

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.

This passage is adapted from Kazuo Ishiguro, *An Artist of the Floating World*. ©1986 by Kazuo Ishiguro. The narrator is a retired Japanese painter named Masuji Ono, who is looking back on his youth in the early twentieth century.

Throughout my years I have preserved the sense, instilled in me by my father, that the reception room of a house is a place to be revered, a place to be kept
 Line 5 unsoiled by everyday trivialities, reserved for the receiving of important guests, or else the paying of respects at the Buddhist altar. Accordingly, the reception room of my house has always had a more solemn atmosphere than that to be found in most households; and although I never made a rule of it as
 10 my own father did, I discouraged my children while they were young from entering the room unless specifically bidden to do so.

My respect for reception rooms may well appear exaggerated, but then you must realize that in the
 15 house I grew up in—in Tsuruoka Village—I was forbidden even to enter the reception room until the age of twelve. That room being in many senses the centre of the house, curiosity compelled me to construct an image of its interior from the occasional
 20 glimpses I managed to catch of it. Later in my life I was often to surprise colleagues with my ability to realize a scene on canvas based only on the briefest of passing glances; it is possible I have my father to thank for this skill, and the inadvertent training he

25 gave my artist's eye during those formative years. In any case, when I reached the age of twelve, the 'business meetings' began, and then I found myself inside that room once every week.

'Masuji and I will be discussing business tonight,'
 30 my father would announce during supper. And that would serve both as my summons to present myself after the meal, and as a warning to the rest of the family to make no noise in the vicinity of the reception room that evening.

35 My father would disappear into the room after supper, and call me some fifteen minutes later. The room I entered would be lit by a single tall candle standing in the centre of the floor. Within the circle of light it cast, my father would be sitting cross-
 40 legged on the tatami before his wooden 'business box'. He would gesture for me to sit opposite him in the light, and as I did so, the brightness of the candle would put the rest of the room into shadow. Only vaguely would I be able to discern past my father's
 45 shoulder the Buddhist altar by the far wall, or the few hangings adorning the alcoves.

My father would then begin his talking. From out of his 'business box' he would produce small, fat notebooks, some of which he would open so that he
 50 could point out to me columns of densely packed figures. All the while, his talking would continue in a measured, grave tone, to pause only occasionally when he would look up at me as though for confirmation. At these points, I would hurriedly
 55 utter: 'Yes, indeed.'

Of course, it was quite impossible for me to follow what my father was saying. Employing jargon, recounting his way through lengthy calculations, he made no concessions to the fact that he was
 60 addressing a young boy. But it seemed equally impossible for me to ask him to stop and explain. For as I saw it, I had been allowed into the reception room only because I had been deemed old enough to understand such talk. My sense of shame was
 65 matched only by a terrible fear that at any moment I would be called upon to say more than ‘Yes, indeed’ and my game would be up. And although month after month went by and I was never required to say anything more, I nevertheless lived in dread of the
 70 next ‘business meeting’.

Of course, it is clear to me now that my father never expected me for a moment to follow his talk, but I have never ascertained just why he put me through these ordeals. Perhaps he wished to impress
 75 upon me from that early age his expectation that I would eventually take over the family business. Or perhaps he felt that as future head of the family, it was only right I should be consulted on all decisions whose repercussions were likely to extend into my
 80 adulthood; that way, so my father may have figured it, I would have less cause for complaint were I to inherit an unsound business.

1

The passage is primarily concerned with

- A) examining the changing relationship between two characters.
- B) exploring the narrator’s father’s fascination with business matters.
- C) conveying the lasting effect of an experience on the narrator.
- D) depicting the influence of the narrator’s father on the members of his family.

2

According to the narrator, he and his father are similar in their

- A) use of few words to express themselves.
- B) youthful aspirations to become artists.
- C) view of a reception room as a place that should be respected.
- D) enforcement of strict rules for the use of reception rooms.

3

As used in line 14, “exaggerated” most nearly means

- A) pretentious.
- B) excessive.
- C) distorted.
- D) fabricated.

4

Based on the passage, the narrator views his father primarily as a man who

- A) has a commanding presence in his home.
- B) is unusually harsh with his children.
- C) works continuously to ensure his family’s well-being.
- D) values traditions from the past over contemporary practices.

5

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

- A) Lines 25-28 (“In any . . . week”)
- B) Lines 29-30 (“Masuji . . . supper”)
- C) Lines 30-34 (“And that . . . evening”)
- D) Lines 38-41 (“Within . . . box”)

6

The fourth paragraph (lines 35-46) primarily serves to

- A) convey the narrator's unspoken desire for acceptance.
- B) present details of a past event that overwhelmed the narrator.
- C) illustrate the father's eccentric behavior.
- D) depict a scene that heightened the drama of an event.

7

As used in line 52, "measured" most nearly means

- A) limited.
- B) specific.
- C) weighted.
- D) deliberate.

8

The narrator suggests that as a child he viewed the talks with his father as

- A) unreasonable demands that prevented him from pursuing his own interests.
- B) intimidating meetings that he would have preferred to avoid.
- C) special occasions during which he could bond more deeply with his father.
- D) meaningful opportunities to learn more about his family's history.

9

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

- A) Lines 41-46 ("He would . . . alcoves")
- B) Lines 51-55 ("All the . . . indeed")
- C) Lines 62-64 ("For as . . . talk")
- D) Lines 67-70 ("And although . . . meeting")

10

The last paragraph mainly serves to

- A) reveal the narrator's ongoing uncertainty about the purpose of the weekly talks with his father.
- B) illustrate how the weekly talks with his father helped the narrator become successful in business.
- C) imply that their weekly talks led the narrator and his father to acquire a mutual regard for one another.
- D) point out that the narrator finally understood the motivating factor behind his father's weekly talks.

Questions 11-20 are based on the following passage and supplementary material.

This passage is adapted from Carmen Nobel, “What Charities Can Do about Our Aversion to Overhead Costs.” ©2015 by Forbes Media LLC. “Overhead” refers to certain expenditures required to run a business.

Elizabeth A. Keenan of Harvard Business School and her colleagues have spent a lot of time researching ways to overcome the aversion donors to nonprofit organizations have to paying for
 5 administrative expenses. Their initial findings indicate that donors are willing to stomach the idea of overhead—as long as they know someone else’s donation is covering it.

In their first experiment, the team recruited
 10 449 undergraduates to consider which of two charities should receive a \$100 donation: Kids Korps USA, an organization aimed at engaging young people in volunteerism, or charity: water, which brings clean drinking water to people in developing
 15 nations.

The experiment tested how varying the level of overhead costs would affect participants’ willingness to donate. The goal: to see whether increasing the overhead associated with donations to charity: water
 20 would decrease the likelihood to choose it over Kids Korps. (Participants were told there was no overhead associated with donations to Kids Korps.)

The results showed that participants were turned off by overhead. The higher the level of overhead
 25 associated with a donation to charity: water, the lower the percentage of participants who chose to donate to it. When they learned that donations to both charities were overhead-free, 73.3 percent of participants chose to donate to charity: water instead
 30 of Kids Korps. When they learned that 50 percent of a donation to charity: water went toward overhead, only 49.43 percent chose charity: water. But a key question remained: Were participants turned off by the idea of overhead costs in general, believing that
 35 high overhead was a sign of inefficiency or even corruption? Or were they simply averse to the notion that their own donation might go toward overhead?

To find out, the researchers tested whether participants would be more likely to donate to a
 40 charity if the overhead costs had been covered by another contributor, such as a wealthy family or foundation. That made a huge difference, says Keenan. Even when participants were informed that

there was 50 percent overhead associated with
 45 donations to charity: water, 71.43 percent chose to donate to the charity after learning that the overhead costs would be covered by someone else.

Continuing to pursue the efficacy of a dedicated overhead benefactor, Keenan and her colleagues took
 50 their research to the real world, conducting a field experiment with a large education foundation. The potential donors in this study: some 40,000 recipients of a donation request letter, which asked them to give \$20, \$50, or \$100 toward a new project. The letter
 55 recipients were divided into four groups.

In the “control” group, recipients simply received information about the foundation’s new educational initiative. In the “seed” group, recipients were also told that a private donor had already seeded the
 60 initiative with a \$10,000 donation. In the “match” group, recipients were told that a donor had offered to match every dollar given to the project, up to a total of \$20,000. Finally, in the “overhead-free” group, recipients were told that a donor had given a
 65 grant to cover all the overhead costs associated with raising money for the project.

The results were significant. In the control group, 336 out of 10,000 letter recipients (or 3.36 percent) donated to the foundation. In the seed group, the
 70 number increased to 4.75 percent. In the match treatment, 4.41 percent chose to donate. And in the overhead-free treatment, a comparatively whopping 8.55 percent gave money to the foundation.

Figure 1

Effect of Overhead on Donations to charity: water

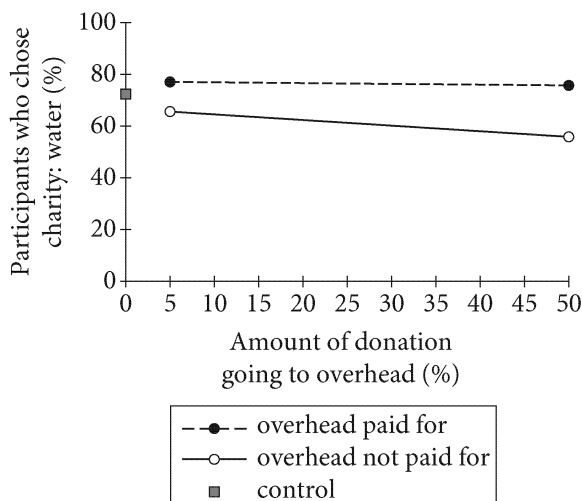


Figure 2

Number of Donations to Educational Charity by Condition

Donation amount	Control group	Seed fund	Matching funds	Overhead-free
\$20	297	396	373	726
\$50	36	52	41	86
\$100	3	27	27	43

Figures adapted from Uri Gneezy, Elizabeth A. Keenan, and Ayelet Gneezy, "Avoiding Overhead Aversion in Charity." ©2014 by American Association for the Advancement of Science.

