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SAT PRACTICE TEST

2016/10

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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 Charlotte Brontë, *Jane Eyre*. Originally published in 1847. The title character is a governess at the Thornfield Hall estate. Governesses were employed to live in private homes and teach the children there. Adèle is Jane's student. Mrs. Fairfax is the housekeeper of Thornfield Hall.

The promise of a smooth career, which my first calm introduction to Thornfield Hall seemed to pledge, was not belied on a longer acquaintance with Line the place and its inmates. Mrs. Fairfax turned out to 5 be what she appeared, a placid-tempered, kind-natured woman, of competent education and average intelligence. My pupil was a lively child, who had been spoilt and indulged, and therefore was sometimes wayward; but as she was committed 10 entirely to my care, and no injudicious interference from any quarter ever thwarted my plans for her improvement, she soon forgot her little freaks, and became obedient and teachable. She had no great talents, no marked traits of character, no peculiar 15 development of feeling or taste, which raised her one inch above the ordinary level of childhood; but neither had she any deficiency or vice which sunk her below it. She made reasonable progress, entertained for me a vivacious, though perhaps not very 20 profound, affection; and by her simplicity, gay prattle, and efforts to please, inspired me, in return, with a degree of attachment sufficient to make us both content in each other's society.

This, *par parenthèse*,¹ will be thought cool 25 language by persons who entertain solemn doctrines about the angelic nature of children, and the duty of those charged with their education to conceive for them an idolatrous devotion. But I am not writing to flatter parental egotism, to echo cant, or prop up 30 humbug; I am merely telling the truth. I felt a conscientious solicitude for Adèle's welfare and progress, and a quiet liking to her little self; just as I cherished towards Mrs. Fairfax a thankfulness for her kindness, and a pleasure in her society 35 proportionate to the tranquil regard she had for me, and the moderation of her mind and character.

Anybody may blame me who likes, when I add further, that, now and then, when I took a walk by myself in the grounds; when I went down to the gates 40 and looked through them along the road; or when, while Adèle played with her nurse, and Mrs. Fairfax made jellies in the storeroom, I climbed the three staircases, raised the trap-door of the attic, and having reached the leads, looked out afar over 45 sequestered field and hill, and along dim sky-line—that then I longed for a power of vision which might overpass that limit; which might reach the busy world, towns, regions full of life I had heard of but never seen; that then I desired more of 50 practical experience than I possessed; more of intercourse with my kind, of acquaintance with variety of character, than was here within my reach. I valued what was good in Mrs. Fairfax, and what was good in Adèle; but I believed in the existence of other 55 and more vivid kinds of goodness, and what I believed in I wished to behold.

Who blames me? Many, no doubt; and I shall be called discontented. I could not help it; the restlessness was in my nature; it agitated me to pain sometimes. Then my sole relief was to walk along the corridor of the third story, backwards and forwards, safe in the silence and solitude of the spot, and allow my mind's eye to dwell on whatever bright visions rose before it—and, certainly, they were many and glowing; to let my heart be heaved by the exultant movement, which, while it swelled it in trouble, expanded it with life; and, best of all, to open my inward ear to a tale that was never ended—a tale my imagination created, and narrated continuously; quickened with all of incident, life, fire, feeling, that I desired and had not in my actual existence.

¹ French for "incidentally"

1

Which choice best summarizes the passage as a whole?

- A) A character discusses why she resigned a seemingly ideal position.
- B) A character reveals how her teaching philosophy informed her work.
- C) A character looks back on feelings she'd had about her situation in life.
- D) A character describes her appreciation for the opportunities life has presented her.

2

The narrator characterizes Adèle primarily as

- A) inspiring.
- B) precocious.
- C) puzzling.
- D) unremarkable.

