

# The SAT<sup>®</sup>

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## IMPORTANT REMINDERS

**1**

A No. 2 pencil is required for the test.  
Do not use a mechanical pencil or pen.

**2**

Sharing any questions with anyone is a violation of Test Security and Fairness policies and may result in your scores being canceled.

# Reading Test

## 65 MINUTES, 52 QUESTIONS

Turn to Section 1 of your answer sheet to answer the questions in this section.

### DIRECTIONS

Each passage or pair of passages below is followed by a number of questions. After reading each passage or pair, choose the best answer to each question based on what is stated or implied in the passage or passages and in any accompanying graphics (such as a table or graph).

#### Questions 1-10 are based on the following passage.

The passage is from Ian McEwan, *Atonement*. ©2001 by Ian McEwan

She was one of those children possessed by a desire to have the world just so. Whereas her big sister's room was a stew of unclosed books, unfolded clothes, unmade bed, unemptied ashtrays, Briony's Line 5 was a shrine to her controlling demon: the model farm spread across a deep window ledge consisted of the usual animals, but all facing one way—towards their owner—as if about to break into song, and even the farmyard hens were neatly corralled. In fact, Briony's 10 was the only tidy upstairs room in the house. Her straight-backed dolls in their many-roomed mansion appeared to be under strict instructions not to touch the walls; the various thumb-sized figures to be found standing about her dressing table—cowboys, deep- 15 sea divers, humanoid mice—suggested by their even ranks and spacing a citizen's army awaiting orders.

A taste for the miniature was one aspect of an orderly spirit. Another was a passion for secrets: in a prized varnished cabinet, a secret drawer was opened 20 by pushing against the grain of a cleverly turned dovetail joint, and here she kept a diary locked by a clasp, and a notebook written in a code of her own invention. In a toy safe opened by six secret numbers she stored letters and postcards. An old tin petty 25 cash box was hidden under a removable floorboard beneath her bed. In the box were treasures that dated back four years, to her ninth birthday when she began

collecting: a mutant double acorn, fool's gold, a rain-making spell bought at a funfair, a squirrel's skull as 30 light as a leaf.

But hidden drawers, lockable diaries and cryptographic systems could not conceal from Briony the simple truth: she had no secrets. Her wish for a harmonious, organized world denied her the reckless 35 possibilities of wrongdoing. Mayhem and destruction were too chaotic for her tastes, and she did not have it in her to be cruel. Her effective status as an only child, as well as the relative isolation of the Tallis house, kept her, at least during the long summer holidays, 40 from girlish intrigues with friends. Nothing in her life was sufficiently interesting or shameful to merit hiding; no one knew about the squirrel's skull beneath her bed, but no one wanted to know. None of this was particularly an affliction; or rather, it appeared 45 so only in retrospect, once a solution had been found.

At the age of eleven she wrote her first story—a foolish affair, imitative of half a dozen folk tales and lacking, she realized later, that vital knowingness 50 about the ways of the world which compels a reader's respect. But this first clumsy attempt showed her that the imagination itself was a source of secrets: once she had begun a story, no one could be told. Pretending in words was too tentative, too vulnerable, too 55 embarrassing to let anyone know. Even writing out the she saids, the and then, made her wince, and she felt foolish, appearing to know about the emotions of an imaginary being. Self-exposure was inevitable the moment she described a character's weakness; the

60 reader was bound to speculate that she was describing herself. What other authority could she have? Only when a story was finished, all fates resolved and the whole matter sealed off at both ends so it resembled, at least in this one respect, every other finished story  
65 in the world, could she feel immune, and ready to punch holes in the margins, bind the chapters with pieces of string, paint or draw the cover, and take the finished work to show to her mother, or her father, when he was home.

1

Details in the passage suggest that, in comparison to Briony, the other members of her family were much less

- A) affectionate
- B) content
- C) studious
- D) neat

2

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-2 (“She . . . so”)
- B) Lines 9-10 (“In fact . . . house”)
- C) Lines 37-40 (“Her effective . . . friends”)
- D) Lines 40-43 (“Nothing . . . know”)

3

Which situation is most similar to the one described in lines 13-16 (“the various...orders”)?

- A) People of all shapes and sizes march together in a parade.
- B) Students are lined up in rows by height for a class picture.
- C) Different types of flowers and shrubs are planted in even rows in a garden.
- D) Books on numerous topics are found in the same section of a library.

4

As used in line 18, “spirit” most nearly means

- A) temperament
- B) development
- C) vigor
- D) atmosphere

5

The main idea of paragraphs two and three (lines 17-46) is that Briony

- A) appeared guileless but was extremely secretive.
- B) loved secrets but had none that mattered.
- C) tried to establish order in the midst of chaos.
- D) went to elaborate lengths to keep secrets.

6

According to the narrator, all of the following were true of Briony’s first story EXCEPT that it

- A) was unoriginal.
- B) revealed a lack of knowledge.
- C) taught its author an important lesson.
- D) was never shared with others.

7

The reference to “she saids” and “and thens” line 56) serves mainly to show Briony’s

- A) boredom with the more basic element of writing.
- B) preference for dialogue and plot over character description.
- C) frustration with her inability to write original stories.
- D) sensitivity to the vulnerability inherent in storytelling.

8

As used in line 61, “authority” most nearly means

- A) power.
- B) support.
- C) source.
- D) right.

9

According to the passage, at which point in the process of authorship would Briony feel most secure?

- A) Beginning a story.
- B) Describing the characters
- C) Writing a story’s ending
- D) Preparing the finished product to show others

10

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 51-53 (“But this . . . told”)
- B) Lines 55-58 (“Even . . . being”)
- C) Lines 58-61 (“Self exposure . . . herself”)
- D) Lines 61-69 (“Only when . . . home”)

**Questions 11-21 are based on the following passage and supplementary material.**

The passage is adapted from David Disalvo, *What Makes Your Brain Happy and Why You Should Do the Opposite*. © 2011 by David DiSalvo.

Whether in person or on screen, one of the strongest influences on our thinking is woven into the verbiage all of us use in discussions big and small: *Line metaphors*. Let’s say that we are comparing cities

5 we have visited or would like to visit, and I mention one that I have not been to, but you have. You say, “It’s a massive, stinking cesspool filled with garbage and crawling with every form of filth imaginable. Immediately my mind conjures an image of a filthy 10 retention pond covered with scum, loaded with trash and lousy with rats and roaches. How close the metaphor you have chosen is to actually describing the city is debatable, but in the few minutes we are speaking this doesn’t really matter. What matters is 15 that you have provided the metaphorical rudiments for me to construct an image that is now schematically associated with the city in my mind. One day I may visit that city and determine that your metaphor was inaccurate, or I may conclude that it was dead-on.

20 Until then- or until I come across information that contradicts or verifies your description, the image will be there. And even after, I’ll find removing that image from my mind very difficult.

That is the power of metaphor- a power so subtle 25 we barely notice how much it impacts our thinking. Researchers Paul Thibodeau and Lera Boroditsky from Stanford University demonstrated how influential metaphors can be through a series of five experiments designed to tease apart the “why” and 30 “when” of a metaphor’s power. First, the researchers asked 482 students to read one of two reports about crime in the city of Addison. Later they had to suggest solutions for the problem.

In the first report, crime was described as a 35 “wild beast preying on the city” and “lurking in neighborhoods.” After reading these words, 75 percent of the students put forward solutions that involved enforcement or punishment, such as building more jails or even calling in the military for help. Only 25 40 percent suggested social reforms, such as fixing the economy, improving education, or providing better healthcare.

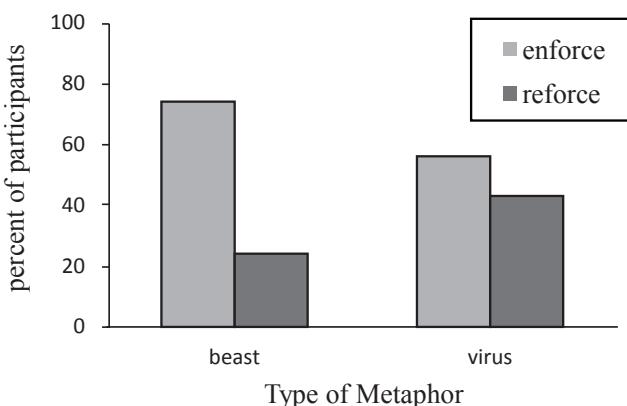
The second report was exactly the same except

it described crime as a “virus infecting the city” and 45 “plaguing” communities. After reading this version, only 56 percent opted for greater law enforcement while 44 percent suggested social reforms.

Interestingly, very few of the participants realized how affected they were by the differing crime 50 metaphors. When Thibodeau and Boroditsky asked the participants to identify which parts of the text had most influenced their decisions, the vast majority pointed to the crime statistics, not the language. Only 3 percent identified the metaphors as culprits. 55 The researchers confirmed their results with more experiments that use the same reports without as many vivid words. Even though these reports described crime as a beast or virus only once, the researchers found the same trend as before. 60 They also discovered that the words themselves do not wield much influence without the right context. When Thibodeau and Boroditsky asked participants to come up with synonyms for either “beast” or “virus” before reading crime reports that omitted the 65 metaphors entirely, the participants provided similar solutions for solving the city’s problems. In other words, the metaphors only worked if they framed the story.

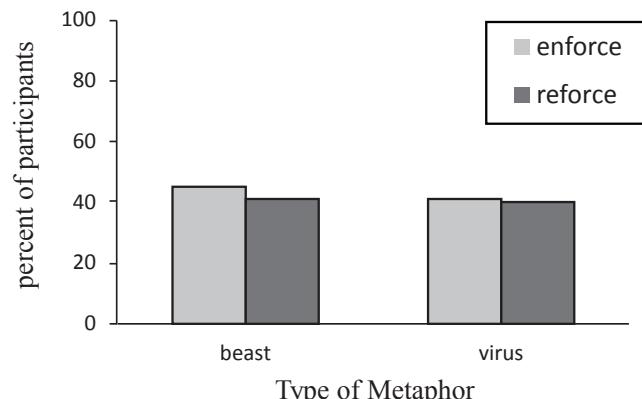
**Figure 1**

Percent of Participants Offering Enforcement Responses and Reform Responses When Beast and Virus Metaphors Framed Story



**Figure 2**

Percent of Participants Offering Enforcement Responses and Reform Responses When Primed With Beast and Virus Metaphors Synonyms Task



Adapted from Paul H. Thibodeau and Lera Boroditsky, *Metaphors we think with: The Rule of Metaphor in Reasoning* ©2011 by Paul H. Thibodeau and Lera Boroditsky

11

The main purpose of the passage is to

- A) discuss how metaphors are used in depictions of crime.
- B) demonstrate how metaphors shape people’s perceptions.
- C) illustrate how metaphors can undermine social policies.
- D) show how metaphors can be used to enhance storytelling.