11

As used in line 8, "covering" most nearly means

- A) funding.
- B) concealing.
- C) guarding.
- D) managing.

12

According to the passage, one difference between the first and second experiments was that in the first experiment, participants

- A) donated all of their money to one charity, whereas in the second experiment, participants could split their donation across several charities.
- B) could refuse to donate money to any charity, whereas in the second experiment, participants were required to donate to a charity.
- C) evaluated the merits of donating to one of two different charities, whereas in the second experiment, participants considered only a single charity.
- D) chose between different configurations of a single charity, whereas in the second experiment, participants were asked about only one configuration of a charity.

13

Which statement about the two charities in the first experiment is best supported by information in the passage?

- A) Kids Korps was presented as markedly less efficient than was charity: water.
- B) Kids Korps was inherently less appealing to participants than was charity: water.
- C) Unlike charity: water, Kids Korps has a private donor to pay for all the overhead costs.
- D) Unlike charity: water, Kids Korps was a familiar organization to participants before the experiment.

14

Based on the passage, what is the answer to the question in lines 33-36 (“Were . . . corruption”) and why?

- A) Yes, because the charity most participants chose when it was overhead-free was overwhelmingly rejected by most participants when overhead costs were associated with it.
- B) Yes, because the charity with overhead costs related to inefficiency was less favored by participants than was the charity with other types of overhead costs.
- C) No, because participants favored the charity with overhead costs if their own donations were not directed to those costs.
- D) No, because participants favored the charity with overhead costs even when 50% of their own donations were used to pay those costs.

15

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

- A) Lines 30-32 (“When . . . charity: water”)
- B) Lines 36-37 (“Or were . . . overhead”)
- C) Lines 38-42 (“To find . . . foundation”)
- D) Lines 43-47 (“Even . . . else”)

16

As used in line 50, “conducting” most nearly means

- A) performing.
- B) conveying.
- C) supervising.
- D) financing.

17

Which choice best supports the conclusion that the strategy for overcoming overhead aversion that is suggested by the results of the first experiment can be successful in a nonlaboratory setting?

- A) Lines 67-69 (“In the control . . . foundation”)
- B) Lines 69-70 (“In the seed . . . percent”)
- C) Lines 70-71 (“In the match . . . donate”)
- D) Lines 71-73 (“And in . . . foundation”)

18

According to figure 1, when 5% of the donation was going to overhead, the percentage of participants in both experimental conditions who chose to donate to charity: water was

- A) less than 20%.
- B) between 20% and 40%.
- C) between 60% and 80%.
- D) greater than 80%.

19

The change in data values represented by the downward slope of the two lines in figure 1 illustrates which point made in the passage?

- A) The percentage of participants choosing to donate to charity: water when overhead costs were not paid for by another contributor was unaffected by the percentage of the donation going to overhead.
- B) The percentage of participants choosing to donate to charity: water decreased as the amount of the donation going to overhead decreased.
- C) The percentage of participants choosing to donate to charity: water increased as the percentage of the charity's overhead costs increased.
- D) The percentage of participants choosing to donate to charity: water decreased as the percentage of the donation going to overhead costs increased.

20

According to figure 2, the least frequently occurring donation was in which amount and which condition?

- A) \$50 in the control group condition
- B) \$100 in the control group condition
- C) \$50 in the matching funds condition
- D) \$100 in the matching funds condition

Questions 21-31 are based on the following passage and supplementary material.

This passage is adapted from David E. Alexander, *On the Wing: Insects, Pterosaurs, Birds, Bats, and the Evolution of Animal Flight*. ©2015 by Oxford University Press.

Then-graduate student Stephen Yanoviak was studying ants by observing them from catwalks built high in the rain forest canopy in Peru when he made
 Line the rather startling discovery that if he knocked an
 5 ant off a branch, the ant somehow steered its fall toward the nearest tree trunk, often landing on the trunk. These were worker ants with no trace of wings, so their ability to “fall” back to the trunk was astonishing. By coincidence, one of the faculty
 10 members in Yanoviak’s department was Robert Dudley, an animal flight specialist who just happened to do much of his research in the tropics. Dudley was amazed by Yanoviak’s story, and together they designed a series of experiments to see if ants really
 15 could guide their fall back to tree trunks.

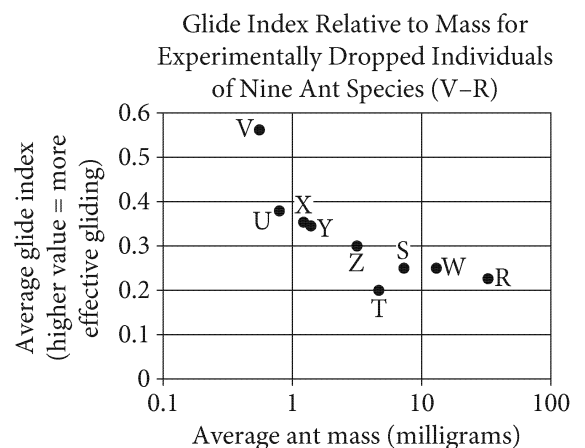
In their original experiments, 85% of the ants landed on the trunks of trees they fell from. Several studies later, Yanoviak and his colleagues have established that in addition to the original ant species
 20 they studied, a variety of other animals living in rain forest canopies have this ability. These include the workers of several unrelated species of arboreal ants from Africa and Central and South America as well as a variety of other wingless insects and spiders.
 25 Curiously, the first species of ant they studied steered its falls backward (tail first), and seems mainly to use its hind legs for steering; almost all the species they looked at later steered reassuringly head first.

Aerodynamically, worker ants are lousy gliders,
 30 with a glide angle of 75 degrees from the horizontal, compared with winged gliders, with glide angles of 10 degrees or 20 degrees. In fact, traditionally, biologists have called glide angles of greater than 45 degrees “parachuting” and reserved “gliding” for
 35 angles of less than 45 degrees. This is an arbitrary distinction with no basis in aerodynamics because any glide angle less than 90 degrees requires some lift production, so we will consider these ants to be gliding, albeit at a very steep angle.

The researchers dubbed this ability “directed aerial descent” to refer to animals with no apparent aerodynamic specializations that nevertheless perform a very crude, inefficient, but useful form of gliding. They suggest two important implications for
 45 their discovery. First, given the variety of wingless

animals that display this ability, the behavior must have significant survival benefits. Indeed, small animals adapted to life in the tops of rain forest canopy trees are poorly adapted to life on the ground
 50 and tend to be easy prey for terrestrial predators. Moreover, worker ants generally do not survive unless they can return to their own colony’s nest, so landing back on the trunk of their original tree is at a premium.

Second, if wingless animals with no noticeable aerodynamic adaptations can consistently and reliably adjust the direction of their descent during a fall, then they already possess most of the sensory and neural mechanisms they would need to control a
 60 more efficient glide. No one would think of a cat as a glider, yet cats reliably land on their feet after even short falls. That kind of orienting-during-a-fall behavior is directed aerial descent at its most rudimentary, and many arboreal animals have taken
 65 it a step further and evolved the ability to steer during falls. If many arboreal animals have this ability, as now seems likely, and if some of those animals experienced selection pressure to extend falls into glides, they would have a head start in evolving
 70 more effective gliding. Ironically, biologists have long considered the evolution of flight control ability to be one of the major hurdles to be overcome during the evolution of flight, but this “hurdle” may already be behind many arboreal animals.



Figures adapted from Stephen P. Yanoviak, Robert Dudley, and Michael Kaspari, “Directed Aerial Descent in Canopy Ants.” ©2005 by Nature Publishing Group.

21

Over the course of the passage, the main focus shifts from

- A) an analysis of a hypothesis that guided past research about insects to an account of recent experimental results that undermine that hypothesis.
- B) an observation about a pattern of behavior in insects to a challenge to other researchers to corroborate that observation.
- C) a description of new findings about one type of insect to a discussion of the significance of this discovery with regard to other animals.
- D) a criticism of biologists' views on gliding to a consideration of the merits of experiments performed by animal flight specialists.

22

According to the passage, Yanoviak was initially surprised to observe that worker ants

- A) were more likely than other kinds of ants to fall from branches.
- B) glided as quickly and accurately as animals that were capable of flight.
- C) seemed to be able to control the direction of their falls.
- D) could survive falls from great heights.

23

In line 8, the author places the word “fall” in quotation marks to suggest that

- A) Yanoviak was incapable of understanding what he was observing.
- B) the ants' descent differed significantly from what is usually thought of as a fall.
- C) the height from which ants can safely fall is greater than one might expect.
- D) the ants are descending at an unusually slow rate.

24

As used in line 16, “original” most nearly means

- A) initial.
- B) inventive.
- C) unique.
- D) essential.

25

Which choice best supports the idea that there is a specific way in which gliding ants would normally be expected to behave?

- A) Lines 12-15 (“Dudley . . . trunks”)
- B) Lines 17-21 (“Several . . . ability”)
- C) Lines 25-28 (“Curiously . . . head first”)
- D) Lines 32-35 (“In fact . . . less than 45 degrees”)

26

As used in line 43, “crude” most nearly means

- A) obvious.
- B) basic.
- C) offensive.
- D) obsolete.

27

Which statement about ants and gliding can reasonably be inferred from the passage?

- A) The evolutionary ancestors of certain ant species were able to glide at angles of less than 45 degrees.
- B) Ants use gliding as their principle means of migrating from one tree to another in Central American forests.
- C) Ant species native to Africa and Central America tend to glide at steeper angles than ant species native to Europe and Asia.
- D) Certain ants possess characteristics that are necessary but not sufficient to allow them to glide at angles of less than 45 degrees.

28

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

- A) Lines 21-24 (“These . . . spiders”)
- B) Lines 35-39 (“This . . . angle”)
- C) Lines 40-44 (“The researchers . . . gliding”)
- D) Lines 55-60 (“Second . . . glide”)

29

According to the graph, what was the approximate glide index of Species X?

- A) 0.2
- B) 0.25
- C) 0.3
- D) 0.35

30

A student claims that the data in the graph support the statement that arboreal ants are better gliders than cats are. Is the student correct and why?

