically be placed

- A) after sentence 1.
- B) after sentence 3.
- C) after sentence 4.
- D) after sentence 5.

Though automated instruments have since recorded higher speeds in cyclones, the 1934 record stands to this 43 day. It stands as the highest wind speed measured by human observers. 44 However, Mount Washington Observatory continues to operate as the staff carries on the work of recording and studying weather data using newer equipment but remaining inspired by the past—those scientists who came before.

43

Which choice most effectively combines the sentences at the underlined portion?

- A) day
- B) day, and it is known
- C) day, still standing
- D) day; it holds the record

44

- A) NO CHANGE
- B) Likewise,
- C) In other words,
- D) DELETE the underlined portion.



# Math Test – No Calculator

**25 MINUTES, 20 QUESTIONS**

Turn to Section 3 of your answer sheet to answer the questions in this section.

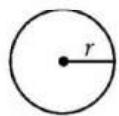
## DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16–20, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

- The use of a calculator is not permitted.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

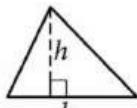
## REFERENCE



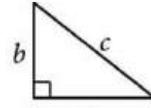
$$\begin{aligned} A &= \pi r^2 \\ C &= 2\pi r \end{aligned}$$



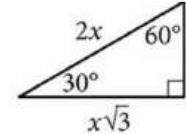
$$A = \ell w$$



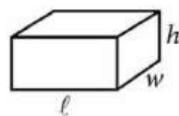
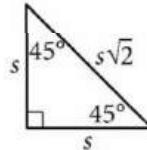
$$A = \frac{1}{2}bh$$



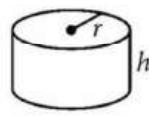
$$c^2 = a^2 + b^2$$



Special Right Triangles



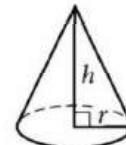
$$V = \ell wh$$



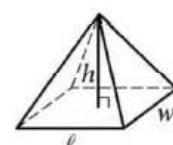
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.

1



In the given triangle,  $AB = AC$  and  $\angle ABC$  has a measure of  $67^\circ$ . What is the value of  $x$ ?

- A) 36
- B) 46
- C) 58
- D) 70

2

A petting zoo sells two types of tickets. The standard ticket, for admission only, costs \$5. The premium ticket, which includes admission and food to give to the animals, costs \$12. One Saturday, the petting zoo sold a total of 250 tickets and collected a total of \$2,300 from ticket sales. Which of the following systems of equations can be used to find the number of standard tickets,  $s$ , and premium tickets,  $p$ , sold on that Saturday?

- A)  $s + p = 250$   
 $5s + 12p = 2,300$
- B)  $s + p = 250$   
 $12s + 5p = 2,300$
- C)  $5s + 12p = 250$   
 $s + p = 2,300$
- D)  $12s + 5p = 250$   
 $s + p = 2,300$

3

Which of the following is equivalent to  $(x^2 + 7) - 2(x^2 + 3)$ ?

- A)  $-x^2 + 10$
- B)  $-x^2 + 1$
- C)  $-3x^2 + 10$
- D)  $-3x^2 + 1$

4

$$S = 4\pi r^2$$

The formula above gives the surface,  $S$ , of a sphere in terms of the length of its radius,  $r$ . Which of the following gives the radius of the sphere in terms of its surface area?

- A)  $r = \sqrt{\frac{S}{4\pi}}$
- B)  $r = \sqrt{\frac{4\pi}{S}}$
- C)  $r = \frac{\sqrt{S}}{4\pi}$
- D)  $r = \frac{\sqrt{4\pi}}{S}$



5

$$(2x + 3) - (x - 7)$$

Which of the following is equivalent to the given expression?

- A)  $x - 4$
- B)  $3x - 4$
- C)  $x + 10$
- D)  $2x^2 + 21$

6

In the  $xy$ -plane, the points  $(-2, 3)$  and  $(4, -5)$  lie on the graph of which of the following linear functions?