3

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

- A) Lines 7-9 ("My pupil . . . wayward")
- B) Lines 9-13 ("as she . . . teachable")
- C) Lines 13-18 ("She . . . below it")
- D) Lines 30-32 ("I felt . . . self")

4

The narrator mentions Adèle's "simplicity" and "prattle" (lines 20-21) primarily to

- A) acknowledge certain endearing qualities.
- B) highlight particular deficiencies.
- C) emphasize the child's teachable nature.
- D) suggest the child's need for improvement.

5

In the passage, the narrator primarily presents herself as being

- A) cool and unforgiving.
- B) loving and attentive.
- C) insightful and sophisticated.
- D) forthright and unbiased.

6

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

- A) Lines 24-28 ("This . . . devotion")
- B) Lines 28-30 ("But I am . . . truth")
- C) Lines 33-35 ("I cherished . . . for me")
- D) Lines 46-49 ("I longed . . . seen")

7

- The narrator discusses Adèle and Mrs. Fairfax in the second paragraph (lines 24–36) primarily to
- A) explain her ambivalence toward these characters.
 - B) reveal the apparent motivations of these characters.
 - C) challenge conventional assumptions about these characters.
 - D) present a fuller picture of her relationship with these characters.

8

- The rhetorical question in line 57 suggests that the narrator is
- A) filled with resentment toward those who judge her.
 - B) uncertain about the loyalty of those closest to her.
 - C) aware that some will disapprove of her dissatisfaction.
 - D) envious of the freedom of others.

9

- As used in line 59, “nature” most nearly means
- A) physical vitality.
 - B) essential character.
 - C) controlling force.
 - D) uncivilized state.

10

- The “visions” (line 64) that the narrator has are best described as
- A) dramatic and surreal.
 - B) vivid and intense.
 - C) raw and overpowering.
 - D) calm and comforting.

Questions 11–20 are based on the following passage.

This passage is adapted from Thomas Paine, *Common Sense*. Originally published in January 1776. Paine was born in England in 1737 and immigrated to America in 1774.

I have heard it asserted by some that, as America has flourished under her former connection with Great Britain, the same connection is necessary *Line* toward her future happiness and will always have the same effect. Nothing can be more fallacious than this kind of argument. We may as well assert that, because a child has thrived upon milk, that it is never to have meat, or that the first twenty years of our lives is to become a precedent for the next twenty. 10 But even this is admitting more than is true; for I answer roundly that America would have flourished as much, and probably much more, had no European power taken any notice of her. The commerce by which she hath enriched herself are the necessities of life and will always have a market while eating is the custom of Europe.

But she has protected us, say some. That she hath engrossed us is true, and defended the continent at our expense as well as her own, is admitted; and she 20 would have defended Turkey from the same motive, *viz.*, for the sake of trade and dominion.

Alas! we have been long led away by ancient prejudices and made large sacrifices to superstition. We have boasted the protection of Great Britain 25 without considering that her motive was *interest* not *attachment* and that she did not protect us from *our enemies on our account* but from her enemies on her own account, from those who had no quarrel with us on any *other account*, and who will always be our 30 enemies on the *same account*. Let Britain waive her pretensions to the continent, or the continent throw off the dependence, and we should be at peace with France and Spain were they at war with Britain. The miseries of Hanover's last war ought to warn us 35 against connections.

It hath lately been asserted in Parliament that the colonies have no relation to each other but through the parent-country, i.e., that Pennsylvania and the Jerseys, and so on for the rest, are sister-colonies by 40 the way of England; this is certainly a very roundabout way of proving relationship, but it is the nearest and only true way of proving enmity (or enemyship, if I may so call it). France and Spain never were, nor perhaps ever will be, our enemies as 45 Americans but as our being the *subjects of Great Britain*.