- A) Correct, because the graph indicates that some animals can glide more effectively than others can.
- B) Correct, because the graph presents data consistent with the theory that mammals are commonly considered more rudimentary gliders than insects are.
- C) Incorrect, because the graph compares only different species of the same insect.
- D) Incorrect, because the graph compares animals only by mass.

31

Which correlation between mass and gliding effectiveness in various ant species is most directly supported by the data in the graph?

- A) Ant species of lower average mass have a tendency to be better gliders than more massive ones.
- B) Ant species of higher average mass generally are more effective gliders than less massive ones.
- C) In all cases, ant species of lower average mass are better gliders than more massive ones.
- D) Individual ants that have the same mass have the same gliding effectiveness.

Questions 32-42 are based on the following passage.

This passage is adapted from William Godwin, *An Enquiry Concerning Political Justice and Its Influence on Morals and Happiness*. Originally published in 1793.

Let us proceed to consider the moral effects which the institution of monarchical government is calculated to produce upon the inhabitants of the
 Line countries in which it flourishes. And here it must be
 5 laid down as a first principle that monarchy is founded in imposture. It is false that kings are entitled to the eminence they obtain. They possess no intrinsic superiority over their subjects. The line of distinction that is drawn is the offspring of pretence,
 10 an indirect means employed for effecting certain purposes, and not the offspring of truth. . . .

Secondly, it is false that kings can discharge the functions of royalty. They pretend to superintend the affairs of millions, and they are necessarily
 15 unacquainted with these affairs. The senses of kings are constructed like those of other men, they can neither see nor hear what is transacted in their absence. They pretend to administer the affairs of millions, and they possess no such supernatural
 20 powers as should enable them to act at a distance. . . .

The king is often ignorant of that of which half the inhabitants of his dominions are informed. His prerogatives are administered by others, and the lowest clerk in office is frequently to this and that
 25 individual more effectually the sovereign than the king himself. . . .

To conduct this imposture with success it is necessary to bring over to its party our eyes and our ears. Accordingly kings are always exhibited with all
 30 the splendour of ornament, attendance and equipage. They live amidst a sumptuousness of expence; and this not merely to gratify their appetites, but as a necessary instrument of policy. The most fatal opinion that could lay hold upon the minds of their
 35 subjects is that kings are but men. Accordingly they are carefully withdrawn from the profaneness of vulgar inspection; and, when they are exhibited, it is with every artifice that may dazzle our sense and mislead our judgment.

The imposture does not stop with our eyes, but addresses itself to our ears. Hence the inflated style of regal formality. The name of the king every where obtrudes itself upon us. It would seem as if every thing in the country, the lands, the houses, the
 45 furniture and the inhabitants were his property. Our

estates are the king's dominions. Our bodies and minds are his subjects. Our representatives are his parliament. Our courts of law are his deputies. . . .

The sum of our political duties (the most important
 50 of all duties) is loyalty; to be true and faithful to the king; to honour a man, whom it may be we ought to despise; and to obey. . . .

Man in a state of society, if undebauched by falshoods like these, which confound the nature of
 55 right and wrong, is not ignorant of what it is in which merit consists. He knows that one man is not superior to another except so far as he is wiser or better. Accordingly, these are the distinctions to which he aspires for himself. These are the qualities
 60 he honours and applauds in another. . . . But what a revolution is introduced among these original and undebauched sentiments by the arbitrary distinctions which monarchy engenders? We still retain in our minds the standard of merit, but it daily grows more
 65 feeble and powerless, we are persuaded to think that it is of no real use in the transactions of the world, and presently lay it aside as Utopian and visionary. . . .

One of the most essential ingredients in a virtuous
 70 character is undaunted firmness; and nothing can more powerfully tend to destroy this principle than the spirit of a monarchical government. The first lesson of virtue is, Fear no man; the first lesson of such a constitution is, Fear the king. . . . He that
 75 cannot speak to the proudest despot with a consciousness that he is a man speaking to a man, and a determination to yield him no superiority to which his inherent qualifications do not entitle him, is wholly incapable of sublime virtue. How many
 80 such men are bred within the pale of monarchy? How long would monarchy maintain its ground in a nation of such men? Surely it would be the wisdom of society, instead of conjuring up a thousand phantoms to induce us into error, instead of
 85 surrounding us with a thousand fears to deprive us of true energy, to remove every obstacle and smooth the path of improvement.

32

The author's main purpose in the passage is to

- A) show how rulers' corruption is a consequence of the form of government in which they serve.
- B) indicate how the values embodied in a form of government are incompatible with the values of other nations.
- C) demonstrate that a form of government is so flawed that it undermines the moral development of its citizens.
- D) argue that a form of government can be modernized only if it is radically reformed.

33

As used in line 3, "calculated" most nearly means

- A) designed.
- B) acknowledged.
- C) estimated.
- D) assumed.

34

Based on the passage, which choice best describes the author's perspective on the social eminence accorded to monarchs?

- A) It is an unreliable indicator of the level of popularity enjoyed by monarchs.
- B) It is a reflection of the tensions that exist among different social classes.
- C) It is a self-serving political tool intended to achieve particular ends.
- D) It is determined by a nation's current political situation, rather than by its historical origins.

35

As used in line 13, "functions" most nearly means

- A) duties.
- B) ceremonies.
- C) characteristics.
- D) outcomes.

36

In the passage, the author suggests that monarchs are typically inadequate political leaders in which way?

- A) Monarchs' unawareness of their subjects' social standing distorts their perceptions of the overall conditions in their kingdoms.
- B) Monarchs' indifference or outright hostility to legislative matters leads them to neglect their official roles in state-sponsored parliamentary governments.
- C) Monarchs' geographical isolation within their own kingdoms makes their policies unresponsive to local and regional concerns.
- D) Monarchs' unfamiliarity with their subjects and their subjects' needs shifts the burden of governance to more knowledgeable subordinates.

37

In conjunction with lines 13-15, which choice provides the best evidence for the answer to the previous question?

- A) Lines 15-18 (“The senses . . . absence”)
- B) Lines 18-20 (“They pretend . . . distance”)
- C) Lines 21-22 (“The king . . . informed”)
- D) Lines 22-26 (“His prerogatives . . . himself”)

38

In the passage, the author strongly suggests that monarchical power is most significantly undermined by which situation?

- A) The people’s obligations to the crown grow more burdensome over the course of a monarch’s reign.
- B) The monarch lays claim to land traditionally inhabited by the people.
- C) The people come to recognize that their monarch is merely human.
- D) The level of luxury enjoyed by the monarch and his household attracts the attention of the people.

39

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

- A) Lines 31-33 (“They . . . policy”)
- B) Lines 33-35 (“The most . . . men”)
- C) Lines 43-45 (“It would . . . property”)
- D) Lines 49-52 (“The sum . . . obey”)

40

According to the author, the imposture of royalty partly depends on

- A) laws that expand the traditional political role of the monarch.
- B) unlawful gifts of public properties to loyal subjects.
- C) frequent reminders of royal authority in everyday language.
- D) parliamentary elections in which few citizens have the right to vote.

41

In the passage, the author indicates that in a monarchy, royal authority is pitted against the

- A) subjects' sense of self-respect and integrity.
- B) religious sentiments held by a majority of citizens.
- C) virtues inherent in traditional royal governments.
- D) monarch's true character as an individual.

42

The questions in lines 79-82 serve primarily to

- A) challenge the notion that a government can shape the character of its citizens.
- B) warn of the imminent downfall of a once-powerful, historic institution.
- C) emphasize the difficulty of reforming a reviled government.
- D) suggest that a change in citizens' attitudes could have significant consequences for the government.

Questions 43-52 are based on the following passages.

Passage 1 is adapted from Elizabeth Pennisi, “How Angiosperms Took Over the World.” ©2009 by American Association for the Advancement of Science. Passage 2 is adapted from Joseph E. Armstrong, *How the Earth Turned Green: A Brief 3.8-Billion-Year History of Plants*. ©2014 by the University of Chicago. Angiosperms are flowering plants whose seeds are encased in ovaries; gymnosperms lack flowers and have exposed seeds.

Passage 1

How did orchids, daisies, and their ilk become so dominant? Researchers have long chalked it up to their flowers, which enlist insects and other animals to help them reproduce and spread. But two plant biologists credit the leaves instead. More leaf veins made the plants better photosynthesizers, the duo reports, enabling angiosperms to outgrow their competition.

The two researchers—Timothy Brodribb, a hydraulic physiologist at the University of Tasmania, and Taylor Feild, now at the University of Tennessee—were studying how leaves transport water. They noticed that the leaves of early angiosperms seemed to contain far fewer veins than those of angiosperms that evolved later. “We were shocked by the extraordinary contrast,” Brodribb recalls.

Their work has shown that the density of veins is important to the ability of the plant to photosynthesize. To grow, plants must take in carbon dioxide through valves in the leaves called stomata. When open, stomata lose water, so the more efficient the transport of water to replenish lost moisture, the more stomata that can stay open and take up carbon dioxide. The researchers wondered if the evolution of more veins per leaf gave angiosperms the boost they needed to become widespread.

Based on fieldwork in 13 countries over 6 years, the duo examined the venation of 504 flowering plants and 225 other plants, including 166 extinct species, and looked for trends in venation patterns through time. In addition, they measured water and carbon dioxide exchange in leaves from 35 species of flowering and nonflowering plants.

“The evidence for a transformation in venation was remarkably clear,” says Brodribb. Early angiosperms had simple leaf patterns with few veins. But about 100 million years ago, newer species of angiosperms had doubled, tripled, and, ultimately, increased by 10-fold the number of leaf veins, the team reported.

According to the researchers’ model of plant physiology, a tripling of vein density would have doubled the plant’s photosynthetic capacity. Brodribb and Feild argue that more photosynthesis meant more carbon for growth. And that would have given the angiosperms the energy to push competitors like conifers out of the canopy around 150 million years ago, making angiosperms the most productive group of land plants in the world.