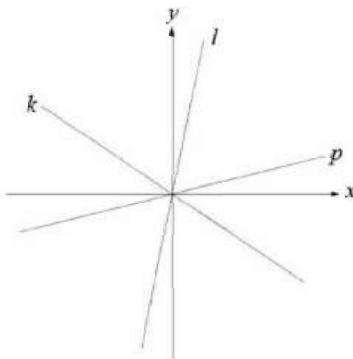
- A)  $f(x) = x + 5$
- B)  $f(x) = \frac{1}{2}x + 5$
- C)  $f(x) = -\frac{4}{3}x + \frac{1}{3}$
- D)  $f(x) = -\frac{3}{2}x + 1$

7

A rectangular volleyball court has an area of 162 square meters. If the length of the court is twice the width, what is the width of the court, in meters?

- A) 9
- B) 18
- C) 27
- D) 54

8



In the  $xy$ -plane above, lines  $k$ ,  $l$ , and  $p$  are shown. Which of the following lists the slopes of the lines from least to greatest?

- A) The slope of  $l$ , the slope of  $k$ , the slope of  $p$
- B) The slope of  $p$ , the slope of  $k$ , the slope of  $l$
- C) The slope of  $k$ , the slope of  $l$ , the slope of  $p$
- D) The slope of  $k$ , the slope of  $p$ , the slope of  $l$



9

A cube has a surface area of 54 square meters. What is the volume, in cubic meters, of the cube?

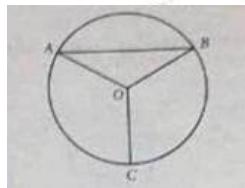
- A) 18
- B) 27
- C) 36
- D) 81

10

A line in the  $xy$ -plane has a slope of 0. Which of the following could be an equation of the line?

- A)  $x = 0$
- B)  $y = 1$
- C)  $x = y$
- D)  $y = -x$

11



Point  $O$  is the center of the circle above, and the measure of  $\angle AOB$  is  $30^\circ$ . If the length of  $\overline{OC}$  is 18, what is the length of arc  $\widehat{AB}$ ?

- A)  $9\pi$
- B)  $12\pi$
- C)  $15\pi$
- D)  $18\pi$

11

$$h(x) = 2(x - 4)^2 - 32$$

The quadratic function  $h$  is defined as shown. In  $xy$ -plane, the graph of  $y = h(x)$  intersects the  $x$ -axis at point  $(0, 0)$  and  $(t, 0)$ , where  $t$  is a constant. What is the value of  $t$ ?

- A) 1
- B) 2
- C) 4
- D) 8

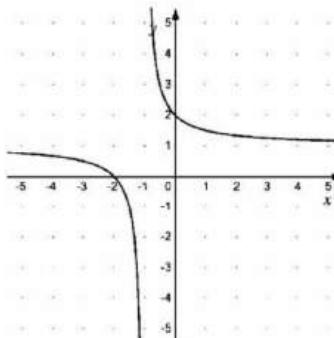
13

$$x(x - 2) = 35$$

What is the product of the solutions to the given equation?

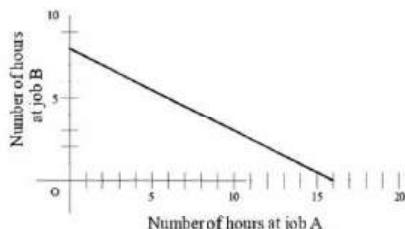
- A) 35
- B) 12
- C) -2
- D) -35

15



The graph of  $y = f(x)$  is shown in the  $xy$ -plane above. Which of the following could define  $f$ ?

14



To earn money for college, Avery works two part-time jobs: A and B. She earns \$10 per hour working at job A and \$20 per hour working at job B. In one week, Avery earned a total of  $s$  dollars for working at the two part-time jobs. The graph above represents all possible combinations of numbers of hours Avery could have worked at the two jobs to earn  $s$  dollars. What is the value of  $s$ ?

- A) 128
- B) 160
- C) 200
- D) 320

**DIRECTIONS**

**For questions 16–20,** solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer →  
in boxes.

Answer:  $\frac{7}{12}$

7	/	1	2
○	○	○	○
○	○	○	○
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Grid in result.