But Britain is the parent-country, say some. Then the more shame upon her conduct. Even brutes do not devour their young, nor savages make war upon 50 their families; wherefore, the assertion, if true, turns to her reproach; but it happens not to be true, or only partly so, and the phrase *parent- or mother-country* hath been adopted by the king and his parasites, with a low design of gaining an unfair bias on the 55 credulous weakness of our minds. Europe, and not England, is the parent-country of America. This New World hath been the asylum for the persecuted lovers of civil and religious liberty from *every part of Europe*. Hither have they fled, not from the tender 60 embraces of the mother, but from the cruelty of the monster; and it is so far true of England that the same tyranny which drove the first emigrants from home pursues their descendants still.

11

The main purpose of the passage is to

- A) present the reasons for America's historical attachment to Great Britain.
- B) argue that America does not need Great Britain's governance.
- C) appeal to Great Britain to support America in becoming independent.
- D) explain the source of enmity between Great Britain and Europe.

12

The passage suggests that Paine believes “some” people (lines 1, 17, and 47) are

- A) reluctant to sever ties with Great Britain.
- B) unjust in their claims about Great Britain.
- C) intentionally spreading misinformation about Great Britain.
- D) pessimistic about British intent.

13

As used in lines 2 and 3, “connection” most nearly means

- A) physical link.
- B) means of communication.
- C) recognized relationship.
- D) influential person.

14

According to Paine, the assertion referred to in the first sentence of the passage is fallacious because it assumes that

- A) America’s needs will not change over time.
- B) America will not flourish in the future.
- C) America has not fully appreciated Great Britain’s governance.
- D) Great Britain and America share fundamental values.

15

Paine’s references to “ancient prejudices” (lines 22-23) and “superstition” (line 23) serve mainly to

- A) demonstrate his feelings of alienation from Great Britain.
- B) point out the irrationality of a particular colonial view.
- C) show the effectiveness of Great Britain’s efforts at self-promotion.
- D) exhort the colonies to adopt new political allegiances.

16

According to Paine, those who are “enemies on the *same account*” (line 30) are antagonistic toward America because they

- A) are enemies of Great Britain.
- B) are enemies of France and Spain.
- C) have pretensions of European supremacy.
- D) are fearful of international entanglements.

17

Which choice most clearly conveys the claim that the American colonies do not have especially strong ties to one another?

- A) Lines 6-9 (“We may . . . next twenty”)
- B) Lines 36-40 (“It hath . . . England”)
- C) Lines 50-52 (“wherefore . . . partly so”)
- D) Lines 61-63 (“and it . . . still”)

18

- Paine refers to the idea of Great Britain being the “parent-country” or “mother-country” of the American colonies primarily to
- A) highlight America’s feelings of loyalty toward Great Britain.
 - B) indicate the intimacy between America and Great Britain.
 - C) explain Great Britain’s corrective actions against America.
 - D) emphasize Great Britain’s harsh and manipulative treatment of America.

19

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

- A) Lines 17-18 (“That . . . true”)
- B) Lines 30-33 (“Let . . . with Britain”)
- C) Lines 48-50 (“Even . . . families”)
- D) Lines 55-56 (“Europe . . . America”)

20

The comment in lines 59-61 (“Hither . . . monster”) mainly serves to

- A) compare the experience of immigrants in Europe and America.
- B) emphasize the idea that many Americans fled repression.
- C) point out certain unintended consequences of immigration to America.
- D) refute the notion that Europe persecuted lovers of liberty.

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

This passage is adapted from Sid Perkins, "Cold Climate Shrinks Mountains." ©2013 by American Association for the Advancement of Science.

Every year, billions of tons of rock and soil vanish from Earth's surface, scoured from mountains and plains and swept away by wind, rain, and other elements. The chief driver of this dramatic

Line 5 resurfacing is climate, according to a new study. And when the global temperature falls, erosion kicks into overdrive.

Scientists have long debated what drives most of the world's erosion: Is it predominantly triggered by Line 10 climate, or is it the result of mountain-building, tectonic activity? Most previous studies of erosion have relied on measuring the amounts of sediment that accumulate somewhere after being carried away from their sources and deposited elsewhere. But such Line 15 analyses focus on the aftereffects of erosion, not the process itself, says Frédéric Herman, a geophysicist at the University of Lausanne in Switzerland. And most research has looked at limited regions of Earth—a particular mountain range, say, and not the planet as Line 20 a whole.