12

The passage makes the most extensive use of which type of evidence?

- A) Data from surveys
- B) Testimony from experts
- C) Results from experiments
- D) Stories from personal experience

13

As used in line 9, “conjures” most nearly means

- A) charges.
- B) summons.
- C) enchantments.
- D) practices.

14

In the first paragraph, the author suggests that metaphors function by

- A) creating humorous images through obvious exaggeration.
- B) challenging people’s perceptions of familiar objects and places.
- C) challenging conceptions of truth and falsehood.
- D) establishing foundations for strong mental connections.

15

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 6-8 (“You say . . . imaginable”)
- B) Lines 11-14 (“How . . . matter”)
- C) Lines 14-17 (“What . . . mind”)
- D) Lines 17-19 (“One . . . dead-on”)

16

As used twice in line 24, “power” most nearly means

- A) controlling influence.
- B) moral effectiveness.
- C) physical might.
- D) official authority.

17

It can reasonably be inferred from the passage that the majority of students recalling the first report viewed crime in Addison as representing a

- A) physical threat that needed to be managed.
- B) failure of the city’s economic policies.
- C) commonplace occurrences in most urban areas.
- D) social epidemics that could not be contained

18

Which choice provides the best evidence that people are generally unaware of how metaphorical language affects their decision making?

- A) Lines 9-11 (“Immediately . . . reaches”)
- B) Lines 26-30 (“Researchers . . . power”)
- C) Lines 50-53 (“Where . . . language”)
- D) Lines 60-61 (“They also . . . context”)

19

The last sentence of the passage mainly serves to

- A) restate the passage’s central idea about constructing metaphors.
- B) acknowledge a potential weakness of the study’s treatment of metaphors.
- C) express concern about an apparent limitation of metaphors.
- D) reinforce a claim about how metaphors achieve their effect.

20

Assuming that an equal number of participants read passages containing “beast” and “virus” metaphors, which of the following statements about participant responses is NOT supported by figure 1?

- A) More participants offered enforcement responses to the “beast” metaphor than to the “virus” metaphor.
- B) Reform responses to the “virus” metaphor outnumbered reform responses to the “beast” metaphor.
- C) The overall percentage of participants offering reform responses was lower than the overall percentage of participants offering enforcement responses.
- D) Participants offered nearly twice the number of reform responses to the “beast” metaphor as they did to the “virus” metaphor.

21

Which of the following statements about participant responses is supported by figure 2?

- A) The percentages of participants offering enforcement to reform responses after providing “beast” or “virus” synonyms were nearly equal.
- B) The percentage of participants who came up with vivid synonyms tended to offer the greatest number of enforcement responses.
- C) The overall percentage of participants offering reform responses decreased with each repetition of the synonym task.
- D) A much larger percentage of participants providing “beast” synonyms offered reform responses than did participants providing “virus” synonyms.

**Questions 22–32 are based on the following passage and supplementary material.**

This passage is adapted from Erik Stokstad, "Bone Study Shows *T. Rex* Bulked Up with Massive Growth Spurt" ©2004 by American Association for the Advancement of Science.

*Tyrannosaurus rex* was a creature of superlatives. As big as a bull elephant, *T. rex* weighed 15 times as much as the largest carnivores living on land today. Line Now, paleontologists have for the first time charted 5 the colossal growth spurt that carried *T. rex* beyond its tyrannosaurid relatives.

Growth rates have been studied in only a half-dozen dinosaurs and no large carnivores. That's because the usual method of telling ages—counting 10 annual growth rings in the leg bone—is a tricky task with tyrannosaurids. "I was told when I started in this field that it was impossible to age *T. rex*," recalls Gregory Erickson, a paleobiologist at Florida State University, who led the study. The reason is that the 15 weight-bearing bones of large dinosaurs become hollow with age and the internal tissue tends to get remodeled, thus erasing growth lines.

But leg bones aren't the only place to check age. While studying a tyrannosaurid called *Daspletosaurus* 20 at the Field Museum of Natural History (FMNH) in Chicago, Erickson noticed growth rings on the end of a broken rib. Looking around, he found similar rings on hundreds of other bone fragments in the museum drawers, including the fibula, gastralia, and the pubis. 25 These bones don't bear substantial loads, so they hadn't been remodeled or hollowed out.

Switching to modern alligators, crocodiles, and lizards, Erickson found that the growth rings accurately recorded the animals' ages. He and his 30 colleagues then sampled more than 60 bones from 20 specimens of four closely related tyrannosaurids. Counting the growth rings with a microscope, the team found that the tyrannosaurids had died at ages ranging from 2 years to 28.

35 By plotting the age of each animal against its mass—conservatively estimated from the circumference of its femur—they constructed growth curves for each species. *Gorgosaurus* and *Albertosaurus*, both more primitive tyrannosaurids, 40 began to put on weight more rapidly at about age 12. For 4 years or so, they added 310 to 480 grams per day. By about age 15, they were full-grown at about 1100 kilograms. The more advanced *Daspletosaurus*

followed the same trend but grew faster and maxed 45 out at roughly 1800 kilograms.

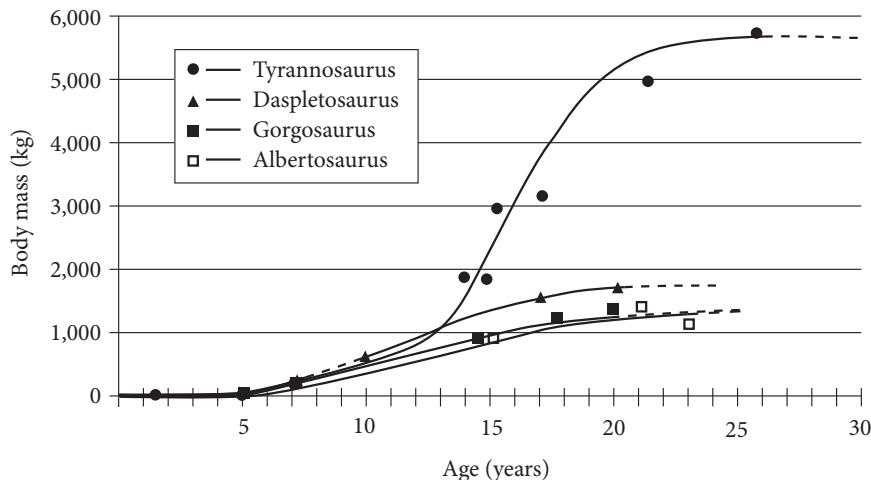
*T. rex*, in comparison, was almost off the chart. As the team describes this week in Nature, it underwent a gigantic growth spurt starting at age 14 and packed on 2 kilograms a day. By age 18.5 years, the heaviest 50 of the lot weighed more than 5600 kilograms. Jack Horner of the Museum of the Rockies in Bozeman, Montana, and Kevin Padian of the University of California, Berkeley, have found the same growth pattern in other specimens of *T. rex*.

55 It makes sense that *T. rex* would grow this way, experts say. Several lines of evidence suggest that dinosaurs had a higher metabolism and faster growth rates than living reptiles do (although not as fast as birds'). Previous work by Erickson showed that 60 young dinosaurs stepped up the pace of growth, then tapered off into adulthood; reptiles, in contrast, grow more slowly, but they keep at it for longer.

Being able to age the animals will help shed light on the population structure of tyrannosaurids. For 65 instance, the researchers determined the ages of more than half a dozen *Albertosaurs* that apparently died together. They ranged in age from 2 to 20 in what might have been a pack. "You've got really young living with the really old," Erickson says. These things 70 probably weren't loners.

The technique could also help researchers interpret the medical history of individuals. Growth rings might reveal at what age various types of injuries occurred. And because a variety of scrap bones can 75 be analyzed for growth rings, more individuals can be examined.

### Logistics Growth Curves for Tyrannosaurus and Three Related Tyrannosaurids



Adapted from Gregory M. Erickson. et al. "Gigantism and Comparative Life History Parameters of Tyrannosaurid Dinosaurs"

22

Which finding, if accurate, would most clearly undermine Erickson's theory about the growth rate of *T. rex*?

- A) As tyrannosaurids evolved into more advanced species, their growth rates increased.
- B) Growth rates for individual *T. rex* varied according to differences in medical history.
- C) *T. rex* had a significantly longer life span than other tyrannosaurids did.
- D) Bone growth ring formation in *T. rex* is a random event.

23

What does the passage indicate about tyrannosaurid bones that were not the dinosaur's primary weight bearing bones?

- A) They yield more accurate results in scientific studies than the rib bones of tyrannosaurids do.
- B) They were more prone to injury than other bones in the tyrannosaurid skeleton.
- C) They grew at a slower rate than that at which the leg bones of tyrannosaurids grew.
- D) They retained growth rings that were lost in certain other tyrannosaurid bones.

24

Which choice provides the best evidence for the answer to the previous question?

- A) Line 18 (“But leg . . . age”)
- B) Lines 22-26 (Looking . . . out”)
- C) Lines 27-33 (“Switching . . . tyrannosaurids”)
- D) Lines 72-74 (“Growth . . . occurred”)

25

As used in lines 28 and 33, “found” most nearly means

- A) located.
- B) disclosed.
- C) encountered.
- D) discovered.

26

Lines 55-56 (“It...say”) serve mainly to

- A) reintroduce a topic mentioned earlier in the passage and explores it in greater detail.
- B) transition from a set of facts to a larger context in which those facts can be considered.
- C) anticipate and refute a potential objection to the author’s argument.
- D) acknowledge the limitations of a position but suggest that those limitations are irrelevant.