Passage 2

What is it about flowering plants that has made them so successful both in terms of ecology and species diversity? The fossil record of the Cretaceous indicates the flower plant lineage diversified early and rose to ecological dominance quickly. Using a molecular clock to date major phylogenetic divergences suggests 44.5% of living species are found in lineages that diversified and appeared from 130 to 102 mya (million years ago) in the lower Cretaceous. This suggests that angiosperm evolution was well underway by the time the oldest unambiguous flowering plant fossil appears at 132 mya. Many more lineages appear to have originated between 102 and 77 mya in the Upper Cretaceous. The surprise is not the speediness of the diversification; after all, this is a 55-million-year period of time, and only 65 million years have transpired since the end of the Cretaceous to the present day. The surprise is that so many major lineages appear to have arisen so long ago. Conifers and ferns also diversified during the same period but on a much smaller scale.

Our human tendency is to select some key feature of flowering plants and declare it responsible for all their success. The advantage of animal dispersal afforded by the flower and its carpel-enclosed ovules, at the stages of both pollen and seed dispersal, plays a key role in explaining the flowering plant phenomenon. But flowering plants have other features that can be regarded as an “improvement” over gymnosperms, and these include a range of leaf forms and functions (in addition to flower parts),

double fertilization leading to endosperm (the tissue
85 surrounding the plant embryo), structurally complex
wood, diverse life histories, and varied growth forms
like epiphytes, vines, herbs, and parasites.

In some manner the answer must be “yes to all”
because all these features play a role and in no single
90 respect, except for endosperm, are these flowering
plant features unique to this group. Similar features
can be found in various other seed plants and even
ferns, but only in flowering plants do they all come
together in concert. This suite of characters all
95 together is the key to flowering plant dominance.

43

The main purpose of Passage 1 is to

- A) compare the conclusions of two experiments regarding the development of angiosperms.
- B) describe research findings that explore the historical success of angiosperms.
- C) challenge a hypothesis about a key difference between angiosperms and gymnosperms.
- D) examine data from scientists whose botanical research has been largely overlooked.

44

As used in line 5, “credit” most nearly means

- A) give reimbursement to.
- B) depend on.
- C) believe in.
- D) attribute something to.

45

The author of Passage 1 most strongly suggests that Brodribb and Feild’s research into the relationship between leaf venation and angiosperm dominance was stimulated by

- A) the fieldwork of other researchers over several years.
- B) their interest in proving a new theory about photosynthesis.
- C) the observation of an adaptation in certain plant species.
- D) anecdotal evidence that showed the success of flowering plant species.

46

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

- A) Lines 13-17 (“They . . . recalls”)
- B) Lines 18-22 (“Their . . . stomata”)
- C) Lines 22-25 (“When . . . dioxide”)
- D) Lines 29-33 (“Based . . . time”)

47

Which choice from Passage 2 best supports the idea that flowering plant lineages were diversifying earlier than the date established by fossil records?

- A) Lines 52-54 (“What . . . diversity”)
- B) Lines 54-56 (“The fossil . . . quickly”)
- C) Lines 61-64 (“This . . . 132 mya”)
- D) Lines 70-73 (“The surprise . . . scale”)

48

According to Passage 2, which statement is true regarding the diversification of conifers and ferns when compared to the diversification of angiosperms?

- A) It generated a more successful class of plants than did the diversification of angiosperms.
- B) It occurred concurrently with the diversification of angiosperms.
- C) It produced a greater number of separate lineages than did the diversification of angiosperms.
- D) It took place over a longer period of time than did the diversification of angiosperms.

49

As used in line 77, “afforded” most nearly means

- A) spelled.
- B) loaned.
- C) attempted.
- D) provided.

50

Which choice best states the purpose of the questions at the beginnings of both Passage 1 and Passage 2?

- A) To introduce a set of ideas the authors will dispute
- B) To establish the scope of the topics the authors will address
- C) To cast doubt on a certain model of thinking that the authors will explore
- D) To encourage readers to share in the authors’ particular views on a subject

51

Which choice best states how each passage treats the theory that animal seed dispersal is responsible for the ecological success of angiosperms?

- A) Passage 1 demonstrates how the theory developed over a relatively long period of time, whereas Passage 2 is concerned about its application rather than its development.
- B) Passage 1 rejects the theory as a misguided idea advanced by prior researchers, whereas Passage 2 praises those who established it as a model regarding successful diversification.
- C) Passage 1 offers the theory as useful background information, whereas Passage 2 suggests that it has been unfairly discounted by those interested in the development of flowering plants.
- D) Passage 1 describes the theory as a widely accepted idea that is being challenged by new research, whereas Passage 2 affirms its importance to the diversification of angiosperms.

52

Which choice best describes a key difference between the passages?

- A) Passage 1 focuses solely on angiosperms, whereas Passage 2 includes a detailed discussion of both angiosperms and gymnosperms.
- B) Passage 1 presents findings on one feature of angiosperms, whereas Passage 2 identifies multiple features that are important for angiosperm development.
- C) Passage 1 highlights the work of two researchers, whereas Passage 2 includes a broad array of research findings.
- D) Passage 1 offers a definitive explanation of how angiosperms became dominant, whereas Passage 2 reflects on how angiosperms remain dominant in the present day.

STOP

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

Writing and Language Test

35 MINUTES, 44 QUESTIONS

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

DIRECTIONS

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

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

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

Questions 1-11 are based on the following passage.

Edmonia Lewis: Remaking the Classic

Although she is little known today, sculptor Edmonia Lewis is an important figure in American art. Born in New York in the mid-1800s, **1** Lewis's training took place in Boston; she crafted clay and plaster medallions of abolitionist leaders. The sale of these extremely popular works enabled her, along with other expatriate American artists, to establish a studio in Rome. It was in Rome that Lewis undertook **2** its most ambitious projects: large marble sculptures in the neoclassical style, which emphasizes symmetry, harmony, and idealism. Lewis's

1

- A) NO CHANGE
- B) Lewis trained in Boston, where she
- C) Boston was where Lewis trained and
- D) it was in Boston that Lewis trained, and she

2

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

use of this popular style to make political statements and depict unconventional subjects **3** had a profound impact on nineteenth-century audiences.

The 1867 sculpture *Forever* **4** *Free*, meanwhile, was inspired by Lewis's African American heritage and the

3

Which choice most effectively introduces a central idea that is developed in the passage?

- A) NO CHANGE
- B) produced hostile reactions from nineteenth-century art critics.
- C) left a memorable impression on nineteenth-century artists.
- D) provided a useful touchstone for twentieth-century art historians.

4

- A) NO CHANGE
- B) *Free*, however,
- C) *Free*, consequently,
- D) *Free*

issuance of the Emancipation Proclamation four years prior. Taking its title from the text of that **5** document, *Forever Free* depicts a man and woman. Reacting to the news of the abolition of slavery. **6** In the statue, a woman kneels in **7** prayer; a man stands beside her, one uplifted arm in chains, the other free of its manacle and resting on the shoulder of the woman. Lewis suggests a sense of optimism by depicting each member of the couple with an uplifted gaze, a conventional neoclassical pose; however, by simultaneously depicting tangible remnants of slavery, she also suggests that much remained to be accomplished. In its evocation of emancipation and of the triumphs and struggles of the subsequent years, *Forever Free* “tell[s] in the very poetry

5

- A) NO CHANGE
- B) document, *Forever Free* depicts a man and woman reacting
- C) document, *Forever Free* depicting a man and woman reacting
- D) document. *Forever Free* depicts a man and woman reacting

6

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

Many artworks produced at that time focused on the subject of emancipation.

Should the writer make this addition here?

- A) Yes, because it provides necessary context for the paragraph’s discussion of *Forever Free*.
- B) Yes, because it establishes that Lewis was not the only artist whose works commemorated emancipation.
- C) No, because it interrupts the paragraph’s discussion of *Forever Free*.
- D) No, because it does not provide enough specificity about the artworks created by Lewis’s peers.

7

- A) NO CHANGE
- B) prayer, a man stands beside her, one uplifted arm in chains;
- C) prayer: a man stands beside her one uplifted arm in chains,
- D) prayer; a man stands beside her, one uplifted arm in chains:

of stone the story of the last ten years,” wrote a reporter who attended the highly publicized 1869 **8** divulging of the statue in Boston.

Forever Free was acclaimed by audiences in the United States, yet the 1876 sculpture *The Death of Cleopatra* was perhaps Lewis’s most famous artwork. The ancient Egyptian queen Cleopatra was a popular subject for neoclassical artists, but Lewis, unlike her contemporaries, represented Cleopatra at the moment of her death. Though many features of the sculpture (such as the symmetry of the queen’s throne) **9** reflects neoclassical principles, the queen’s disheveled appearance—slumped on her throne with her robes askew—disrupts this harmony. **10** With its frank portrayal of death, the sculpture shocked and riveted audiences when it was first exhibited in Philadelphia in 1876.

8

- A) NO CHANGE
- B) baring
- C) unveiling
- D) disclosing

9

- A) NO CHANGE
- B) reflect
- C) were reflecting
- D) would reflect

10

Which choice provides the best transition from the previous sentence?

- A) NO CHANGE
- B) Attracting large crowds,
- C) Currently on display at the Smithsonian,
- D) Having been shipped from Rome,

While Lewis is thought to have produced between sixty and eighty sculptures during her lifetime, only about thirty—including *Forever Free* and *The Death of Cleopatra*—have been located. The pieces that have **11** made it are an enduring testament to the achievement of an artist who adapted neoclassical style for distinctly modern ends.

11

Which choice best maintains the style and tone established in the passage?

- A) NO CHANGE
- B) hung around
- C) survived
- D) eluded loss

Questions 12-22 are based on the following passage.

A Sound Strategy for Analyzing Data

Data from research are usually depicted visually in graphs and charts, but they can also be rendered in audio form in a process called sonification. Because we can perceive several aspects of sound simultaneously and hearing is more sensitive to minute changes than vision is, researchers can sometimes better evaluate data points by listening to them rather than by seeing them.

Sonification, which enables the detection of small fluctuations in a stream of measurements, is especially helpful for interpreting data involving multiple interacting variables. **12** Seismologists, scientists who study Earth's internal structure, deserve much of the credit for pioneering the practice in the 1960s.

12

Which choice most effectively establishes the main claim of the passage?