To more directly estimate rates of erosion, researchers use techniques generally known as thermochronometry, or the measure of how a rock's temperature has changed through time. Many such Line 25 techniques rely on assessing how the decay of radioactive elements within a rock has affected its minerals. For their new study, Herman and his colleagues used four such techniques. In two of them, the researchers measured how much decay-produced Line 30 helium had built up in a rock's minerals. (Once the rock falls below a certain temperature, the helium stops diffusing out of the minerals efficiently.) In the other two, the team tallied the amount of microscopic damage produced by radioactive decay. Line 35 (Once the rock falls below a certain temperature, the atoms in a crystal aren't able to shift and heal the damage.) Using these approaches, the researchers could estimate the dates at which the rocks cooled to temperatures between 250°C and 70°C—and Line 40 therefore track the speed at which the rocks rose toward ground level as the overlying strata eroded away.

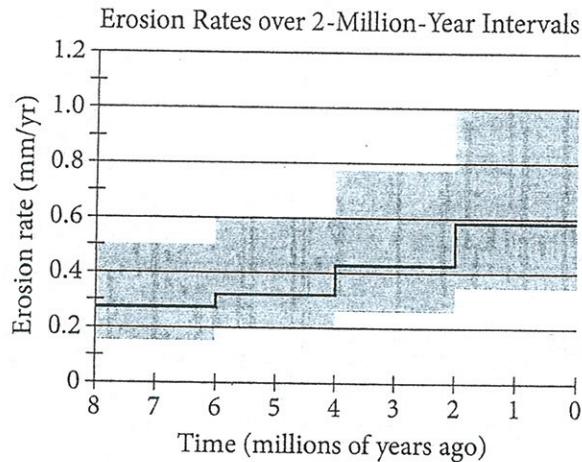
Using data they'd gathered themselves, as well as that gleaned from other studies, the scientists Line 45 compiled almost 18,000 data points from across the globe. During the past 8 million years, rates of erosion have varied from less than 0.01 millimeter per year (in central and western Australia and in central North America, for example) to as much as Line 50 10 mm/yr (at sites in the Himalayas, Taiwan, and New Zealand).

These regional trends may not be surprising: Australia is relatively flat and dry, and the Himalayas and Taiwan host relatively steep terrain that's often Line 55 lashed by monsoons. But the big story, Herman says, lies in the global trends seen as those 8 million years unfolded.

About 6 million years ago, as Earth's climate cooled, erosion rates generally rose at all latitudes but Line 60 increased most notably in mountainous regions. Then, in the wake of even stronger cooling that helped trigger a series of ice ages and interglacial periods beginning about 2.4 million years ago, erosion rates doubled. Because erosion increased Line 65 most dramatically in midlatitude mountain ranges—areas most likely to first experience glaciers as climate gradually cooled—Herman and his colleagues blame the acceleration in erosion on glacial scouring.

Line 70 The new findings, and especially their global scale, "confirms for me that [the increases in erosion rates] are a climate signal," says David Egholm, a geophysicist at Aarhus University in Denmark. In particular, he notes, the latitude-dependent variation Line 75 in erosion rates "most probably" can be attributed to glaciers.

If Earth's climate continues to cool, as it has over the long term in the past few million years, rates of erosion will likely continue to rise. But if that cooling Line 80 trend stalls, erosion worldwide will gradually decrease.



Adapted from F. Herman et al., "Worldwide Acceleration of Mountain Erosion Under a Cooling Climate." ©2013 by Nature Publishing Group.

The black line shows the average rate of erosion during each interval. The shaded area shows the variation from the average rate.

21

The main purpose of the passage is to

- A) explain the processes that cause erosion of rocks.
- B) describe the results of a study showing how Earth's climate affects erosion rates.
- C) explain tectonic activity and how mountain building is related to erosion.
- D) describe the process of the radioactive decay of elements in rock.