27

Based on the passage, the overall pattern of the growth exhibited by *T. rex*

- A) is typical of dinosaur species that lived in packs.
- B) confirms that *T. rex* had a shorter life span than today’s reptiles do.
- C) is more like that of other tyrannosaurids than that of reptiles living today.
- D) suggests that previous estimates of *T. rex* growth rates were too conservative.

28

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 35-38 (“By plotting . . . species”)
- B) Lines 47-50 (“The team . . . 5600 kilograms”)
- C) Lines 59-62 (“Previous . . . longer”)
- D) Lines 67-70 (“They . . . loners”)

29

As used in line 67, “ranged” most nearly means

- A) aligned.
- B) varied.
- C) roamed.
- D) corresponded.

30

Based on the figure's logistic growth curves, at approximately what age did *Tyrannosaurus* surpass *Daspletosaurus* in body mass?

- A) 8 years
- B) 10 years
- C) 13 years
- D) 15 years

31

The figure's logistic growth curves support which of the following statements about *Tyrannosaurus*?

- A) *Tyrannosaurus* is estimated to have reached approximate maximum body mass at about 25 years of age.
- B) *Tyrannosaurus* is estimated to have experienced a decrease in metabolism beginning at age 15.
- C) *Tyrannosaurus* varied less in weight from one specimen to another than other tyrannosaurid species did.
- D) *Tyrannosaurus* had the largest estimated birth weight of all tyrannosaurid species.

32

Which of the following choices best identifies a point of disagreement between the figure and the passage?

- A) The passage lists the adult *Albertosaurus* as being equal in size to the adult *Daspletosaurus*, but the figure indicates that at full size *Daspletosaurus* was heavier than *Albertosaurus*.
- B) The passage states that *Albertosaurus* and *Gorgonsaurus* reached full size at about age 15, but the figure indicates that neither species reached full size until after 18.
- C) The passage asserts that the four species lived at the same time, but the figure indicates that *Tyrannosaurus* lived at a later period than the other three species did.
- D) The passage implies that *Tyrannosaurus* had a faster rate of metabolism than the other three species, but the figure indicates that all four species shared the same rate of metabolism.

**Questions 33-42 are based on the following passage.**

This passage is adapted from Ralph Waldo Emerson's "Politics". Originally published in 1844.

Every man's nature is a sufficient advertisement to him of the character of his fellows. My right and my wrong, is their right and their wrong. Whilst I do Line what is fit for me, and abstain from what is unfit, my 5 neighbor and I shall often agree in our means, and work together for a time to one end.

But whenever I find my dominion over myself not sufficient for me, and undertake the direction of him also, I overstep the truth, and come into false relations 10 to him. I may have so much more skill or strength than he, that he cannot express adequately his sense of wrong, but it is a lie, and hurts like a lie both him and me. Love and nature cannot maintain the assumption: it must be executed by a practical lie, namely, by force. 15 This undertaking for another, is the blunder which stands in colossal ugliness in the governments of the world. It is the same thing in numbers, as in a pair, only not quite so intelligible. I can see well enough a great difference between my setting myself down to 20 a self-control, and my going to make somebody else act after my views: but when a quarter of the human race assume to tell me what I must do, I may be too much disturbed by the circumstances to see so clearly the absurdity of their command. Therefore, all public 25 ends look vague and quixotic beside private ones. For, any laws but those which men make for themselves, are laughable. If I put myself in the place of my child, and we stand in one thought, and see that things are thus or thus, that perception is law for him and me. 30 We are both there, both act. But if, without carrying him into the thought, I look over into his plot, and, guessing how it is with him, ordain this or that, he will never obey me. This is the history of governments, — one man does something which is to bind another. 35 A man who cannot be acquainted with me, taxes me; looking from afar at me, ordains that a part of my labor shall go to this or that whimsical end, not as I, but as he happens to fancy. Behold the consequence. Of all debts, men are least willing to pay the taxes. 40 What a satire is this on government! Everywhere they think they get their money's worth, except for these.

Hence, the less government we have, the better, — the fewer laws, and the less confided power. The antidote to this abuse of formal Government, is,

45 the influence of private character, the growth of the Individual; the appearance of the principal to supersede the proxy; the appearance of the wise man, of whom the existing government, is, it must be owned, but a shabby imitation. That which all 50 things tend to educe, which freedom, cultivation, intercourse, revolutions, go to form and deliver, is character; that is the end of nature, to reach unto this coronation of her king.

To educate the wise man, the State exists; and with 55 the appearance of the wise man, the State expires. The appearance of character makes the State unnecessary. The wise man is the State. He needs no army, fort, or navy, — he loves men too well; no bribe, or feast, or palace, to draw friends to him; no vantage ground, 60 no favorable circumstance. He needs no library, for he has not done thinking; no church, for he is a prophet; no statute book, for he has the lawgiver; no money, for he is value; no road, for he is at home where he is; no experience, for the life of the creator 65 shoots through him, and looks from his eyes. He has no personal friends, for he who has the spell to draw the prayer and piety of all men unto him, needs not husband and educate a few, to share with him a select and poetic life. His relation to men is angelic; his 70 memory is myrrh to them; his presence, frankincense and flowers.

We think our civilization near its meridian, but we are yet only at the cock-crowing and the morning star. In our barbarous society the influence of character 75 is in its infancy. As a political power, as the rightful lord who is to tumble all rulers from their chairs, its presence is hardly yet suspected.

33

- The main purpose of the passage is to
- A) question the legitimacy of formal governments
  - B) Suggest how governments could be more effective.
  - C) argue that governments undermine communities
  - D) explain how governments discourage individuality.

34

- Over the course of this passage, the main focus shifts from
- A) a critique of the role of government to the anticipation of a new societal model.
  - B) an admission of individual poor judgment to the pursuit of human excellence.
  - C) a satiric view of government practices to an idealized view of ancient societies
  - D) a lighthearted account of people's poor treatment of one another to an earnest call for improved relations.

35

- As used in line 4, "fit" most nearly means
- A) familiar.
  - B) suitable.
  - C) healthy.
  - D) adapted

36

- The words "truth" and "false" and "lie" in lines 9-12 serve mainly to
- A) emphasize the wrongfulness of a behavior.
  - B) reveal conflicting views about an approach.
  - C) express regret over a personal attitude.
  - D) offer an ironic perspective on a situation.

37

- Emerson argues that governments make which errors in their treatment of people?
- A) They fail to educate people about civic responsibilities.
  - B) They enact policies that turn people against their neighbors.
  - C) They impose laws that may violate people's personal values.
  - D) They refuse to acknowledge their tyranny over the people they govern.

38

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 1-6 (“Every man’s . . . end”)
- B) Lines 13-14 (“Love . . . force”)
- C) Lines 24-27 (“Therefore . . . laughable”)
- D) Lines 43-46 (“The antidote . . . Individual”)

39

In the passage, Emerson characterizes taxes as

- A) clearly obsolete.
- B) largely unavoidable.
- C) wholly inadequate.
- D) fundamentally unjust.

40

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 15-17 (“This undertaking . . . world”)
- B) Lines 27-29 (“If I . . . me”)
- C) Lines 35-38 (“A man . . . fancy”)
- D) Lines 42-43 (“Hence . . . power”)

41

According to the passage, what is the wise man’s relationship to the state?

- A) The wise man effectively challenges the state.
- B) The wise man ultimately takes the place of the state.
- C) The wise man provides guidance to the state.
- D) The wise man educates the future leaders of the state.

42

It can reasonably be inferred from the last paragraph that Emerson believes that

- A) few wise people are influencing society at this time.
- B) civilization is undergoing a moral decline.
- C) a political revolution is under way.
- D) most people are dissatisfied with the current government.

**Questions 43-52 are based on the following passages.**

Passage 1 is adapted from "A Warm Little Pond?" ©2013 by The Economist Newspaper Limited. Passage 2 is adapted from Stuart Clark, "Fire & Ice: What Really Happened to Water on Mars." ©2008 by Reed Business Information, Ltd.

**Passage 1**

Soon after it formed about 4.5 billion years ago, liquid water seems to have flowed over the surface of the planet. Its climate may also have been warmer than it is today, courtesy of an atmosphere much

5 thicker than its wispy modern counterpart. But what the Curiosity rover [which landed on Mars in 2012] has done is to suggest that all the ingredients for life were present in one specific place, and for a reasonably long stretch of time.

10 That place is what appears to be part of a dried up lake bed called Yellowknife Bay just south of the Martian equator. Analysis by Curiosity revealed the presence of mudstone, a type of rock formed by fine grains of sediment settling out of a column of calm, 15 still water. The surrounding geology supports that hypothesis, with evidence of ancient river channels that lead into a lake which would have been about 50km (30 miles) long and 5km wide.

Chemical analysis of Yellowknife Bay's rocks 20 bolsters the researchers' case. The six elements held by biologists to be fundamental to Earthlike life—carbon, hydrogen, oxygen, sulphur, nitrogen and phosphorous—are all present. Better still, the rocks suggest the ancient lake was neither too acidic, nor 25 too alkaline, nor too salty.

And it may have persisted for quite some time. By measuring the thickness of the strata, and 30 making some educated estimates about how quickly they might have formed, John Grotzinger and his colleagues reckon the lake could have endured for anything from centuries to millennia. Add in a little plausible speculation—specifically, that there may be 35 more sedimentary rocks buried beyond Curiosity's reach, or that other rocks may have eroded over the course of time—and the lake's possible lifespan rises to tens of millions of years. The surface may not have been wet for all of that period, notes Dr Grotzinger, but groundwater could have persisted even when the surface was temporarily dry.

**Passage 2**

40 According to the conventional view, from soon after its formation about 4.5 billion years ago until 2 to 2.5 billion years ago, Mars was a watery world like Earth, with luxuriant seas, perhaps even an ocean, that might have supported life. These large bodies of 45 water were gradually lost through climate change, caused by a decline in volcanic activity and the whittling away of the planet's atmosphere by radiation from the Sun. Some water remained frozen in the polar caps, but most drained downwards into the 50 rocks and froze.

While there can be no mistaking that water did exist on Mars in large quantities, as new information from Mars's many probes and landers comes in, it is looking increasingly likely that this simple tale 55 isn't true. Instead, the "warm, wet phase" of Mars, when life might have originated, was actually quite short-lived, lasting less than a billion years, and was followed by a series of extreme conditions unlike any experienced on Earth.