- A) NO CHANGE
- B) Because sonification is so helpful, universities and governments should provide more funding for its development.
- C) Therefore, it deserves consideration as an effective alternative to visual displays of information.
- D) Not only can sonification help yield important scientific discoveries, but it can also be used to create beautiful musical compositions.

One simple **13** example of sonification is: the heart-rate monitor, which translates the electrical activity of the heart into data represented as a series of tones. A faster or slower tempo indicates changes in the heart's rhythm. **14** More complex data can be sonified by using specialized synthesis techniques that convert numerical values to tones; interpretation consists of identifying patterns and variations in the resulting audio.

13

- A) NO CHANGE
- B) example, of sonification is
- C) example of sonification is,
- D) example of sonification is

14

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

Generally, people who exercise regularly have a lower resting heart rate.

Should the writer make this addition here?

- A) Yes, because it reinforces the point made about heart rhythms in the previous sentence.
- B) Yes, because it provides an effective transition to the discussion of complex data that follows in the paragraph.
- C) No, because it blurs the paragraph's focus by introducing loosely related information about exercise.
- D) No, because it fails to identify the factors that lead to a higher resting heart rate.

While there is not yet consensus among researchers on an established set of practices for sonifying data, the method already boasts a variety of current applications that demonstrate its potential. One application, for instance, is identifying and preventing network system failures. Sonification researcher David Worrall of the Australian National University analyzed computer network use at Germany's Fraunhofer Institute for Integrated **15** Circuits. By converting network metadata to sound that rises and falls in pitch in relation to time intervals between network events. By listening to the patterns, **16** one of his findings was that malfunctions like a printer driver failure were preceded by a predictable series of sounds. If sonification can be used to monitor a network in real time, the telltale pattern **17** leading so as to a malfunction could be recognized and acted on to avert the failure. Airlines, online sales companies, and banks rely on consistently functioning networks, so it is **18** easy to see how sonification could serve **19** this industry.

15

- A) NO CHANGE
- B) Circuits by
- C) Circuits, he did this by
- D) Circuits; and by

16

- A) NO CHANGE
- B) malfunctions like a printer driver failure were found by him to be
- C) he found that malfunctions like a printer driver failure were
- D) it was found by him that malfunctions like a printer driver failure were

17

- A) NO CHANGE
- B) leading up
- C) in the lead
- D) as a leader

18

Which choice best maintains the style and tone of the passage?

- A) NO CHANGE
- B) a cinch
- C) a piece of cake
- D) facile

19

- A) NO CHANGE
- B) such an industry.
- C) both industries.
- D) these industries.

In addition to its **20** ability to rival computer graphics technology, there are ways for sonification to effect positive change on a larger scale. For example, the International Community for Auditory Display believes that sonification could transform education, teaching young students more holistically, using sound as well as vision. **21** Next, the efficacy of sonification in representing a wide array of data reinforces its utility as a research **22** method. This research method can be used to draw out findings that had previously been lost in the noise.

20

Which choice provides the best transition from the previous paragraph?

- A) NO CHANGE
- B) uses for data analysis,
- C) popularity with scientists,
- D) usefulness for businesses that are struggling financially,

21

- A) NO CHANGE
- B) On the other hand,
- C) Accordingly,
- D) All told,

22

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

- A) method that can be used to draw out findings that had previously been lost in the noise.
- B) method from which those things that had been previously lost in the noise—findings—can be drawn.
- C) method; findings that had previously been lost in the noise can be drawn out from it.
- D) method, and drawing out findings that had previously been lost in the noise is what it can be used for.

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

A Breed Apart

The close bond between humans and dogs is known to be ancient, but the timing and location of canine domestication remain in dispute. Now, scientists have found evidence that dogs were likely **23** domesticated not, as was previously thought, once. Instead, it was twice.

In a 2016 study, researchers attempted to map the genetic family tree of dogs by comparing the genomes of hundreds of modern dogs with DNA samples recovered from ancient dogs, **24** that was including a 4,800-year-old specimen from Ireland. Because certain types of genetic mutations occur at relatively consistent rates across generations, **25** these certain types of mutations can be used to ascertain when **26** and to what degree different lineages of a species may have diverged from each other? The analysis revealed a major genetic split between modern European and Asian dog breeds.

23

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

- A) domesticated not once, as was previously thought, but twice.
- B) domesticated twice, though it was previously thought that it was once.
- C) domesticated twice, not, as was previously thought, once.
- D) domesticated—contrary to what was previously thought—not once, but twice.

24

- A) NO CHANGE
- B) included was
- C) including
- D) that included

25

- A) NO CHANGE
- B) these mutations
- C) this is why these mutations
- D) it is these mutations that

26

- A) NO CHANGE
- B) was it and to what degree was it that different lineages of a species may have diverged from each other.
- C) it was and to what degree was it that different lineages of a species may have diverged from each other?
- D) and to what degree different lineages of a species may have diverged from each other.

Further study suggested that this separation began between 14,000 and 6,400 years ago. During this period, there arose a genetic bottleneck—a reduction in genetic diversity often indicative of a small group breaking off from the core population—in the lineage of European dogs. Taken together, these findings would suggest that European dogs are simply descendants of a dog population that had migrated from Asia. **27** Likewise, the discovery of dog remains in Europe from as early as 15,000 years ago (before such a migration could have occurred) **28** makes clear that a population of European dogs predated the arrival of dogs from Asia. Furthermore, both **29** populations showed genetic marker's indicative of domestication. The scientists therefore hypothesized that a dog population in Europe was domesticated from wolves that had inhabited the continent; similarly, a dog population in Asia was domesticated from preexistent Asian wolves. **30** Genetic bottlenecks, the scientists note, have also been observed in human populations.

27

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

28

- A) NO CHANGE
- B) make
- C) have made
- D) are making

29

- A) NO CHANGE
- B) populations showed genetic markers'
- C) populations, showed genetic markers
- D) populations showed genetic markers

30

Which choice provides the most effective transition to the next paragraph?

- A) NO CHANGE
- B) The dog populations then intermixed when the Asian dogs migrated to Europe.
- C) Wolves themselves likely evolved from small carnivorous mammals that lived at the beginning of the Cenozoic era, approximately 65 million years ago.
- D) The 15,000-year-old European dog remains were discovered by quarry workers in 1914 in a suburb of Bonn, Germany.

In support of their hypothesis, the scientists point to the **31** change in prevalence over time of four haplogroups (collections of genes that indicate a particular line of descent) in ancient and modern European dogs. More than **32** 60 percent of the ancient European dog DNA samples that were 3,040–5,999 years old contained haplogroup A, which is associated with interbreeding with Asian dogs. By contrast, the same haplogroup appeared in less than 25 percent of the DNA from the most ancient European dogs and in an even smaller share of other ancient dogs. Scientists say such a drastic genetic alteration would not arise from random mutations. Rather, one domesticated population likely merged with another.

Haplogroup in Ancient and Modern European Dogs

Dog DNA samples	Approximate percent of samples containing haplogroup			
	A	B	C	D
Ancient dogs, 9,000–14,700 years old	20%	10%	70%	0%
Ancient dogs, 6,000–8,999 years old	6%	0%	70%	24%
Ancient dogs, 3,040–5,999 years old	6%	6%	63%	25%
Modern dogs, <3,040 years old	64%	22%	12%	2%

Adapted from Laurent A. F. Frantz et al., "Genomic and Archaeological Evidence Suggest a Dual Origin of Domestic Dogs." ©2016 by American Association for the Advancement of Science.

31

Which choice is consistent with the information presented in the table?

- A) NO CHANGE
- B) gradual decline over time
- C) steady increase
- D) lack of data regarding one

32

Which choice provides accurate data from the table?

- A) NO CHANGE
- B) 60 percent of the modern European dog DNA samples
- C) 25 percent of the ancient European dog DNA samples that were 9,000–14,700 years old
- D) 65 percent of the ancient European dog DNA samples that were 6,000–8,999 years old

As Greger Larson, one of the authors of the **33** study points out, domestication is a rare event in any species. It is a testament to the bond between dogs and humans that in the case of canines, this process appears to have occurred twice.

33

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

Questions 34-44 are based on the following passage.

Vending for Change

[1] Nine-year-old Christine Souffrant's day had a predictable pattern. [2] After school, she would dodge **34** shopper's to make her way to her mothers space in a crowded New York City flea market. [3] As the sun set, Souffrant would help her mother pack the unsold items into bags and haul them back home to Queens. [4] She'd then eat dinner and do her homework. [5] These early experiences as a street **35** vendor both at home in New York and when visiting family in Haiti—influenced her later decision to become an entrepreneur. [6] Souffrant and her mother sold imported wears (such as vibrant clothing, jewelry, and art) from their native Haiti off blankets spread out in Columbus Circle. **36**

34

- A) NO CHANGE
- B) shoppers' to make her way to her mother's
- C) shoppers to make her way to her mothers'
- D) shoppers to make her way to her mother's

35

- A) NO CHANGE
- B) vendor—both at home in New York and when visiting family in Haiti—
- C) vendor, both at home in New York and when visiting family in Haiti;
- D) vendor both at home in New York and when visiting family in Haiti,

36

To make the paragraph most logical, sentence 6 should be placed

- A) where it is now.
- B) after sentence 2.
- C) after sentence 3.
- D) after sentence 4.

Souffrant's ambition was strengthened in 2010, after an earthquake struck Haiti. In the aftermath of the quake, her mother's business, which relied on a steady supply of goods from Haitian artisans, had to close. Her mother and brother ultimately returned to Haiti, while Souffrant remained in the United States to attend college. During a visit to her family, Souffrant was struck by the tenacity of the **37** vendors. It was amazing that they had set up shops on top of the rubble. Vending had enabled her family to prosper in the United States, but it was essential for survival in Haiti; Souffrant suddenly grasped not only how powerful but also how fragile the vendor economy could be. **38** She decided that, after college, she would find a way to combine her entrepreneurial ambition with her desire to help improve the lives of street vendors.