22

As used in line 4, "driver of" most nearly means

- A) leader of.
- B) operator of.
- C) factor in.
- D) transmitter in.

23

According to the passage, one objection to the methods used in previous studies of erosion is that they

- A) studied only the effects triggered by climate.
- B) provided information about results rather than processes.
- C) did not record temperatures of sediment samples.
- D) failed to investigate glaciers.

24

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

- A) Lines 8-11 ("Scientists . . . activity")
- B) Lines 11-14 ("Most . . . elsewhere")
- C) Lines 28-30 ("In two . . . minerals")
- D) Lines 58-60 ("About . . . regions")

25

In relation to the research described in the passage, the main function of thermochronometry is to

- A) use changes in the temperature of rock to estimate rates of erosion.
- B) better understand how helium diffusion in rock occurs.
- C) develop better protection methods against radioactivity.
- D) predict why there are occasional interglacial periods.

26

Based on the passage, when the temperature of rock is above 250°C, it is reasonable to conclude that

- A) crystals in minerals can no longer repair radioactive damage.
- B) radioactive decay stops occurring in minerals.
- C) helium can easily diffuse out of minerals.
- D) helium stops diffusing out of minerals.

27

In the third paragraph (lines 21-42), the author's assertion that "atoms in a crystal aren't able to shift and heal the damage" serves mainly to

- A) suggest there are similarities between rocks and living organisms.
- B) create a sense of empathy with the geophysicists and the work they do.
- C) explain why some rocks show more evidence of radioactive decay than do others.
- D) inject a lighthearted tone into a complicated subject.

28

Which choice provides the best evidence for Egholm's assertion regarding the most likely cause of latitude-dependent variations in erosion rates?

- A) Lines 37-42 ("Using these . . . away")
- B) Lines 43-46 ("Using data . . . globe")
- C) Lines 55-57 ("But . . . unfolded")
- D) Lines 64-69 ("Because . . . scouring")

29

As used in line 71, "scale" most nearly means

- A) balance.
- B) extent.
- C) climb.
- D) weight.

30

According to the graph, the average erosion rate between 2 and 4 million years ago was closest to

- A) 0.10 mm/yr.
- B) 0.28 mm/yr.
- C) 0.33 mm/yr.
- D) 0.43 mm/yr.

31

According to the graph, the variation from the average rate of erosion

- A) has been constant over the past 8 million years.
- B) has decreased over the past 8 million years.
- C) has been greatest over the past 2 million years.
- D) was greatest between 6 and 8 million years ago.

Questions 32-42 are based on the following passage and supplementary material.

This passage is adapted from Eric Jaffe, "Cities Are Innovative Because They Contain More Ideas to Steal." ©2013 by The Atlantic Monthly Group.

We all know that cities are great engines of innovation. One reason that's the case is that cities grow "superlinearly": interpersonal connections ^{Line} grow at a greater rate than sheer population, and with that super proximity comes a super exchange of ideas. The secrets of industry, as economist Alfred Marshall once wrote, are truly "in the air."

But innovation is a blanket term that can encompass very different things. Scholars who study the subject typically limit it to the urban proliferation of patents. For sure, the creation of original concepts and products is a sign of innovation. At the same time, it could also reflect a new way of doing business—applied from some other sector, perhaps, or even adapted from a competitor for some other purpose.

So we know cities innovate, but we don't necessarily know what that innovation means.

Well, we have a slightly better idea now thanks to the recent work of economists Neil Lee of Lancaster University Management School and Andrés Rodríguez-Pose of the London School of Economics. Lee and Rodríguez-Pose used a sweeping 2010 business survey to study the innovation patterns of roughly 1,600 small and medium enterprises across the United Kingdom. The survey divided innovation into two types (products and processes) and two sources (entirely "original" ideas or merely those newly "learned" to the firm).