60 If this is true, Mars's reputation as a once-habitable planet that may still harbor microscopic life is at stake. A billion years might well have been long enough for life to emerge, but the speed with which those conditions vanished would have made it much 65 more difficult for that early life to truly establish itself.

The main evidence for this new view of Mars comes from recent observations of the planet's surface. Gerhard Neukum used images from the High Resolution Stereo Camera on the European Space

70 Agency's Mars Express probe [which reached its working orbit in 2004] to date the Martian surface, using the number of craters present as a yardstick. Since planets were most severely bombarded early in the formation of the solar system, and since lava from 75 Mars's volcanoes can cover evidence of bombardment. Neukum assumed that areas with fewer craters are younger.

Neukum's analysis found no evidence to support the conventional view that Mars lost its water once, 80 very slowly over billions of years. Instead, it seemed that the water disappeared within a billion years of the planet's formation and then reappeared five times following major volcanic upheavals. The earliest of these mega-eruptions took place 3.5 billion years ago, 85 with repeat performances 1.5 billion, 800 million, 200 million, and 100 million years ago.

During these episodes, major releases of lava partially resurfaced the planet. This sudden outpouring of internal heat thawed frozen reserves 90 of underground water and drove it upwards to the surface. These events may not have lasted more than a few tens of thousands of years but they left ample evidence of water on the surface of the planet in the form of outflows channels, river beds, and even 95 shorelines.

43

The author of Passage 1 indicates that the data collected by the Curiosity rover at Yellowknife Bay are significant because they

- A) raise the possibility that the conditions necessary for life were met at that location.
- B) prove that liquid water lasted longer on Mars than scientists previously believed.
- C) suggest that a large amount of frozen groundwater is present in that area.
- D) imply that microscopic life may be found in sedimentary rocks nearby.

44

In passage 2, what is the main purpose of the third paragraph (lines 60-65) in relation to the passage's discussion of Neukum?

- A) To concede that Neukum's study is controversial
- B) To explain the main issues addressed by Neukum's research
- C) To describe a significant implication of Neukum's findings
- D) To discuss a possible error in Neukum's analysis.

45

As used in lines 65, "truly establish itself" most nearly means

- A) reach a secure and lasting state.
- B) first come into being.
- C) be recognized by experts as life.
- D) leave fossil traces behind.

46

It can most reasonably be inferred from Passage 2 that some areas of Mars's surface that display evidence of having had liquid water in the relatively recent past also display

- A) significant quantities of water in the form of ice caps.
- B) features that were formed by volcanic activity less than 100 million years ago.
- C) fewer craters than would be expected if those areas had formed early in Mars's development.
- D) extensive reserves of frozen groundwater that show signs of having thawed in the past.

47

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 44-50 ("These . . . froze")
- B) Lines 51-59 ("While . . . Earth")
- C) Lines 66-72 ("The main . . . yardstick")
- D) Lines 73-77 ("Since . . . younger")

48

As used in line 73, “severely” most nearly means

- A) strictly.
- B) intensely.
- C) arduously.
- D) plainly.

49

The primary purpose of the passage is to

- A) advance a theory about why Mars was unable to retain its liquid water.
- B) discuss findings relevant to the question of how long liquid water was present on Mars.
- C) summarize the arguments about whether Mars ever had a large enough body of water to sustain life.
- D) describe evidence suggesting that elements necessary for life were once abundant on Mars.

50

Based on the presentation of Neukum’s views in Passage 2, Neukum would most likely agree with which claim about the surface features of Yellowknife Bay that are described in Passage 1?

- A) They must have formed between 2 and 2.5 billion years ago.
- B) They were likely formed by flowing lava rather than by persistent liquid water.
- C) They were formed by the ocean that was lost due to declining volcanic activity and the gradual loss of Mars’s atmosphere.
- D) They may have been formed by thawed groundwater that was on the surface for only a brief period.

51

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 40-44 (“According . . . life”)
- B) Lines 80-83 (“Instead . . . upheavals”)
- C) Lines 87-88 (“During . . . planet”)
- D) Lines 91-95 (“These . . . shorelines”)

52

The author of Passage 2 would most likely agree with which statement about the estimate for the life span of the lake at Yellowknife Bay that is offered in Passage 1?

- A) The estimate is unverifiable, since the site of the lake has been significantly altered by cratering.
- B) The estimate is likely wrong, since it assumes that the lake could have been formed only by liquid water.
- C) Even if the high end of the estimate is correct, there was not enough time for life to have thrived in the lake.
- D) Although the estimate is probably right, the lake formed much earlier in Mars’s history than is assumed.

**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 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.

### Green Energy Gets Literal

At a time of urgent global need to reduce dependence on fossil fuels, scientists and engineers 1 are searching for alternative sources of energy. Lately, they have

1

Which choice best introduces the information presented in the paragraph?

- A) NO CHANGE
- B) continue to study the effects of global warming.
- C) are urging consumers to invest in fuel-efficient vehicles.
- D) are studying various forms of sustainable architecture.

turned their attention to **2** biofuels. The generation of biofuels from microorganisms, such as algae, has distinct advantages over **3** plants when it comes to the generation of biofuels; algae have a faster rate of growth, require less space in which to grow, and **4** make way more oil per amount of biomass than do plants.

**2**

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

biofuels, which can be produced from either plants or microorganisms.

Should the writer make this revision?

- A) Yes, because it articulates the main idea of the passage.
- B) Yes, because it introduces a distinction that is further developed in the paragraph.
- C) No, because it contains an irrelevant detail that blurs the focus of the paragraph.
- D) No, because it diverges from the passage's emphasis on microorganisms.

**3**

- A) NO CHANGE
- B) the generation of biofuels from plants:
- C) the biofuels generated from plants:
- D) plants when comparing methods of biofuel generation:

**4**

- A) NO CHANGE
- B) manufacture a more plentiful yield of oil.
- C) fabricate a more massive output of oil.
- D) produce a higher oil yield.

The Bio Intelligent Quotient (BIQ) building, an apartment complex in Hamburg, Germany, was designed to test the efficiency of algal energy. **5** One hundred twenty-nine bioreactors were made of glass panels. These panels were attached to the building's facade. Algae grow in between the glass panels of each bioreactor and provide heat energy for the building. Like plants, **6** however, algae require only a supply of nutrients and water because they synthesize their own carbohydrates by converting light energy from the Sun **7** for chemical energy during the process of photosynthesis.

5

Which choice most effectively combines the underlined sentences?

- A) One hundred twenty-nine bioreactors made of glass panels were attached to the building's facade.
- B) Made of glass panels, bioreactors, one hundred twenty-nine in total, were attached to the building's facade.
- C) After being made of glass panels, one hundred twenty-nine bioreactors were attached to the building's facade.
- D) Attached to the building's facade there were one hundred twenty-nine bioreactors, and these were made of glass panels.

6

- A) NO CHANGE
- B) for instance,
- C) on the other hand,
- D) DELETE the underlined portion.

7

- A) NO CHANGE
- B) in
- C) into
- D) through

Using energy from photosynthesis, **8** during summer months the algae rapidly reproduce. When they've accumulated beyond the space capacity of the bioreactors, the algae can be harvested and taken to an off-site power plant, where the biomass is used to produce methane gas. **9** As an added bonus during the summer **10** months, the growing algae in the bioreactors provide shade, which reduces the building's energy consumption.

**8**

- A) NO CHANGE
- B) summer months are when the algae rapidly reproduce.
- C) it is during the summer months that the algae rapidly reproduce.
- D) the algae rapidly reproduce during the summer months.

**9**

The writer is considering adding the following sentence.

The methane gas is, in turn, used to generate electricity.

Should the writer make this addition here?

- A) Yes, because it elaborates on the information presented in the preceding sentence.
- B) Yes, because it introduces an idea that is further developed in the next sentence.
- C) No, because it conveys information that is unrelated to the passage.
- D) No, because it blurs the focus of the paragraph by introducing irrelevant information.

**10**

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

During winter months, the algae reproduce more slowly but can still supply all of the heat for the BIQ building. Not only do the algae generate heat as they reproduce, but the panels in the bioreactors also absorb additional light energy from the Sun. Heat exchangers then transfer this built-up heat from the bioreactors to water **11** tanks, these are used to heat the building's water supply as well as provide general heating for the building. The building also has another system of heat exchangers that transfers excess heat into water-filled holes 80 meters belowground. This stored heat can then be accessed during times when sufficient heat cannot be captured from the bioreactors.

Biologist Stefan Hindersin, whose firm developed the facades' bioreactor technology, says that Hamburg is famous for its long winters, but "if we can get this running in Hamburg, we can do it nearly everywhere." The BIQ building project has certainly demonstrated the versatility of algae as a biofuel source, and because the algae grow in bioreactors attached to the building, the project has proved to be a biofuel model of space efficiency.

11

- A) NO CHANGE
- B) tanks, which
- C) tanks, and which
- D) tanks being those that

**Questions 12–22 are based on the following passage.**

**Dudley Randall and Broadside Press**

Seeking to promote and popularize the work of African American artists during the 1960's, the Black Arts movement was faced with a challenge. How could the movement, in the words of Detroit poet Dudley Randall, "bring poetry to the people"? Randall's 1965 formation of Broadside Press, a small publishing company based in Detroit, provided an answer to **12** those. Randall had the idea to revive a very old type of publication; the broadside, a single-page work meant to be distributed and displayed publicly. Inexpensive to produce and **13** market, and broadsides typically responded to political and social issues of the day.

12

- A) NO CHANGE
- B) them.
- C) this question
- D) these objections

13

- A) NO CHANGE
- B) market; also,
- C) market,
- D) market;

14 Randall knew broadsides were one of the most common publications in Britain, Ireland, and North America from the sixteenth through the nineteenth centuries. He planned to feature brief poems by a range of writers that would speak to the concerns of the African American community. By pricing the 8-by-11 inch sheets at 50 cents and 15 selling them at community centers, shops, and street corners as well as at local bookstores, Randall sought to position poetry within daily life and reach consumers who might not normally purchase poetry. He also aimed to elevate broadsides to the status of art objects to be savored. To this end, Randall's broadsides would combine poetry with visual art, featuring bold typography and illustrations.

14

Which choice provides the best transition from the previous paragraph?