37

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

- A) vendors and it was amazing that
- B) vendors because of how amazing it was that they
- C) vendors who, amazingly,
- D) vendors in amazement that they

38

At this point, the writer wants to set up the discussion of Souffrant's career path that follows in the next paragraph. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) A college scholarship enabled her to travel to other locales, including Africa, Asia, and the Caribbean.
- C) This experience left a powerful impression on her, one she remembers vividly even years later.
- D) She took several part-time jobs to help her family while finishing her English degree at Dartmouth College, an important goal in her life.

In the following years, **39** Souffrant graduated, worked in banking, and attended graduate school to study business—specifically, social entrepreneurship. Unlike models of philanthropy that **40** has relied on grants and donations, social entrepreneurship uses self-sustaining businesses to drive **41** a transformative social agenda that would change society. With a group of peers, Souffrant formulated a plan to digitize the street-vending industry in order to alleviate poverty in developing countries like Haiti. **42** They received several prestigious grants and awards, including a \$75,000 award at the 2015 Digital Entertainment World Expo.

39

- A) NO CHANGE
- B) Souffrant graduated, worked in banking, and,
- C) Souffrant graduated, worked, in banking, and
- D) Souffrant: graduated, worked in banking, and

40

- A) NO CHANGE
- B) is reliant
- C) rely
- D) relies

41

- A) NO CHANGE
- B) an agenda that would transform and change the world.
- C) a transformative social agenda.
- D) a plan to change the world through a social agenda.

42

Which of the following true statements best concludes the paragraph’s discussion of the development of Souffrant’s business?

- A) NO CHANGE
- B) The idea grew from a fledgling classroom project to a mature business plan, and in 2014 her company officially launched.
- C) Her graduate school was in Dubai, an urban area with many business investors, and Souffrant took advantage of these opportunities.
- D) While her family initially felt that leaving the corporate world for entrepreneurship was too risky, they eventually became Souffrant’s biggest supporters.

Souffrant’s business model is simple: Street vendors are given phones so they can upload pictures of their products to an online platform. Tourists and travelers in the surrounding area then **43** use the platform to browse and purchase the handicrafts and have them delivered locally. To ensure that this digital platform was improving the lives of the vendors, Souffrant ran a pilot program with a select group of street vendors in Haiti. **44** She trained volunteers to work in collaboration with local coordinators and youth in Haiti. This early success lends credence to Souffrant’s belief that entrepreneurship can serve society as well as business owners.

43

- A) NO CHANGE
- B) uses the platform
- C) used the platforms
- D) use platforms

44

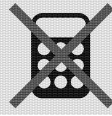
The writer wants to support the previous sentence’s claim with information that illustrates the company’s success. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) To guarantee access for all possible vendors, her company partnered with a large telecommunications provider in Haiti.
- C) She determined that these Haitian vendors earned nine to fourteen times their annual income over the course of the trial period.
- D) To keep the project size manageable, fifty artisans were interviewed for participation, with ten selected for the pilot.

STOP

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

No Test Material On This Page



Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

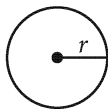
DIRECTIONS

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

NOTES

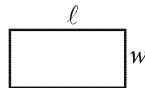
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
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- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain of a given function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

REFERENCE

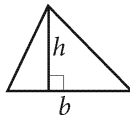


$$A = \pi r^2$$

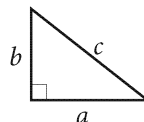
$$C = 2\pi r$$



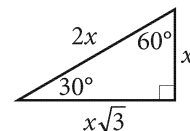
$$A = \ell w$$



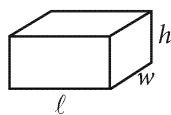
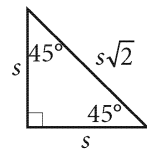
$$A = \frac{1}{2}bh$$



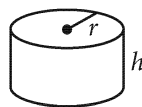
$$c^2 = a^2 + b^2$$



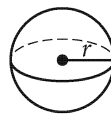
Special Right Triangles



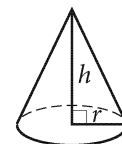
$$V = \ell wh$$



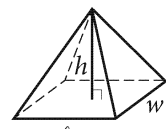
$$V = \pi r^2 h$$



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



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

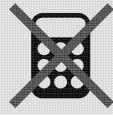


$$V = \frac{1}{3}\ell wh$$

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

The number of radians of arc in a circle is 2π .

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



1

$$8 - r = 3r$$

What value of r satisfies the given equation?

- A) 2
- B) 4
- C) 5
- D) 11

2

The function f is defined by the equation $f(x) = 2^x$.
What is the value of $f(1)$?

- A) 0
- B) 1
- C) 2
- D) 4

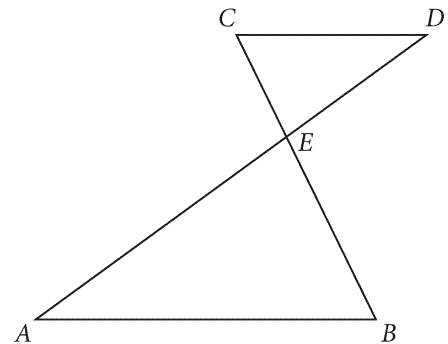
3

$$2y^2(3y + 1)$$

Which of the following is equivalent to the expression above?

- A) $5y^3 + 1$
- B) $6y^3 + 1$
- C) $5y^3 + 3y^2$
- D) $6y^3 + 2y^2$

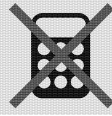
4



Note: Figure not drawn to scale.

In the figure shown, $\overline{AB} \parallel \overline{CD}$, and \overline{AD} and \overline{BC} intersect at point E . If the ratio of AB to CD is 3 to 2 and $CE = 6$, what is the length of \overline{BE} ?

- A) 12
- B) 9
- C) 6
- D) 4

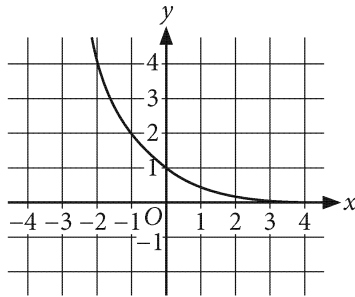


5

In the xy -plane, the graph of the linear function f contains the points $(0, 2)$ and $(3, -1)$. Which of the following defines f ?

- A) $f(x) = -x + 2$
- B) $f(x) = -x - 2$
- C) $f(x) = 2x + 2$
- D) $f(x) = 2x - 7$

6



The graph of $y = h(x)$ is shown in the xy -plane. Which of the following could define the function h ?

- A) $h(x) = \left(\frac{1}{4}\right)^x$
- B) $h(x) = \left(\frac{1}{2}\right)^x$
- C) $h(x) = 2^x$
- D) $h(x) = 4^x$

7

The table shows output values, $m(x)$, of quadratic function m for corresponding input values x .

x	$m(x)$
-1	8
1	6
3	8

If a is a positive constant, which of the following can define the function m ?

- A) $m(x) = -a(x - 1)^2 + 6$
- B) $m(x) = -a(x + 1)^2 + 6$
- C) $m(x) = a(x - 1)^2 + 6$
- D) $m(x) = a(x + 1)^2 + 6$

8

$$10x - 4x = 60$$

Margaret saves money by bringing lunch from home rather than buying it at work. The equation above can be used to determine how many lunches, x , she needs to bring from home to save \$60. Margaret spends \$10 for each lunch she buys at work. What is the meaning of the number 4 in the equation?

- A) The number of lunches she needs to buy at work rather than bring from home in order to save \$60
- B) The number of lunches she needs to bring from home rather than buy at work in order to save \$60
- C) The amount, in dollars, she saves for each lunch she brings from home rather than buys at work
- D) The cost, in dollars, of each lunch she brings from home



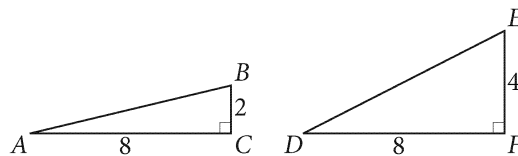
9

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

The formula above expresses the kinetic energy K of an object in terms of the object's mass m and speed v . Which of the following expresses the mass of the object in terms of its speed and kinetic energy?

- A) $m = 2Kv^2$
- B) $m = \frac{Kv^2}{2}$
- C) $m = \frac{K}{2v^2}$
- D) $m = \frac{2K}{v^2}$

10



Right triangles ABC and DEF are shown. Which of the following statements about these triangles is true?

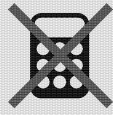
- A) $\sin A = \frac{1}{2} \sin D$
- B) $\sin A = 2 \sin D$
- C) $\tan A = \frac{1}{2} \tan D$
- D) $\tan A = 2 \tan D$

11

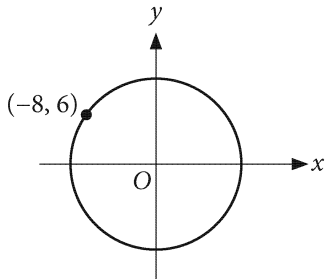
$$\frac{x-3}{x^2-3^2}$$

Which of the following is equivalent to the expression above, where $x > 3$?

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



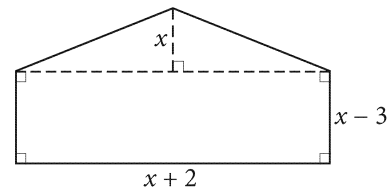
12



In the xy -plane above, the circle has its center at the origin and point $(-8, 6)$ lies on the circle. What is the circumference of the circle?

- A) 12π
- B) 16π
- C) 20π
- D) 25π

13



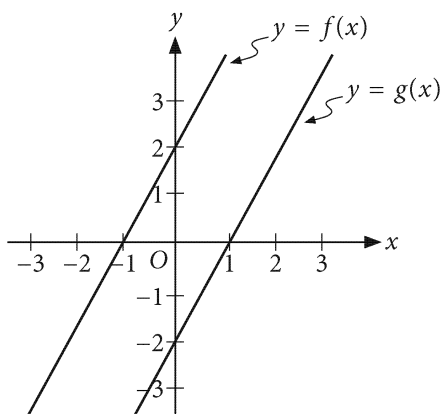
Note: Figure not drawn to scale.

Which of the following functions M best represents the area of the figure shown?