The main results of the survey fit well with what's already known about urban innovation. U.K. firms located in the city were indeed more likely than those in rural areas to report both new products (52 to 46 percent, respectively) and new processes (43 to 34 percent). From there, Lee and Rodríguez-Pose dug deeper to try to understand how exactly this urban advantage emerged.

When it came to new business products, cities seemed to derive their innovation from some combination of original and learned ideas—not really one or the other. So the city environment, ripe with chance exchanges and interactions, might only explain a sliver of new product development. Some complex combination of other forces (e.g., creative inspiration or specific demands or more approaches to problem solving) is also involved.

When it came to new business *processes*, however, the urban advantage seemed to rely almost entirely on ideas learned from neighboring firms (as opposed to original ideas). Here the city itself would appear to play its greatest role in innovation. Greater proximity to other firms, and perhaps also greater employee movement from company to company, no doubt increases the flow of outside information and leads to new ways of working.

As Lee and Rodríguez-Pose conclude, in an upcoming issue of *Urban Studies*, there's probably "a greater degree of nuance with respect to the ways in which cities support innovation" than often perceived:

"Underlying the innovation advantage of cities are two separate processes. One may allow new approaches to problem solving and the development of entirely new products. Yet alongside this, a second allows urban firms to learn, or rather mimic, other firms and gain an innovation advantage from this."

There are any number of reasons why cities might be better suited to perpetuate learned ideas than to harvest original ones. For starters, truly original innovations are quite rare. They're also quickly patented, which makes them tough to emulate. Beyond that, customers might not flock to a company seen as creating only copycat products, whereas they probably couldn't care less how the firm actually operates.

So there may well be secrets of industry wafting through the city air, but they don't stay secret for long.

Percentage of Firms Innovating in Urban and Nonurban Areas

	Firm has introduced new product innovation in past 12 months			Firm has introduced new process innovation in past 12 months		
	All product innovations	Entirely new product innovations	New to the firm	All process innovations	Entirely new process innovations	New to the firm
Nonurban firms	45.8	11.8	34.0	33.6	7.0	26.6
Urban firms	52.1	14.6	37.5	43.0	7.3	35.7
All firms	50.2	13.7	36.5	40.2	7.2	33.0

Note: Total sample is 1,652 firms, of which 1,167 are urban and 485 are not.

Adapted from Neil Lee and Andrés Rodríguez-Pose, "Original Innovation, Learnt Innovation and Cities." ©2013 by Urban Studies Journal Limited.

32

The author discusses the work of Lee and Rodríguez-Pose primarily to show that

- A) scholars are beginning to understand more about how cities innovate.
- B) although it is assumed that cities foster innovation, the evidence suggests otherwise.
- C) contemporary researchers use a single definition of innovation in cities.
- D) compared to urban firms, nonurban firms are at a disadvantage due to lack of innovation.

34

The author indicates that studies of urban business have tended to

- A) emphasize a distinction between two types of innovation.
- B) base their conclusions on a small sample of urban businesses.
- C) focus on only one manifestation of innovation.
- D) underestimate urban businesses' dependence on interpersonal connections.

35

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

- A) Lines 2-6 ("One . . . ideas")
- B) Lines 9-11 ("Scholars . . . patents")
- C) Lines 26-29 ("The survey . . . firm")
- D) Lines 30-31 ("The main . . . innovation")

33

As used in line 4, "sheer" most nearly means

- A) pure.
- B) overt.
- C) steep.
- D) transparent.

36

As used in line 13, “reflect” most nearly means

- A) produce.
- B) consider.
- C) imitate.
- D) indicate.

37

Based on the passage, Lee and Rodríguez-Pose would most likely say that truly original business processes are

- A) a by-product of the greater interpersonal connections found in cities.
- B) seldom created by employees moving from one firm to another.
- C) not as common as are new processes borrowed from other companies.
- D) necessary to the survival of urban businesses.