- A) NO CHANGE
- B) Although broadsides were historically used to print advertisements, news, or proclamations, many modern publishers use the format to produce a combination of literature and art.
- C) After establishing Broadside Press in 1965, Randall first ran the press out of his home on Detroit's west side.
- D) Though broadsides had fallen out of popular use in the twentieth century, Randall believed they could serve a purpose in 1960s Detroit.

15

Which choice gives a second example that supports the idea that Randall tried to reach consumers who did not normally purchase poetry?

- A) NO CHANGE
- B) despite the fact that his academic background was in English and library science,
- C) building on his experience working at the Ford Motor Company from 1932 to 1937,
- D) even though he sometimes published volumes of poetry instead of simple broadsheets,

[1] The first series of six broadsides issued by

Broadside Press [16] featured works by well-known African American writers. [2] This debut legitimized Randall's venture while breathing avant-garde life into familiar poems. [3] For example, Pulitzer Prize-winning poet Gwendolyn Brooks's famous poem "We Real Cool" was redesigned for Broadside Press with [17] capitalized, uppercase, oversized white lettering against a black background. [4] Inclusion in Randall's initial series of broadsides marked a turning point for Brooks. [5] The lettering, which resembled writing on a chalkboard, gave the poem new [18] resplendence by rendering the perspective of the poem's [19] speakers—a group of teenagers—at the level of typography. [6] Soon afterward, she abandoned Harper and Row Publishers and began working exclusively with Broadside Press. [7] She was delighted to see her work, as well as other poems by established and emerging artists, tucked into wallets and displayed in shop windows. [20]

16

- A) NO CHANGE
- B) has featured
- C) feature
- D) had featured

17

- A) NO CHANGE
- B) capitalized,
- C) capitalized, large
- D) uppercase, large

18

- A) NO CHANGE
- B) reverberation
- C) resonance
- D) vim and vigor

19

- A) NO CHANGE
- B) speakers, a group of teenagers
- C) speakers a group of teenagers,
- D) speakers—a group of teenagers

20

To make this paragraph most logical, sentence 4 should be placed

- A) where it is now.
- B) after sentence 2.
- C) after sentence 5.
- D) after sentence 6.

From 1965 to 1975 Broadside Press issued nearly a hundred broadsides, around one per month, even as it [21] expended to include other print media. [22] Developing new styles of typography, Broadside Press played an important role in the Black Arts movement.

21

- A) NO CHANGE
- B) expanded to
- C) expanded too
- D) extended too

22

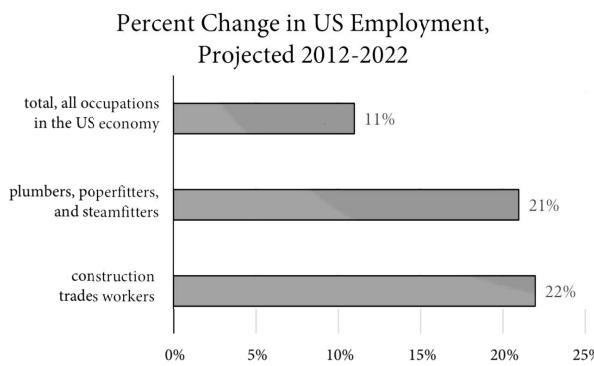
Which choice best summarizes the passage's main argument about Broadside Press?

- A) NO CHANGE
- B) Serving as Brooks's sole publisher,
- C) By providing new ways of connecting artists and audiences,
- D) Competing even with large, established publishing companies,

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

### Fair Trades

The total number of jobs available in the United States is projected to **23** increase 1 percent from 2012 to 2022. However, the number of skilled-trade jobs is projected to increase at around double that amount. The fact that most trade jobs must be performed by skilled humans, not machines, **24** make them very secure. **25** Furthermore, a combination of government policy changes, demographic trends in the workforce, and **26** there are other factors that will likely ensure a steady supply of these jobs for years to come. As the examples of plumbing, pipefitting, and steamfitting demonstrate, **27** the most important factor to consider when choosing a future profession is the average compensation of jobs in the field.



Adapted from US Bureau of Labor Statistics, Employment Projections Published in 2014

23

Which change offers an accurate interpretation of the data in the chart?

- A) NO CHANGE
- B) decline to half its current level
- C) increase 11 percent
- D) stay at about the same level

24

- A) NO CHANGE
- B) are what makes
- C) have made
- D) makes

25

- A) NO CHANGE
- B) However,
- C) That said,
- D) Accordingly,

26

- A) NO CHANGE
- B) other factors
- C) being other factors that
- D) with other factors

27

- A) NO CHANGE
- B) skilled-trade jobs are a sensible career choice that many young people may wish to consider.
- C) the short-term prospects of skilled-trade jobs are good, but no one can predict their long-term development.
- D) the outlook for skilled-trade jobs ultimately depends on governmental policy.

Plumbers, pipefitters, and steamfitters are **28** specialists. They all perform variations of the same tasks; installing and maintaining the pipe systems that carry liquids and gases through homes, business, and factories. These jobs do not require a college degree, but training can take just as long as getting a degree; tradespeople typically apprentice with an experienced supervisor for four to five years before they are considered fully trained and licensed. Once licensed, these workers receive pay that compares favorably with that of many other **29** occupations: the median yearly pay for plumbers is \$49,140.

Because the maintenance and repair of plumbing and pipe systems are crucial, there will always be a basic need for the services of plumbers, pipefitters, and steamfitters. These jobs are projected to be in especially high demand in the near future. **30** More scrupulous government regulations are expected to increase the need for new fire sprinkler systems and low-flow toilets and showerheads. New construction is also on the rise, creating more job opportunities for those workers who have the knowledge and skill to install complicated pipe systems in houses and commercial buildings.

**28**

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

- A) specialists who all perform
- B) specialists, and they specialize in performing
- C) specialized performers who do
- D) specialized in the performance of

**29**

- A) NO CHANGE
- B) occupations': the median yearly pay for plumbers'
- C) occupations; the median yearly pay for plumber's
- D) occupations; the median yearly pay for plumbers

**30**

- A) NO CHANGE
- B) More disciplinary
- C) More obstinate
- D) Stricter

[1] In the United States, 53 percent of skilled-trade workers are 45 or older, whereas only 44 percent of the overall US workforce falls into this age range. [2] According **31** to—the executive officer of the Dallas Builders Association, the average age of plumbers is 56. [3] Fewer than 5 percent of skilled-trade workers continue working after they turn 65, in large part because trade occupations tend to be more physically taxing than other kinds of work. [4] Demand for these trades will be further compounded by the aging of the current workforce. [5] Given the competitive salary and the current and expanding demand for plumbing, pipefitting, and **32** steamfitting; these and similar trades are likely to be very attractive to the next generation of US workers. **33**

31

- A) NO CHANGE
- B) to the executive officer,
- C) to; the executive officer
- D) to the executive officer

32

- A) NO CHANGE
- B) steamfitting. These
- C) steamfitting, these
- D) steamfitting—these

33

To make this paragraph most logical, sentence 4 should be placed

- A) where it is now.
- B) before sentence 1.
- C) after sentence 1.
- D) after sentence 5.

Questions 34–44 are based on the following passage.

**Frank Lloyd Wright and the Promise of Broadacre**

In a 1932 *New York Times Magazine* [34] article, legendary American architect, Frank Lloyd Wright sketched out his vision for Broadacre, the perfect city. Wright went on to draw detailed plans for his utopia, plans that included, among other [35] features, homes, factories, schools, and parks. In 1935 in New York City, Wright unveiled an intricate 12-foot-by-12-foot model of [36] Broadacre, that was exhibited extensively throughout the United States for years after its debut. Fueled by Wright's boundless imagination and relentless promotion, Broadacre became the most influential city that never was.

34

- A) NO CHANGE
- B) article, legendary American architect
- C) article, legendary, American architect
- D) article legendary American architect,

35

- A) NO CHANGE
- B) features; homes, factories, schools,
- C) features; homes, factories, schools
- D) features---homes, factories schools,

36

- A) NO CHANGE
- B) Broadacre. Which was
- C) Broadacre, which was
- D) Broadacre; that

[1] Broadacre was Wright's rejection of the modern city, which he considered unhealthy, unsightly, and unsafe. [2] The design incorporates large swaths of green space. [3] Houses are clustered together in fields or built on one-acre plots. [4] There are a few skyscrapers, but they're surrounded by small farms. [5] The buildings are connected by tree-lined superhighways. **37**

Broadacre's legacy can be seen in today's cities as well. Wright's design includes several "mixed-use" zones, where residential, recreational, and commercial life converge. Many cities are currently embracing this approach as they convert warehouses into apartments, turn railroad tracks into bike paths, and build homes in close proximity to businesses. Municipalities are replacing **38** vegetation that has solely ornamental value with food-producing plants for community use, which Wright also advocated.

**37**

The writer wants to add the following sentence.

These design elements, along with the planned community's reliance on cars, foreshadow the appearance of American suburbia.

To make the paragraph most logical, the sentence should be placed

- A) after sentence 1.
- B) after sentence 2.
- C) after sentence 3.
- D) after sentence 5.

**38**

- A) NO CHANGE
- B) plants that have nothing but ornamentation to offer
- C) ornamental vegetation
- D) vegetation

Wrights Broadacre designs are inviting and innovative.

Broadacre would not have been so influential, **39** though, had Wright limited himself to architectural niceties. For Wright, Broadacre was as much a manifesto as a model. It **40** boosted the individual and abolished anonymity and uniformity. It encompassed a bountiful landscape that could provide nourishment for **41** their residents. It was nothing less than a blueprint for a more perfect society. Wright boldly declared that in Broadacre, **42** “unwholesome life would get no encouragement and the ghastly heritage left by overcrowding in overdone ultra-capitalistic centers would be likely to disappear.”

**39**

- A) NO CHANGE
- B) on the other hand,
- C) therefore,
- D) in other words,

**40**

Which choice most strongly emphasizes Wright’s commitment to the individual in Broadacre, as presented in the paragraph?

- A) NO CHANGE
- B) championed
- C) supported
- D) helped

**41**

- A) NO CHANGE
- B) its residences.
- C) its residents.
- D) his residents.

**42**

Which quotation by Wright most effectively supports the main idea of the paragraph?