- A) $M(x) = \frac{3}{2}x^2 - 6$
- B) $M(x) = 4x^2 - 12x$
- C) $M(x) = 2x^2 + x - 6$
- D) $M(x) = 3x^2 + 5x - 12$



14



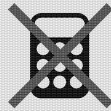
The graphs of the linear functions f and g are shown in the xy -plane above. Which of the following defines g in terms of f ?

- A) $g(x) = f(x) + 4$
- B) $g(x) = f(x) - 4$
- C) $g(x) = f(x) + 2$
- D) $g(x) = f(x) - 2$

15

A plumber charges an initial fee of \$50 and an additional \$20 fee for every $\frac{1}{4}$ hour of work. The plumber worked for h hours on a job, and the total cost for the job was \$210. Which of the following equations models this situation?

- A) $50 + (20 \cdot 4h) = 210$
- B) $(50 + 20) \cdot 4h = 210$
- C) $50 + \left(20 \cdot \frac{1}{4}h\right) = 210$
- D) $(50 + 20) \cdot \frac{1}{4}h = 210$



DIRECTIONS

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

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If

3	1	/	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0

 is entered into the grid, it will be interpreted as $\frac{31}{2}$, not $3\frac{1}{2}$.)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

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

Write answer in boxes. →

7	/	1	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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
<input checked="" type="radio"/>	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Grid in result. {

Answer: 2.5

	2	.	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	3
4	4	4	4
5	5	5	<input checked="" type="radio"/>
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

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

	2	/	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	<input checked="" type="radio"/>
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
7	7	7	7
8	8	8	8
9	9	9	9

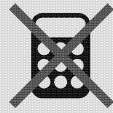
.	6	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	<input checked="" type="radio"/>	<input checked="" type="radio"/>	6
7	7	7	<input checked="" type="radio"/>
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	<input checked="" type="radio"/>	<input checked="" type="radio"/>	0
1	1	1	<input checked="" type="radio"/>
2	<input checked="" type="radio"/>	2	2
3	3	3	3

2	0	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input checked="" type="radio"/>	0	0	0
1	1	<input checked="" type="radio"/>	1
<input checked="" type="radio"/>	2	2	2
3	3	3	3

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



16

x	y
0	4
2	9

The table shows two values of x and the corresponding values of y for two points on a line in the xy -plane. What is the slope of the line?

17

$$\sqrt{x} = 4$$

For what value of x is the equation above true?

18

$$\begin{aligned}x + y &= 30 \\ 3x - y &= 10\end{aligned}$$

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

19

$$|x - 7| = 8$$

If x is the positive solution of the equation above, what is the value of $x - 7$?

20

$$\begin{aligned}3x - y &= 19 \\ 1.5x - 0.5y &= b\end{aligned}$$

In the system of equations above, b is a constant. If the system has infinitely many solutions, what is the value of b ?

STOP

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



Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

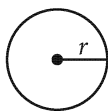
DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

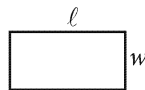
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- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated,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

REFERENCE

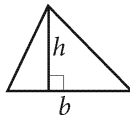


$$A = \pi r^2$$

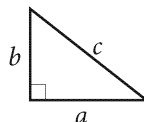
$$C = 2\pi r$$



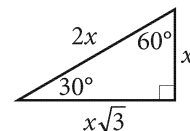
$$A = \ell w$$



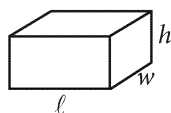
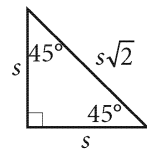
$$A = \frac{1}{2}bh$$



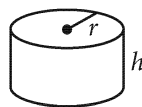
$$c^2 = a^2 + b^2$$



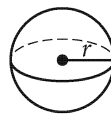
Special Right Triangles



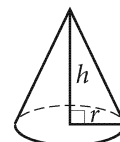
$$V = \ell wh$$



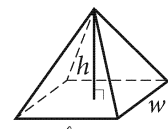
$$V = \pi r^2 h$$



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



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



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

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

The number of radians of arc in a circle is 2π .

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

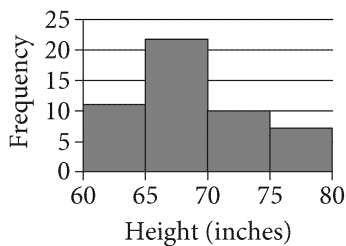


1

Troy ordered posters of two sizes, small and large, from an office supply store for a total cost of \$220. Each small poster cost \$15, and each large poster cost \$20. If he ordered 5 large posters, how many small posters did he order?

- A) 12
- B) 10
- C) 8
- D) 6

2



The histogram summarizes the distribution of height, in inches, for a sample of 50 adults, where the first bar represents people who have a height of at least 60 inches but less than 65 inches, the second bar represents people who have a height of at least 65 inches but less than 70 inches, and so on. According to the histogram, how many adults in the sample have a height of at least 65 inches but less than 70 inches?

- A) 7
- B) 10
- C) 11
- D) 22

3

During a chemical reaction, 1 mole of nitrogen is consumed for every 2 moles of ammonia produced. If a total of 250 moles of nitrogen are consumed during the reaction, what is the number of moles of ammonia produced?

- A) 1,000
- B) 500
- C) 125
- D) 31.25

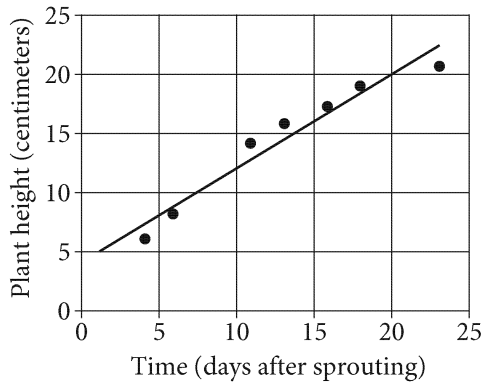
4

What is 20% of 15,000 ?

- A) 3,000
- B) 2,500
- C) 2,000
- D) 1,500



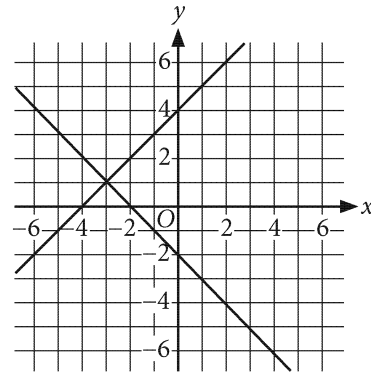
5



Jan planted one seed of a common bean plant and monitored the growth. She recorded the plant height, in centimeters, and the time, in days after sprouting, at 7 different times. The data are shown on the scatterplot along with a line of best fit. For how many of these 7 points was the actual height greater than the height predicted by the line of best fit?

- A) 3
- B) 4
- C) 6
- D) 7

6



The equations in a system are graphed in the xy -plane shown. Which of the following points (x, y) is the solution to this system?

- A) $(-4, 4)$
- B) $(-4, -2)$
- C) $(-3, -1)$
- D) $(-3, 1)$

7

A stack of 100 cards contains only green cards and yellow cards. The ratio of green cards to yellow cards is 2 to 3. How many yellow cards are in the stack?

- A) 30
- B) 40
- C) 60
- D) 80



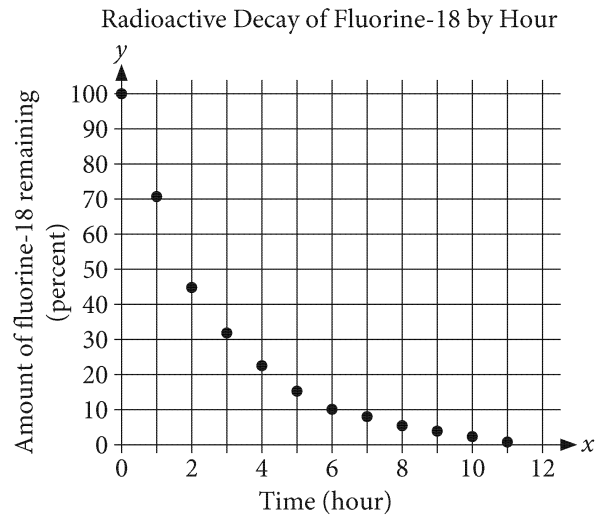
8

If $\frac{a}{3} = 4$ and $3w = a$, what is the value of $2w$?

- A) 2
- B) 4
- C) 6
- D) 8

9

The radioactive decay of a sample of fluorine-18 was measured. The scatterplot shows the amount, by percent of initial mass, of fluorine-18 remaining each hour.



Which of the following functions best models the relationship between the amount of fluorine-18 remaining, $y\%$, and the number of hours, x , since measurements began?

- A) $y = 680(0.10)^{2x}$
- B) $y = 680(1.10)^{2x}$
- C) $y = 100(0.68)^x$
- D) $y = 100(1.68)^x$



Questions 10 and 11 refer to the following information.

$$\text{Mars: } M(d) = 50 - 0.05d$$

$$\text{Venus: } V(d) = 108 - 0.78d$$

The given functions approximate the numbers of craters on the surfaces of Mars and Venus that have diameter d , rounded to the nearest kilometer.

10

Based on the function for Venus, which of the following is closest to the approximate number of craters on Venus that have a diameter of 10 kilometers, rounded to the nearest kilometer?

- A) 10
- B) 50
- C) 78
- D) 100

11

Based on the given functions, for which of the following diameters, in kilometers, do Mars and Venus have approximately the same number of craters?

- A) 13
- B) 70
- C) 79
- D) 190



Questions 12 and 13 refer to the following information.

The equation $M = 20t + 730$, where t is an integer and $0 \leq t \leq 10$, models the mean monthly milk production, M , in pounds per dairy cow at a certain farm, where t is the number of years since 1962.

12

Which of the following inequalities describes the mean monthly milk production M , in pounds per dairy cow, from 1962 through 1972?

- A) $0 \leq M \leq 730$
- B) $730 \leq M \leq 930$
- C) $930 \leq M \leq 1,970$
- D) $1,970 \leq M \leq 2,170$

13

Based on the model, how many years after 1962 was the mean monthly milk production per dairy cow 810 pounds?