Answer: 2.5

2	.	5
○	○	○
○	○	○
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
○	○	○
○	○	○
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7

.	6	6	6
○	○	○	○
○	○	○	○
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

.	6	6	7
○	○	○	○
○	○	○	○
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

Answer: 201 – either position is correct

2	0	1
○	○	○
○	○	○
1	1	1
2	2	2

2	0	1
○	○	○
○	○	○
1	1	1
2	2	2

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

## 3

16

If  $\sqrt{x + 5} = 6$ , what is the value of  $x$ ?

17

$$3(3x + 5) = kx + 15$$

In the equation above,  $k$  is a constant. If all values of  $x$  satisfy the equation, what is the value of  $k$ ?

18

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

What value of  $x$  satisfies the equation above?

## 3

19

$$\begin{aligned}-3x + 5y &= 1 \\ 2x - 3y &= 2\end{aligned}$$

If  $(x, y)$  is the solution to the given system of equations, what is the value of  $x$ ?

20

An exponential function  $f$  is defined by  $f(t) = b^t$ , where  $b$  is a constant greater than 1. If  $f(8) = 16 \cdot f(6)$ , what is the value of  $b$ ?



# Math Test – Calculator

**55 MINUTES, 38 QUESTIONS**

Turn to Section 4 of your answer sheet to answer the questions in this section.

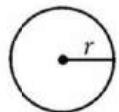
## DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 31–38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

1. The use of a calculator is permitted.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

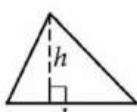


$$A = \pi r^2$$

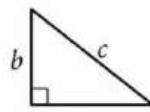
$$C = 2\pi r$$



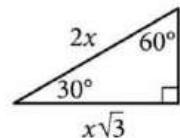
$$A = \ell w$$



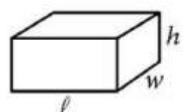
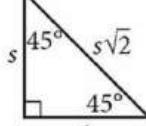
$$A = \frac{1}{2}bh$$



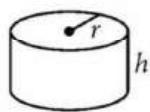
$$c^2 = a^2 + b^2$$



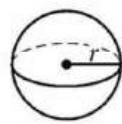
Special Right Triangles



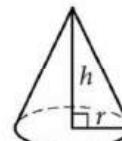
$$V = \ell wh$$



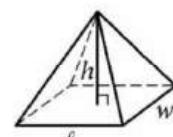
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3} \ell wh$$

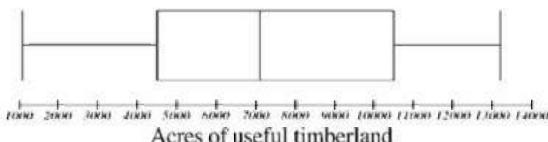
The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1



The number of acres of useful timberland in 13 counties in California is summarized in the box plot above. Which of the following is closest to the median number of acres?

- A) 4,399
- B) 7,067
- C) 8,831
- D) 10,595

2

Robert rented a truck to transport materials he purchased from a hardware store. He was charged an initial fee of \$20.00 plus an additional \$0.70 per mile driven. If the truck was driven 38 miles, what was the total amount Robert was charged?

- A) \$46.60
- B) \$52.90
- C) \$66.90
- D) \$86.50

3

The equation  $y = 0.1x$  models the relationship between the number of different pieces of music a certain pianist practices,  $y$ , during an  $x$ -minute practice session. How many pieces did the pianist practice if the session lasted 30 minutes?

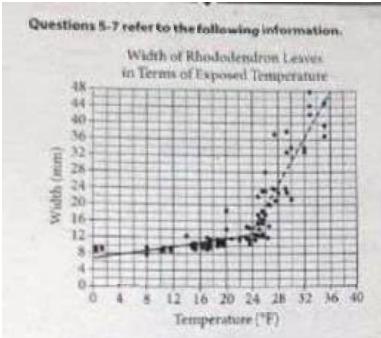
- A) 1
- B) 3
- C) 10
- D) 30

4

$$3(a + 4) + 6a = 3(a + 4) + 30$$

What value of  $a$  satisfies the equation above?