- A) NO CHANGE
- B) “the school problem is solved by segregating a group of low buildings in the interior spaces of the city where the children can go without crossing traffic.”
- C) “every kind of builder would be likely to have a jealous eye to the harmony of the whole within broad limits fixed by the county architect.”
- D) “architecture—in the broad sense—would thrive.”

Wright was not alone in his belief in Broadacre as a beacon of hope for an improved urban future. He rallied sixty-four prominent **43** Americans to sign a petition asking the US government to award him unlimited funds to build Broadacre. The government **44** hasn't granted Wright carte balance to build his dream, yet the designs of Broadacre and the longing for more humane and livable cities endure.

43

The writer is considering revising the underlined portion as follows.

Americans, including artist Georgia O'Keeffe, philosopher John Dewey, and playwright Thornton Wilder.

Should the writer make his revision?

- A) Yes, because it strengthens the claim made in the previous sentence by naming some of Wright's supporters.
- B) Yes, because it provides insight into what kinds of professions were considered to be influential in Wright's day.
- C) No, because it doesn't demonstrate that the people listed were prominent during Wright's time.
- D) No, because it doesn't list any prominent architects as Broadacre supporters.

44

- A) NOCHANGE
- B) wasn't going to grant
- C) didn't grant
- D) won't grant

**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.

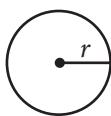
## DIRECTIONS

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.

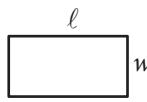
## NOTES

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.

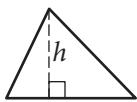
## REFERENCE



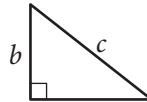
$$\begin{aligned} A &= \pi r^2 \\ C &= 2\pi r \end{aligned}$$



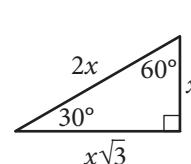
$$A = \ell w$$



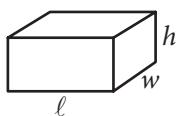
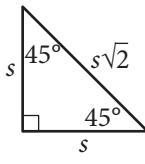
$$A = \frac{1}{2}bh$$



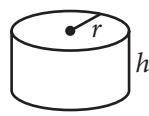
$$c^2 = a^2 + b^2$$



Special Right Triangles



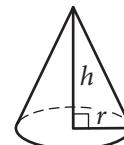
$$V = \ell wh$$



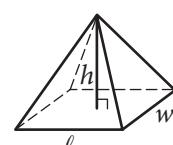
$$V = \pi r^2 h$$



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



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



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

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.



1

A contractor rents a power saw for an initial fee of \$15 and an additional fee of \$12 per day. Which of the following represents the total cost  $c$ , in dollars, to rent a power saw for  $d$  days?

- A)  $c = 27d$
- B)  $c = 15(d + 12)$
- C)  $c = 12d + 15$
- D)  $c = 15d + 12$

2

A baker is making cakes. The recipe requires 3 eggs per cake, and the baker has 100 eggs before beginning the first cake. If the baker uses the eggs only for making the cakes, which of the following expressions represents the number of unused eggs after  $c$  cakes have been made?

- A)  $100 + 3c$
- B)  $100 - 3c$
- C)  $3c - 100$
- D)  $\frac{100}{3}c$

3

$$y = \chi^2$$

$$y = \chi$$

Which of the following ordered pairs  $(x, y)$  is a solution to the system of equations above?

- A)  $(-1, -1)$
- B)  $(-1, 1)$
- C)  $(1, -1)$
- D)  $(1, 1)$



4

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

Which of the following is equivalent to the expression above?

- A)  $2x^3 - 11x^2 + 23x - 20$
- B)  $2x^3 - x^2 + 23x - 20$
- C)  $2x^3 - 5x^2 + 8x - 20$
- D)  $x^2 - x - 1$

5

Two warehouse employees need to move microwave ovens and televisions that weigh 45 pounds and 85 pounds, respectively, using a freight elevator. The freight elevator can hold a maximum of 2,400 pounds. Together, the employees and their loading equipment weigh 400 pounds. What is the maximum number of microwave ovens the two employees can take on the elevator if both employees, the loading equipment, and 20 televisions are in the elevator?

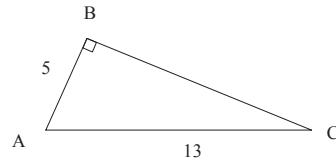
- A) 5
- B) 6
- C) 7
- D) 20

6

A hotel has two types of rooms: superior rooms that cost \$100 per night and basic rooms that cost \$80 per night. On a given night, the hotel received \$4,200 from renting 46 rooms. How many superior rooms were rented on that night?

- A) 20
- B) 21
- C) 26
- D) 30

7



Triangle  $ABC$  above is similar to triangle  $DEF$  (not shown) where vertices  $A$ ,  $B$ , and  $C$  correspond to vertices  $D$ ,  $E$ , and  $F$ , respectively. If  $DE = 10$ , what is the area of triangle  $DEF$ ?

- A) 30
- B) 60
- C) 120
- D) 180



8

$$\begin{aligned}3x - 6 &= y \\3y - 6 &= x\end{aligned}$$

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

- A) 3
- B) 6
- C) 12
- D) 18

9

A local movie theater is holding a fund-raiser for the South School. For each child ticket sold, the theater will donate \$2.25. For each adult ticket sold, the theater will donate \$3.50. Assuming the theater will sell 150 child tickets, which inequality can be used to determine the number of adult tickets,  $x$ , that will need to sell in order to donate at least \$1,000 to South School?

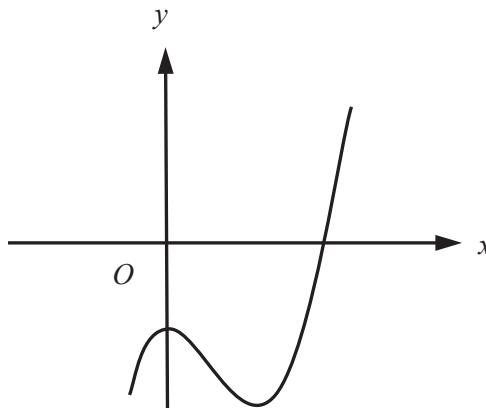
- A)  $3.5x \leq 662.5$
- B)  $3.5x \geq 662.5$
- C)  $3.5x \leq 1,337.5$
- D)  $3.5x \geq 1,337.5$

10

Which of the following is equivalent to  $\frac{x^2y}{x^4y^2}$  for all  $x > 0$  and all  $y > 0$ ?

- A)  $\frac{\sqrt{y}}{x^2}$
- B)  $\frac{x^2}{y^{\frac{1}{2}}}$
- C)  $x^2\sqrt{y}$
- D)  $x^6\sqrt{y^3}$

11



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

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

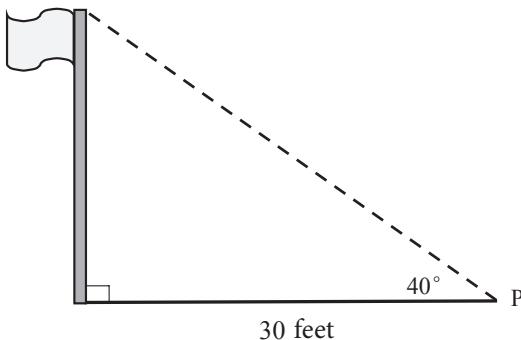


12

The kinetic energy of an object  $k$ , in joules, can be represented by the formula  $k = \frac{1}{2}mv^2$ , where  $m$  is the mass of the object, in kilograms, and  $v$  is the speed at which the object is traveling, in meters per second. Which of the following correctly shows the speed of the object in terms of its kinetic energy and mass?

- A)  $v = \sqrt{\frac{2k}{m}}$
- B)  $v = \sqrt{\frac{2m}{k}}$
- C)  $v = \frac{\sqrt{2m}}{k}$
- D)  $v = \sqrt{2mk}$

13



In the figure above,  $P$  is a point on the ground 30 feet from the base of a flagpole. The angle of elevation from point  $P$  to the top of the flagpole is  $40^\circ$ , and the tangent of  $40^\circ$  is approximately 0.84. Of the following, which is the closest to the height of the flagpole?

- A) 21 feet
- B) 23 feet
- C) 25 feet
- D) 27 feet



14

Which of the following is equivalent to  $\frac{2}{x+2} + \frac{1}{x+1}$  for  $x > 0$ ?

- A)  $\frac{3}{x+3}$
- B)  $\frac{2x+3}{x+3}$
- C)  $\frac{2x+3}{x^2+3x+2}$
- D)  $\frac{3x+4}{x^2+3x+2}$

15

$$3x^3 + bx^2 - 27x - 9b$$

In the polynomial above,  $b$  is constant. Which of the following is a factor of the polynomial?

- A)  $x + 3$
- B)  $x + b$
- C)  $3x^3 + b$
- D)  $x^2 + 9$

**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.

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

Grid in result.

Answer:  $\frac{7}{12}$  ← Fraction line

Answer: 2.5 ← 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

.	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

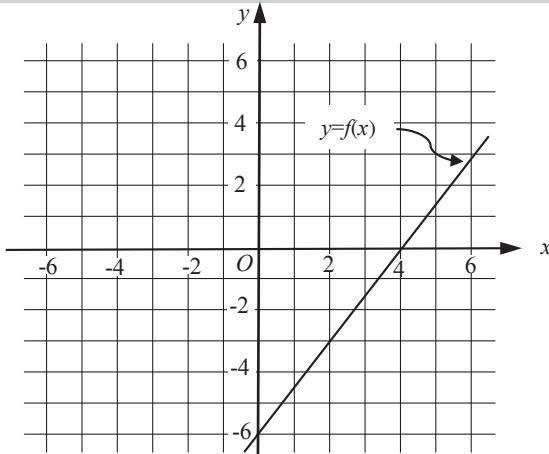
2	0	1
0	0	0
1	1	1
2	2	2
3	3	3

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



The graph of the linear function  $f$  is shown in the  $xy$ -plane above. What is the  $y$ -intercept of the line that is parallel to the graph of  $f$  and passes through the point  $(-4, 0)$ ?

17

The expression  $-4.9t^2 + 23.2t + 1.8$  represents the height, in meters, of a ball  $t$  seconds after it was thrown straight up into the air. What was the initial height, in meters, of the ball when it was thrown?

18

The quadratic equation  $9x^2 + 3 = 147$  has two solutions. What is the sum of the solutions?