- A) 77
- B) 41
- C) 8
- D) 4



14

In the xy -plane, the line with equation $y = mx - 6$ is parallel to the line with equation $6y = 3x + 5$. What is the value of m ?

- A) $\frac{1}{2}$
- B) $\frac{5}{6}$
- C) 2
- D) 3

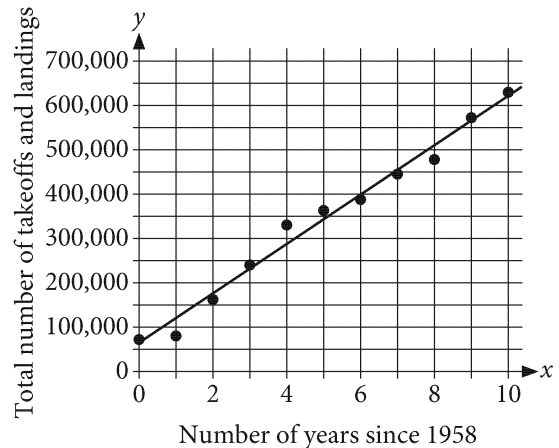
15

The mayor of Springfield is proposing that for each of the next 10 years, the city budget will be 1% less than the budget for the previous year. What type of function best models this proposal as a function of time?

- A) Increasing exponential
- B) Decreasing exponential
- C) Increasing linear
- D) Decreasing linear

16

The scatterplot shows the total number of takeoffs and landings at O'Hare International Airport every year from 1958 through 1968. A line of best fit with a y -intercept of $(0, 59,375)$ is also shown.



Which of the following is the best interpretation of the number 59,375 in this context?

- A) The total number of takeoffs and landings the model predicts at O'Hare for 1958
- B) The total number of takeoffs and landings the model predicts at O'Hare for 1968
- C) The increase in the total number of takeoffs and landings the model predicts at O'Hare each year
- D) The increase in the total number of takeoffs and landings the model predicts at O'Hare from 1958 through 1968



17

If $6(x - 1) + 2 = 5$, what is the value of $x - 1$?

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

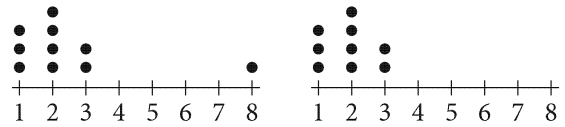
18

$$\frac{(x - 2)^2(x + 1)}{x^2 - 4x + 4} = 0$$

Which of the following is a solution of the given equation?

- A) 4
 B) 2
 C) -1
 D) -4

19



Two dot plots are shown above. The dot plot on the left shows 10 data points. The outlier was removed to create the set with 9 data points shown in the dot plot on the right. Which of the following values is the same for both data sets?

- I. Mean
 II. Median
- A) I only
 B) II only
 C) I and II
 D) Neither I nor II

20

$$P(t) = 3,500(1.023)^t$$

The function shown gives the balance of Tashi's account $P(t)$, in dollars, t years after she opened the account, where t is an integer. Based on the function P , what is the percent increase of the balance of Tashi's account between any two consecutive years?

- A) 23%
 B) 10.23%
 C) 2.3%
 D) 1.023%



Questions 21 and 22 refer to the following information.

Advertising during a Three-Hour
Television Program

Type of advertisement	Length of advertisement (seconds)			
	15	30	60	Total
Food or beverage	0	34	9	43
Television show or movie	4	22	6	32
Vehicle	0	8	10	18
Other	6	1	0	7
Total	10	65	25	100

The table above shows the total number of television advertisements that appeared during a 3-hour television program, by type and length of advertisement.

21

If a food or beverage advertisement that appeared during the 3-hour television program is chosen at random, what is the probability that the length of the advertisement is 60 seconds?

- A) $\frac{9}{25}$
 B) $\frac{9}{43}$
 C) $\frac{9}{100}$
 D) $\frac{25}{100}$

22

What is the ratio of the length of advertisement time to the length of nonadvertisement time for the 3-hour television program?

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



23

Data set X consists of the 49 integers from 1 to 49, inclusive, and data set Y consists of the 49 integers from 5 to 53, inclusive. Which of the following are equal for the two data sets?

- I. The standard deviations
- II. The medians

- A) I only
- B) II only
- C) I and II
- D) Neither I nor II

24

The function $y = f(x)$ is graphed in the xy -plane and crosses the x -axis at 5 distinct points. Which of the following could define the function f ?

- A) $f(x) = x^5$
- B) $f(x) = (x - 5)^3$
- C) $f(x) = (x - 2)^3(x - 1)(x + 1)$
- D) $f(x) = x^3(x - 3)^3(x - 2)(x - 1)(x + 1)$

25

$$x^2 + bx + 25 = 0$$

In the equation above, b is a constant. If the equation has exactly one solution, which of the following could be the value of b ?

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

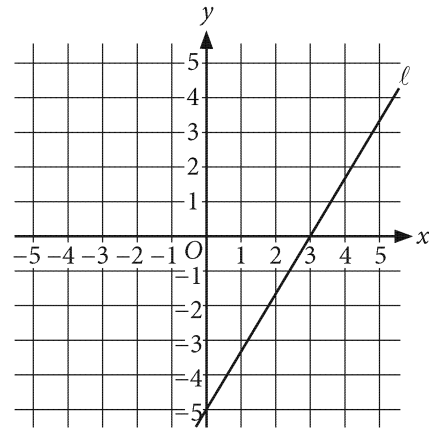


26

Dominique is purchasing a car priced at \$20,000. At the time of purchase, he will also buy additional equipment for the car, which is priced at d dollars. There is a 5 percent sales tax on Dominique's total purchase. If he pays \$25,200, including tax, for the car and the additional equipment, what is the value of d ?

- A) \$1,200
- B) \$1,260
- C) \$4,000
- D) \$4,200

27



Line ℓ is shown in the xy -plane above. Which of the following is an equation of line ℓ ?

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



28

Which of the following is an equation of the circle in the xy -plane that passes through the origin and has center $(5, 12)$?

- A) $x^2 + y^2 = 169$
- B) $(x - 5)^2 + (y - 12)^2 = 13$
- C) $(x + 5)^2 + (y + 12)^2 = 169$
- D) $(x - 5)^2 + (y - 12)^2 = 169$

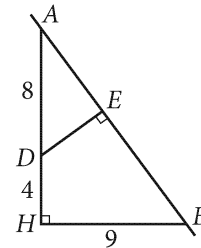
29

$$y = 2x^2 - 12x + 22$$

In which of the following equivalent forms of the given equation do the coordinates of the vertex of its graph in the xy -plane appear as constants or coefficients?

- A) $y = 2(x^2 - 6x + 11)$
- B) $y = 2(x^2 - 6x) + 22$
- C) $\frac{1}{2}y - 2 = (x - 3)^2$
- D) $y - 4 = 2(x - 3)^2$

30



Note: Figure not drawn to scale.

The figure above represents Liliana's position, D , on a map relative to her home, H , and the highway, \overline{AB} , that passes nearby. If the distances shown in the diagram are in miles, and \overline{AH} and \overline{BH} form a right angle at H , what is the length, in miles, of \overline{DE} , the shortest distance between Liliana's position and the highway, \overline{AB} ?

- A) 4.8
- B) 4.5
- C) 4.2
- D) 3.9


DIRECTIONS

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

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or $7/2$. (If

3	1	/	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

7	/	1	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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
<input checked="" type="radio"/>	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Answer: 2.5

	2	.	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	3
4	4	4	4
5	5	5	<input checked="" type="radio"/>
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

Grid in result.

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

	2	/	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	<input checked="" type="radio"/>
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	<input checked="" type="radio"/>	<input checked="" type="radio"/>	6
7	7	7	<input checked="" type="radio"/>
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	<input checked="" type="radio"/>	0	
1	1	1	<input checked="" type="radio"/>
2	<input checked="" type="radio"/>	2	2
3	3	3	3

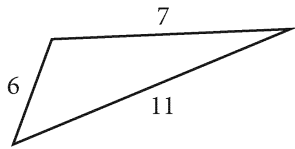
2	0	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input checked="" type="radio"/>	0	0	
1	1	<input checked="" type="radio"/>	1
<input checked="" type="radio"/>	2	2	2
3	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.

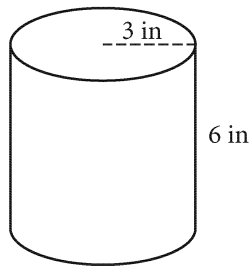


31



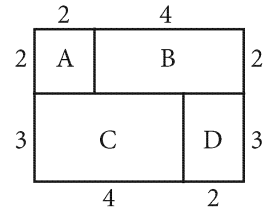
What is the mean of the lengths of the sides of the triangle shown?

32



The right circular cylinder shown has a radius of 3 inches and a height of 6 inches. The volume of the cylinder is $x\pi$ cubic inches. What is the value of x ?

33



The 6-by-5 rectangle shown is divided into four rectangular regions, A, B, C, and D. The area of region A is what fraction of the area of the 6-by-5 rectangle?

34

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

The function f above is defined for all x , where k is a constant. If $f(5) = 23$, what is $f(10)$?



35

In the xy -plane, the graph of $f(x) = x^2$ is intersected by five lines parallel to the x -axis. What is the sum of the x -coordinates of the points of intersection of the five lines with the graph of f ?

36

If $x^2 + y^2 = 15$ and if $x^2 - y^2 = 10$, what is the value of $x^4 - y^4$?

Questions 37 and 38 refer to the following information.

Year	Forest cover in the Brazilian Amazon (square kilometers)
1970	4,000,000
1977	3,960,000
2002	3,480,000

The table shows the estimated area of forest cover in the Brazilian Amazon, in square kilometers, for the years 1970, 1977, and 2002.

37

Based on the estimates shown in the table, the area of forest cover in the Brazilian Amazon was $p\%$ less in 2002 than in 1970. What is the value of p ?

38

Based on the table, how many square megameters of forest cover was in the Brazilian Amazon in 1977? (1000 kilometers = 1 megameter)

STOP

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