- A) 0.5
- B) 2
- C) 5
- D) 24



Rhododendron leaves curl up at temperatures below freezing, and they uncurl and widen as the temperature rises. The scatterplot above shows the results of a study in which the widths of some rhododendron leaves from the same plant were measured at various times over a certain period. The widths  $w$ , in millimeters (mm), were plotted against the temperatures  $T$ , in degrees Fahrenheit ( $^{\circ}\text{F}$ ), at the times the leaves were measured. The solid line segment is a line of best fit that models the relationship between the temperatures and widths of the leaves when  $0 \leq T < 24$ . The dashed line segment is a line of best fit that models the relationship when  $24 \leq T \leq 36$ .

5

Based on the dashed line segment, which of the following is closest to the temperature at which the width of a rhododendron leaf is predicted to be 42 millimeters?

- A)  $34^{\circ}\text{F}$
- B)  $36^{\circ}\text{F}$
- C)  $38^{\circ}\text{F}$
- D)  $40^{\circ}\text{F}$

6

At a time when the temperature was  $14^{\circ}\text{F}$ , the width of one of the rhododendron leaves was measured. By approximately how much does the actual measurement differ from the predicted value?

- A) It is approximately 10 millimeters greater than the predicted value.
- B) It is approximately 2 millimeters greater than the predicted value.
- C) It is approximately 2 millimeters less than the predicted value.
- D) It is approximately 10 millimeters less than the predicted value.

7

Based on the solid line segment, which of the following could be predicted width, in millimeters, of a rhododendron leaf when the temperature is  $T^{\circ}\text{F}$ , where  $0 \leq T < 12$ ?

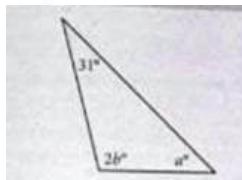
- A) 5
- B) 8
- C) 12
- D) 14

8

An object with a mass of 1.0 kilogram weighs approximately 2.2 pounds. An object having which of the following masses, in kilograms, weighs closest to 2.0 pounds?

- A) 0.45
- B) 0.91
- C) 1.1
- D) 4.4

9



In the triangle above,  $\alpha = 45$ . What is the value of  $b$ ?

- A) 52
- B) 59
- C) 76
- D) 104

10

At a large high school, 300 students were selected at random and were asked in a survey about a menu change in the school cafeteria. All 300 students completed the survey. It was estimated that 38% of the students were in support of a menu change, with a margin of error of 5.5%. Which of the following is the best interpretation of the survey results?

- A) The percent of the students at the school who support a menu change is 38%.
- B) The percent of the students at the school who support a menu change is greater than 38%.
- C) Plausible values of the percent of the students at the school who support a menu change are between 32.5% and 43.5%.
- D) Plausible values of the number of the students at the school who support a menu change are between 295 and 305.

11

$$\begin{aligned}x - 3y &= 7 \\3y &= 9\end{aligned}$$

If  $(x, y)$  is the solution to the system of equations above, what is the value of  $x$ ?

- A) -2
- B) 10
- C) 16
- D) 34

12

Nayya burns 5 kilocalories per minute running on a treadmill and 10 kilocalories per minute pedaling on a stationary bike. Which of the following equations represents the total number of kilocalories,  $T$ , Nayya has burned after running on the treadmill for 50 minutes and pedaling on the stationary bike for  $m$  minutes?

- A)  $T = 15m + 50$
- B)  $T = 50m + 50$
- C)  $T = 5m + 500$
- D)  $T = 10m + 250$

13

$$f(x) = \frac{(x + 7)}{4}$$

For the function  $f$  defined above, what is the value of  $f(9) - f(1)$ ?

- A) 1
- B) 2
- C)  $\frac{1}{4}$
- D)  $\frac{9}{4}$

14

There were approximately 113,000 occupational therapy jobs in the United States in 2012. The Bureau of Labor Statistics has projected that this number will increase by 29% from 2012 to 2022. Of the following numbers, which is closest to the number of occupational therapy jobs the bureau has projected for the United States in 2022?