19

The product of the two complex numbers  $+2i$  and  $7 + 6i$  is written in the form  $a + bi$  where  $a$  and  $b$  are real numbers. What is the value of  $b$ ? (Note:  $i = \sqrt{-1}$ )

20

$$an + 2 = a(n + 2) + 0.8$$
  
If  $n = -3$  in the equation above, 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.

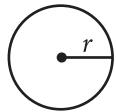
## DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding 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.

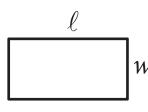
## NOTES

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.

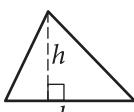
## REFERENCE



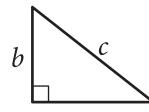
$$\begin{aligned}A &= \pi r^2 \\C &= 2\pi r\end{aligned}$$



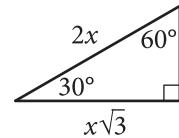
$$A = \ell w$$



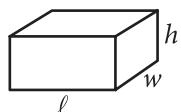
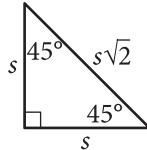
$$A = \frac{1}{2}bh$$



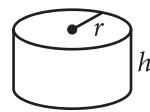
$$c^2 = a^2 + b^2$$



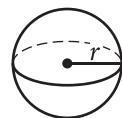
Special Right Triangles



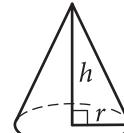
$$V = \ell wh$$



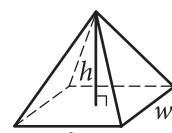
$$V = \pi r^2 h$$



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



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



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

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

Yin mowed  $m$  lawns each day for 8 days. In terms of  $m$ , what is the total number of lawns Yin mowed in the 8 days?

- A)  $8m$
- B)  $\frac{8}{m}$
- C)  $m^8$
- D)  $8 + m$

2

One brand of a commercial ice machine can produce a maximum of 263 pounds of ice each day. If 1 cubic foot of ice weighs about 57.2 pounds, which of the following best approximates the maximum number of cubic feet of ice the machine can produce in one day?

- A) 0.2
- B) 4.6
- C) 206
- D) 320

3

$$(x + 1) - 2(x + 1) = 0$$

What is the solution  $x$  to the equation above?

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

4

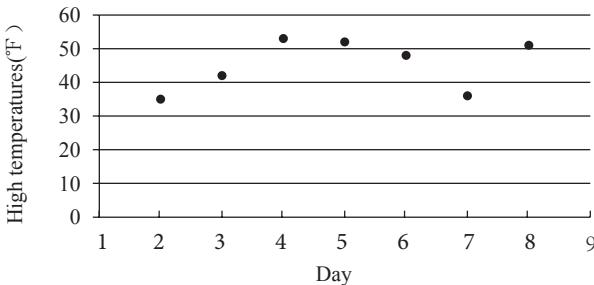
At a large college, of the students working toward a degree in English, 250 were selected at random and asked how many books, on average, they read each month. The results of this survey can be best generalized to which of the following populations?

- A) All students at the same large college
- B) Any sample of 250 students at the same large college
- C) All students working toward a degree in English at any college
- D) All students working toward a degree in English at the same large college



5

A meteorologist records the daily high temperature, in degrees Fahrenheit( $^{\circ}\text{F}$ ), over the course of a week in a city as shown below.



Between which two consecutive days did the greatest increase in high temperature take place?

- A) Day 2 and day 3
- B) Day 4 and day 5
- C) Day 5 and day 6
- D) Day 6 and day 7

6

Over a two-year period, scientists searched for neutrinos (subatomic particles) that are produced outside of the solar system. The energy,  $E$ , of the neutrinos is measured in units of electron volts (TeV). The table below shows the results of the scientists' investigation.

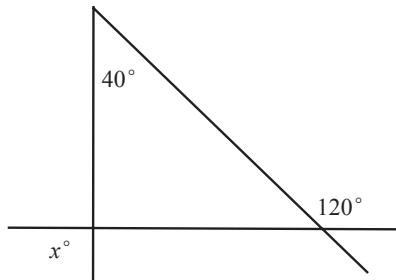
Neutrino energy $E$ (TeV)	Number of neutrinos detected
$E \leq 30$	1
$30 \leq E < 60$	10
$60 \leq E < 90$	7
$90 \leq E < 120$	3
$120 \leq E < 150$	0
$E > 150$	7

Approximately what percentage of neutrinos detected had an energy of 90 TeV or less?

- A) 18%
- B) 25%
- C) 64%
- D) 75%



7



In the figure above, the sides of a triangle are extended as shown. What is the value of  $x$ ?

- A) 80
- B) 70
- C) 60
- D) 40

8

In a soccer league, each team receives 3 points for a win, 1 point for a tie, and 0 points for a loss. The Blue Jersey team has no losses and a total of 36 points after playing 18 games. Which system of equations could be used to solve for the number of wins and ties, where  $w$  is the number of wins and  $t$  is the number of ties?

- A)  $3w + t = 36$   
 $w + t = 18$
- B)  $3w + t = 18$   
 $w + t = 36$
- C)  $3w + 3t = 36$   
 $w + t = 18$
- D)  $3w + 3t = 12$   
 $w + t = 18$

9

An investor receives dividend payments that are 5% of a business's monthly profits. The table below shows the amount  $A$ , in dollars, the investor received and the business's profits, in dollars, for each of four months.

Monthly Profits and Dividend Payments

Month	$p$ , in dollars	$A$ , in dollars
January	100,000	5,000
February	120,000	6,000
March	144,000	7,200
April	172,800	8,640

Which of the following is equations represents the relationship between  $p$  and  $A$ , where  $k$  is a positive constant?

- A)  $A = k^p$
- B)  $A = p^k$
- C)  $A = p + k$
- D)  $A = kp$

10

$$f(x) = \sqrt{x}$$

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

What is the value of  $f(g(-27))$ ?

- A) 27
- B) -27
- C)  $\sqrt{27}$
- D)  $f(g(-27))$  is not a real number.



11

## Musical Works of Two Composers

Musical works	Composer	
	Mozart	Haydn
Symphony	61	106
Concerto	79	45
Piano music	68	19
Opera	23	29

The table above shows the number of each of four different types of music composed by Mozart and Haydn . If a concerto composed by one of these composers is selected at random, what is the probability that Haydn was the composer?

- A)  $\frac{199}{430}$
- B)  $\frac{45}{430}$
- C)  $\frac{45}{199}$
- D)  $\frac{45}{124}$

12

This week, Maxine can work a maximum of 30 hours and needs to earn at least \$425. Her job at a mall pays \$12 per hour, and her job at a college pays \$15 per hour. If  $x$  represents the number of hours worked at the mall and  $y$  represents the number of hours worked at the college, which of the following systems of inequalities represents the situation ?

- A)  $x + y \leq 30$   
 $x + y \geq 425$
- B)  $x + y \geq 30$   
 $12x + 15y \leq 425$
- C)  $x + y \leq 30$   
 $15x + 12y \geq 425$
- D)  $x + y \leq 30$   
 $12x + 15y \geq 425$

13

Which of the following is equivalent to the expression  $1 - x + x^2 - x^3$  ?

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



**Questions 14–16 refer to the following information.**

Ratings Given to a Movie on Release Night

	1	2	3	4	5	Total
Adults	13	35	103	82	17	250
Children	6	22	27	70	25	150
Total	19	57	130	152	42	400

On the first night of each movie's release, the manager of a movie theater asks the people who saw the movie to rate it on a scale of 1(worst) to 5(best). The table above summarizes the responses of all 400 viewers of one particular movie.

14

How does median rating of the adults who saw the movie compare to the median rating of the children who saw the movie?

- A) The median ratings are the same.
- B) The median rating of the adults is greater.
- C) The median rating of the children is greater
- D) The table does not give enough information to compare the medians .

15

What fraction of the adults surveyed gave a rating of 4 or 5 to the movie?

- A)  $\frac{82}{250}$
- B)  $\frac{99}{250}$
- C)  $\frac{194}{400}$
- D)  $\frac{99}{194}$

16

If the theater manager assumes the surveyed group is representative of the first 4000 people to view the movie at this theater, about how many of the 4000 people would the theater manager expect to rate the movie a 2 or lower ?

- A) 380
- B) 760
- C) 1064
- D) 3240

17

If  $a$  is a constant and  $a < 0$ , how many solutions do the equation  $\sqrt{x+a} = a$  ?

- A) No solution
- B) 1 distinct solution
- C) 2 distinct solutions
- D) Infinitely many solutions



19

**Questions 18–19 refer to the following information.**

$$\text{Men: } t_{\text{men}} = -0.1569x + 361.8$$

$$\text{Women: } t_{\text{women}} = -0.2514x + 555.6$$

Since 1912, both men and women have competed in 100-meter freestyle swimming races at the Summer Olympic Games. The winning times for men and women from 1912 through 2012 can be modeled by the equations above, where  $t$  represents the winning time, in seconds,  $x$  in year.

18

According to predictions from the equations ,if the Summer Olympic Games had occurred in the year 2006, which of the following is closest to the number of seconds by which the men's winning time was less than the women's winning time?

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

According to the equations, which of the following conclusions can be drawn concerning the winning times for men and women from 1912 through 2012?

- A)  $t_{\text{men}}$  decreases faster per year than  $t_{\text{women}}$ , and the value  $t_{\text{women}} - t_{\text{men}}$  is increasing as  $x$  increases.
- B)  $t_{\text{men}}$  decreases faster per year than  $t_{\text{women}}$ , and the value  $t_{\text{women}} - t_{\text{men}}$  is decreasing as  $x$  increases.
- C)  $t_{\text{women}}$  decreases faster per year than  $t_{\text{men}}$ , and the value  $t_{\text{women}} - t_{\text{men}}$  is increasing as  $x$  increases.
- D)  $t_{\text{women}}$  decreases faster per year than  $t_{\text{men}}$ , and the value  $t_{\text{women}} - t_{\text{men}}$  is decreasing as  $x$  increases.



20

A manufacturer packages vegetables in cans that are in the shape of right cylinders with height 15 centimeters and volume 750 cubic centimeters . If the manufacturer reduces the volume of the cans to 600 cubic centimeters but keeps the area of the base the same , by how many centimeters does the height of the can decrease?