- A) 115,900
- B) 116,300
- C) 142,000
- D) 145,800

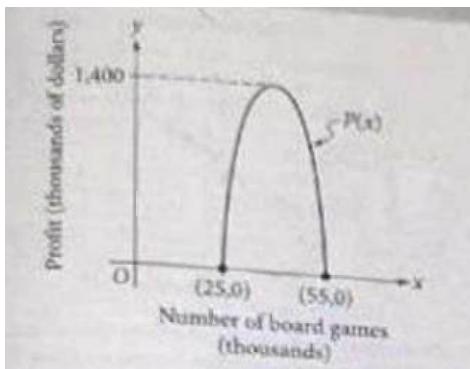
15

A survey was conducted using a sample of history professors selected at random from the California State Universities. The professors surveyed were asked to name the publishers of their current topics. What is the largest population to which the result of the survey can be generalized?

- A) All professors in the United States
- B) All history professors in the United States
- C) All history professors at all California State Universities
- D) All professors at all California State Universities



16



A company produces board games and sells them online and in stores. The quadratic function  $P$  models the company's monthly profits  $P(x)$ , in thousands of dollars, when  $x$  board games, in thousands, are produced and sold. The graph of  $y = P(x)$ , where  $25 \leq x \leq 55$ , is shown in the  $xy$ -plane above. How many board games must the company produce and sell in order to earn the maximum profit estimated by the model?

- A) 20,000
- B) 40,000
- C) 60,000
- D) 1,400,000

17

A number  $n$  is increased 6%. If the result is 318, what is the value of  $n$ ?

- A) 199
- B) 299
- C) 300
- D) 337

18

$$d = 55t$$

The equation above can be used to calculate the distance  $d$ , in miles, traveled by a car moving at a speed of 55 miles per hour over a period of  $t$  hours. For any positive constant  $k$ , the distance the car would have traveled after  $9k$  hours is how many times the distance the car would have traveled after  $3k$  hours?

- A) 3
- B) 6
- C)  $3k$
- D)  $6k$

19

In which of the following tables is the relationship between the values of  $x$  and their corresponding  $y$ -values nonlinear?

A)

$x$	1	2	3	4
$y$	8	11	14	17

B)

$x$	1	2	3	4
$y$	4	8	12	16

C)

$x$	1	2	3	4
$y$	8	13	18	23

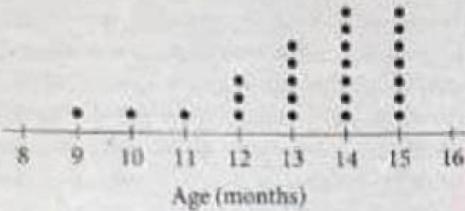
D)

$x$	1	2	3	4
$y$	6	12	24	48



20

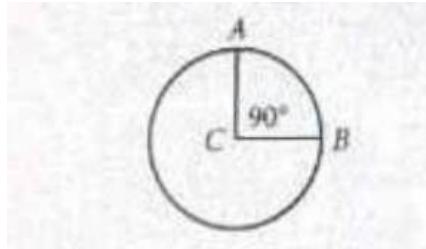
Age of 25 Babies When They Began Walking



The dot plot above gives the ages, in months, at which 25 babies began walking. Which of the following is true about the mean and the median of the data?

- A) The mean is greater than the median.
- B) The mean is less than the median.
- C) The mean is equal to the median.
- D) The relationship between the mean and the median cannot be determined from the dot plot.

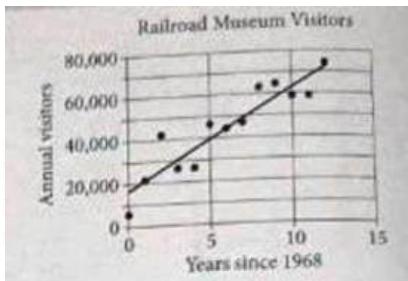
21



Point C is the center of the circle shown above. What is the measure of angle  $ACB$ , in radians?

- A)  $2\pi$
- B)  $\pi$
- C)  $\frac{\pi}{2}$
- D)  $\frac{\pi}{4}$

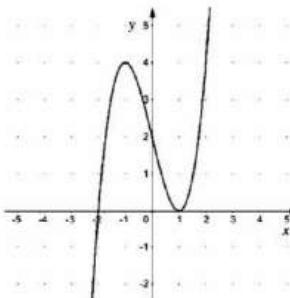
22



The scatterplot above shows the number of visitors to a railroad museum in Pennsylvania each year from 1968 to 1980, where  $t$  is the number of years since 1968 and  $n$  is the number of visitors. A line of best fit is also shown. Which of the following could be an equation of the line of best fit shown?

- A)  $n = 16,090 + 4,680t$
- B)  $n = 4,690 + 16,090t$
- C)  $n = 16,090 + 9,060t$
- D)  $n = 9,060 + 16,090t$

23



The graph of  $y = p(x)$  is shown in the  $xy$ -plane above. Which of the following equations could define the function  $p$ ?

- A)  $p(x) = (x - 2)(x + 1)^2$
- B)  $p(x) = (x - 2)^2(x + 1)$
- C)  $p(x) = (x + 2)^2(x - 1)$
- D)  $p(x) = (x + 2)(x - 1)^2$

24

$x$	-11	-10	-9	-8
$f(x)$	21	18	15	12

The table above shows some values of  $x$  and their corresponding values  $f(x)$  for the linear function  $f$ . What is the  $x$ -intercept of the graph of  $y = f(x)$  in the  $xy$ -plane?

- A)  $(-3, 0)$
- B)  $(-4, 0)$
- C)  $(-9, 0)$
- D)  $(-12, 0)$

25

$$\frac{x^2 - c}{x - b}$$

In the expression above,  $b$  and  $c$  are positive integers. If the expression is equivalent to  $x + b$  and  $x \neq b$ , which of the following could be the value of  $c$ ?

- A) 4
- B) 6
- C) 8
- D) 10

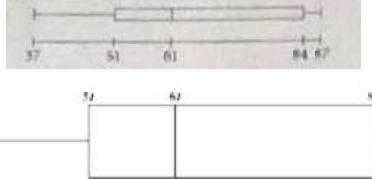
26

$$S(n) = 38,000a^n$$

The function  $S$  above models the annual salary, in dollars, of an employee  $n$  years after starting a job, where  $a$  is a constant. If the employee's salary increases by 4% each year, what is the value of  $a$ ?

- A) 0.04
- B) 0.4
- C) 1.04
- D) 1.4

27



Which of the following statements about the data represented in the box plot above must be true?

- A) There are more data between 61 and 84 than between 51 and 61.
- B) There are no data between 37 and 51.
- C) The mean of the data is 61.
- D) The range of the data is 50.



28

Value	Frequency
1	$a$
2	$2a$
3	$3a$
4	$2a$
5	$a$

The frequency distribution above summarizes a set of data, where  $a$  is a positive integer. How much greater is the mean of the set of data than the median?

- A) 0
- B) 1
- C) 2
- D) 3

29

$$\begin{aligned}y &= 2x + 1 \\y &= ax - 8\end{aligned}$$

In the system of equations above,  $a$  is a constant. If the system of equations has no solution, what is the value of  $a$ ?

- A)  $-\frac{1}{2}$
- B) 0
- C) 1
- D) 2

30

In the  $xy$ -plane, a parabola has vertex  $(3, 1)$  and intersects the  $x$ -axis at two points. If the equation of the parabola is written in the form  $y = -ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are constants, which of the following could be a value of  $c$ ?

- A)  $\sim 8$
- B) 2
- C) 3
- D) 7

**DIRECTIONS**

For questions 31–38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Answer:  $\frac{7}{12}$

Write answer → in boxes.

7	/	1	2
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Grid in result.