- A) 3
- B) 4
- C) 5
- D) 6

21

Vitruvius, a Roman architect of the first century BCE, set guidelines , in his writings for the relationship between the height(rise) and tread (run) of stairs in a building . He wrote that the rise should be between 9 and 10 inches, inclusive per step , and the run should be between 18 and 24 inches, inclusive, Which of the following could NOT be the radio of rise to run for a set of stairs that follows his guidelines?

- A)  $\frac{1}{3}$
- B)  $\frac{5}{12}$
- C)  $\frac{3}{8}$
- D)  $\frac{5}{9}$

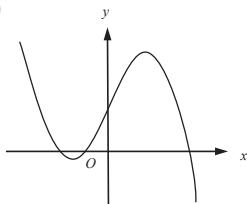


22

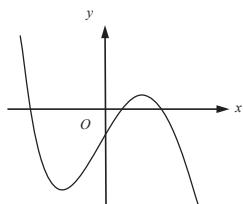
$$y = -(x - 1)(x - 2)(x + 3)$$

In the  $xy$ -plane, which of the following could be a graph of the equation above?

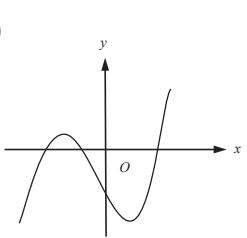
A)



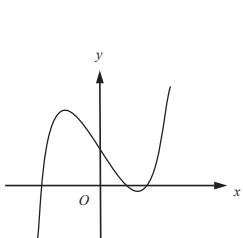
B)



C)



D)



**Questions 23–24 refer to the following information.**

The payload package of a weather balloon is 5 feet above the ground before the balloon is launched from a weather station. After launch, the balloon rises for 30 minutes. The height of the payload package is estimated to increase by 10 feet every 15 seconds. The function  $h$  gives ground in terms of the time  $x$ , in seconds, after the weather balloon is launched.

23

Which of the following represents  $h(x)$ ?

A)  $h(x) = x + 5$

B)  $h(x) = \frac{2}{3}x$

C)  $h(x) = \frac{2}{3}x + 5$

D)  $h(x) = \frac{5+2x}{3}$

24

Which of the following is the best interpretation of the slope of the graph of  $h$ ?

A) The ratio of the height of the payload package, in feet above the ground, to the distance from the weather station, in feet.

B) The ratio of the height of the payload package, in feet above the ground, to the height of 5 feet.

C) The ratio of the number of feet the payload package has risen since launch to the number of seconds since the weather balloon was launched.

D) The angle that the path of the balloon makes with the ground.



25

$$\begin{aligned}\frac{3}{2}x - \frac{1}{3}y &= 14 \\ x + 2y &= -4\end{aligned}$$

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

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

26

7-Day Tidal Predictions for Herring Cove

Day	Low tide (feet)	High tide (feet)
Monday	7.9	30.2
Tuesday	7.9	29.5
Wednesday	7.2	30.2
Thursday	6.6	30.8
Friday	5.9	31.5
Saturday	5.6	33.1
Sunday	6.9	31.5

The table above shows tidal predictions for Herring Cove. According to the table, what is the difference between the median predicted high tide and the median predicted low tide over this 7-day period?

- A) 23.6 feet
- B) 23.9 feet
- C) 24.2 feet
- D) 24.9 feet

27

$$\begin{aligned}x^2 + y &= 4x - 3 \\ y &= 1 - 2x\end{aligned}$$

If  $(x_1, y_1)$  and  $(x_2, y_2)$  are two distinct solutions of the system of equations above, what is the value of  $|x_1 - x_2|$ ?

- A) 2
- B) 6
- C)  $\sqrt{20}$
- D)  $\sqrt{44}$



28

$$9x^2 + bx + 49 = 0$$

In the equation above,  $b$  is constant. If the equation has more than one real solution, which of the following could be value of  $b$ ?

- A) 7
- B) 21
- C) -42
- D) 53

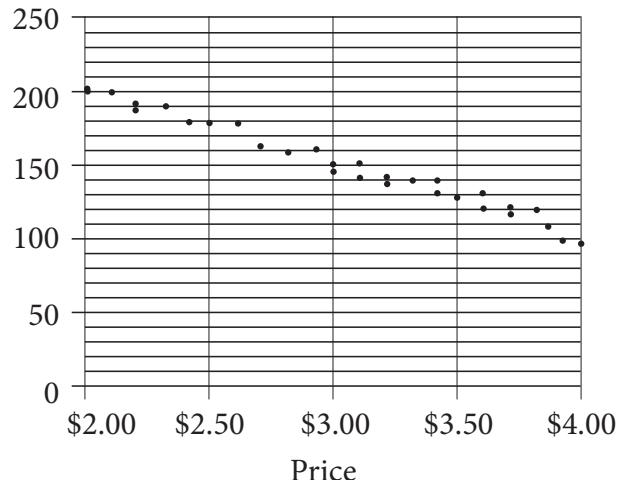
29

In a scale drawing of rectangular living room floor the width of the floor is 2 inches and the length is 4 inches. If the width of the actual living room floor is  $w$  feet, which of the following functions  $A$  could represent the area, in square feet, of the actual living room floor?

- A)  $A(w) = \frac{w^2}{8}$
- B)  $A(w) = 2w^2$
- C)  $A(w) = 4w^2$
- D)  $A(w) = 8w^2$

30

Quantity of a Product Sold versus Price



In the scatterplot above, each point represents the quantity  $n$  of a product sold by a business at price  $p$ , in dollars, for one of 30 days. Which of the following equations best models the relationship between price and quantity sold?

- A)  $n = 50p + 200$
- B)  $n = -50p + 200$
- C)  $n = -50p + 300$
- D)  $p = \frac{1}{50}n + 2$

**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  $\frac{7}{2}$ . (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.

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

7	/	1	2
●	○	○	○
○	○	○	○
1	1	2	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
●	○	○
○	○	○
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
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8

.	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
8	8	8	8

.	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
8	8	8	8

Answer: 201 – either position is correct

2	0	1
●	○	○
○	○	○
1	1	1
2	●	2
3	3	3

2	0	1
●	○	○
○	○	○
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.



31

At Mount Rushmore National Memorial. Four sculptures of United States presidents' heads are carved into a granitic mountain. The ratio of a sculpture's head length to the actual president's head length is 40 feet to 6 inches. What is the sculpture's head length, in feet, for a president with a head length of 9 inches?

32

Miguel is buying prizes for a raffle. He will buy one prize that costs \$50 and four prizes that cost \$20 each. The remainder of the prizes will cost \$10 each. If Miguel can spend no more than \$300 on all the prizes, what is the largest total number of prizes he can buy for the raffle? (Assume there is no sales tax.)



33

The graph of the linear function  $f$  in the  $xy$ -plane has a  $y$ -intercept of 12 and a slope of  $-\frac{3}{4}$ . What is the  $x$ -intercept of the graph of  $f$ ?

34

Lead Samples on a Farm

Sample	1	2	3	4	5	6	7
Lead (ppm)	1523	847	1267	692	1401	1088	?

To determine whether to buy a plot of land, a farmer is having the soil tested for lead. The table above shows the amount of lead, in parts per million (ppm), in six of the seven samples of soil selected at random. If the average (arithmetic mean) amount of lead in the seven samples, in ppm, is no more than 1200, the farmer will buy the plot of land; otherwise, the farmer will not buy it. What is the greatest possible amount of lead, in ppm, that can be in the seventh sample if the farmer buys the land?



35

What is the radius of the circle in the  $-$ -plane that has center  $(1,5)$  and contains the point  $(4,9)$ ?

36

A certain alloy is a mixture of different component as given in the table below.

Component	Percentage (by weight)
Chromium	18%
Nickel	10%
Steel (by weight, 98% iron and 2% carbon)	72%

This alloy is  $p$  percent carbon by weight, what is the value of  $p$ ?



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

A researcher conducted a study of the effects taking a specific vitamin once a day on the blood pressure of elderly people in the state of Vermont. The sample used for the study is all residents at the Chestnut Hills Nursing Home, Located in Vermont. The sample is made up of 38 male participants and 56 female participants. The distribution of the ages of all participants in the study is shown in the table below.

Age range	Number of participants
70 to 74	12
75 to 79	37
80 to 84	37
85 and older	8
Total	94

38

The participants younger than 75 years old are  $x$  percent of all participants. What is the value of  $x$  to the nearest whole number?

37

If the ratio of male to female participants is 1 to 4 for participants who are 80 years or older, how many participants 80 years or older are male?

**STOP**

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

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## March 2017 USA Answers

Reading				Writing				Math N/Calc		Math W/Calc	
Question	Answer	Question	Answer	Question	Answer	Question	Answer	Question	Answer	Question	Answer
1	D	41	B	1	A	41	C	1	C	1	A
2	B	42	A	2	B	42	A	2	B	2	B
3	C	43	A	3	B	43	A	3	D	3	B
4	A	44	C	4	D	44	C	4	A	4	D
5	B	45	A	5	A			5	B	5	D
6	D	46	C	6	D			6	C	6	D
7	D	47	D	7	C			7	C	7	A
8	C	48	B	8	D			8	B	8	A
9	D	49	B	9	A			9	B	9	D
10	D	50	D	10	A			10	A	10	A
11	B	51	D	11	B			11	B	11	D
12	C	52	C	12	C			12	A	12	D
13	B			13	C			13	C	13	D
14	D			14	D			14	D	14	C
15	C			15	A			15	A	15	B
16	A			16	A			16	6	16	B
17	A			17	B			17	1.8	17	A
18	C			18	C			18	0	18	C
19	D			19	A			19	32	19	D
20	D			20	C			20	0.6	20	A
21	A			21	B					21	A
22	D			22	C					22	B
23	D			23	C					23	C
24	B			24	D					24	C
25	D			25	A					25	C
26	B			26	B					26	B
27	C			27	B					27	C
28	C			28	A					28	D
29	B			29	D					29	B
30	C			30	D					30	C
31	A			31	D					31	60
32	B			32	C					32	22
33	A			33	B					33	16
34	A			34	B					34	1582
35	B			35	A					35	5
36	A			36	C					36	1.44
37	C			37	D					37	9
38	C			38	C					38	13
39	D			39	A						
40	C			40	B						

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