Answer: 2.5

2	.	5
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

2	/	3
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7

.	6	6	6
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

.	6	6	7
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7

Answer: 201 – either position is correct

2	0	1
0	0	0
1	1	1
2	2	2

2	0	1
0	0	0
1	1	1
2	2	2

**NOTE:** You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

31

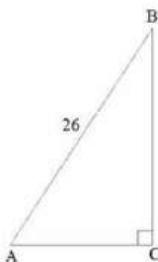
Car component	Not defective	Defective	Total
Component A	225	25	250
Component B	440	10	450
Component C	285	15	300
Total	950	50	1000

The table above summarizes the results of testing 1000 car components of three different types to determine whether they were defective. Of the defective components, what fraction were component B?

32

In the  $xy$ -plane, what is the  $y$ -coordinate of the point of intersection of the graphs of  $y = (x - 1)^2$  and  $y = 2x - 3$ ?

33



Triangle  $ABC$  above is a right triangle, and  $\sin(B) = \frac{5}{13}$ . What is the length of side  $\overline{BC}$ ?

34

$$x^2 - ax + 12 = 0$$

In the equation above,  $a$  is a constant and  $a > 0$ . If the equation has two integer solutions, what is a possible value of  $a$ ?

35

$x$	$y$
3	7
$k$	11
12	$n$

The table above shows the coordinates of three points on a line in the  $xy$ -plane, where  $k$  and  $n$  are constants. If the slope of the line is 2, what is the value of  $k + n$ ?

36

The acceleration due to gravity, in meters per second per second ( $m/s^2$ ), on Earth is 1.3  $m/s^2$  less than 3 times the acceleration due to gravity on Mercury. If the acceleration due to gravity on Earth is  $9.8 m/s^2$ . What is the acceleration due to gravity, in  $m/s^2$ , on Mercury?



Questions 37 and 38 refer to the following information.

Kosumi, located in the city of Redfield, South Dakota, is trying to estimate the distances from Redfield to other cities in the state. On a map, he measured the lengths along major highways from Redfield to some other cities and listed these lengths in the table below.

City	Distance from Redfield on map (inches)
Chamberlain	2
Mitchell	$1\frac{3}{4}$
Pierre	$2\frac{1}{4}$
Sioux Falls	3
Sturgis	6
Watertown	$1\frac{1}{2}$

The map that Kosumi used has a scale of  $\frac{3}{4}$  inches = 50 miles.

37

According to Kosumi's measurements, how many miles is it from Redfield to Sturgis?

38

Kosumi is planning a trip from Redfield to Pierre and expects to average 60 miles per hour while driving. How long, in minutes, will it take for Kosumi to drive from Redfield to Pierre?

# SOLUTIONS

## Reading

1	B	27	D
2	B	28	A
3	C	29	B
4	C	30	A
5	A	31	C
6	B	32	D
7	C	33	C
8	D	34	A
9	A	35	B
10	D	36	D
11	B	37	A
12	A	38	D
13	C	39	C
14	D	40	B
15	A	41	A
16	B	42	B
17	D	43	D
18	A	44	A
19	C	45	D
20	B	46	D
21	C	47	A
22	C	48	D
23	A	49	A
24	C	50	C
25	C	51	C
26	B	52	C

## Writing

1	C	23	C
2	B	24	D
3	B	25	C
4	B	26	A
5	C	27	A
6	D	28	C
7	A	29	A
8	C	30	A
9	B	31	B
10	C	32	D
11	C	33	B
12	B	34	C
13	D	35	D
14	D	36	B
15	A	37	C
16	B	38	B
17	D	39	A
18	B	40	C
19	A	41	D
20	B	42	C
21	B	43	A
22	C	44	D

## Math without calculator

1	B
2	A
3	B
4	A
5	C
6	C
7	A
8	D
9	B
10	B
11	B
12	D
13	D
14	B
15	D
16	31
17	9
18	$\frac{1}{2}, .5$
19	13
20	4

## Math with calculator

1	B	20	B
2	A	21	C
3	B	22	A
4	C	23	D
5	A	24	B
6	B	25	A
7	B	26	C
8	B	27	D
9	A	28	A
10	C	29	D
11	C	30	A
12	D	31	.2, 1/5
13	B	32	1
14	D	33	24
15	C	34	7, 8, 13
16	B	35	30
17	C	36	3.7, 37/10
18	A	37	400
19	D	38	150