38

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

- A) Lines 38-41 (“When . . . other”)
- B) Lines 47-50 (“When . . . ideas”)
- C) Lines 67-69 (“There . . . ones”)
- D) Lines 72-75 (“Beyond . . . operates”)

39

The last sentence of the passage serves mainly to

- A) reiterate a problem identified earlier in the passage.
- B) respond to an observation presented earlier in the passage.
- C) cast doubt on a theory proposed earlier in the passage.
- D) present a justification for a proposal offered earlier in the passage.

40

According to the table, which phenomenon occurred least frequently?

- A) An urban firm introduced an entirely new product.
- B) An urban firm introduced an existing process that was new to the firm.
- C) A nonurban firm introduced an entirely new process.
- D) A nonurban firm introduced an existing process that was new to the firm.

41

Which statement is best supported by the data in the table?

- A) Urban firms are more likely to introduce entirely new products than they are to introduce entirely new processes.
- B) Urban firms are more likely to introduce entirely new products than they are to introduce products that are new only to the firm.
- C) Urban firms and nonurban firms are equally likely to adopt processes introduced by other firms.
- D) Nonurban firms are more likely to introduce new processes than they are to introduce new products.

42

What information about the study conducted by Lee and Rodríguez-Pose is provided in the table but NOT discussed in the passage?

- A) They found that urban firms innovate more than do nonurban firms.
- B) They studied substantially more urban firms than nonurban firms.
- C) They relied on firms’ own definitions of innovation to compile their data.
- D) They discovered that firms value product innovations over process innovations.

Questions 43–52 are based on the following passages.

Passage 1 is adapted from Erin Wayman, "Oxygen Boost Aided Carnivore Evolution in Cambrian Explosion." ©2013 by Society for Science & the Public. Passage 2 is adapted from Tamarra Kemsley, "Discovery Challenges Theory Behind Reason for Cambrian Explosion." ©2013 by Nature World News.

Passage 1

The major groups of modern animals—everything from insects to creatures with a backbone—popped up 540 million to 500 million years ago in a proliferation known as the Cambrian explosion. Fossil and molecular evidence hint that the most primitive animals appeared a couple hundred million years earlier, leading scientists to wonder about the cause of the lag.

Now scientists have stitched together earlier theories to come to a comprehensive explanation. Erik Sperling, an earth scientist at Harvard University, and colleagues say an increase in oxygen in the geologic record at the onset of the Cambrian period allowed carnivores to evolve.

The oxygen boost could have accommodated the high energy costs of pursuing and digesting prey, Sperling says.

Once carnivores arrived, an evolutionary arms race broke out between predators and prey, the team suggests. As prey evolved new defenses and predators developed new weapons, new kinds of animals sprung up.

Support for the oxygen-carnivore theory comes from modern polychaetes, tiny earthworm relatives that live on the seafloor and vary in their feeding habits. Combing through data from previous studies on polychaetes, Sperling's team examined 962 worm species from 68 locations worldwide. The researchers found a clear association: The number of carnivorous species was lower in areas with the lowest oxygen levels. In some of these regions, predatory polychaetes were completely absent.

Previously, scientists either invoked an oxygen increase or an arms race to account for the Cambrian explosion, says Guy Narbonne, a paleobiologist at Queen's University in Kingston, Ontario. Linking oxygen to carnivores provides strong evidence that the explanations are "intimately interrelated," he says.

Paleobiologist Nicholas Butterfield of the University of Cambridge sees the data differently. He thinks the rise of oxygen was actually an effect of the animals on the environment. He contends that shallow marine areas, where early animals most likely lived, were probably well oxygenated and therefore a lack of the gas did not stifle their evolution. It just took a while for a burst of complex animals to arise from simpler ones, he says. "It takes a whole lot of tinkering and experimenting and false starts until you trip over something that works."

Passage 2

Ample oxygen saturated Earth's atmosphere prior to the sudden eruption in the development of life during the Cambrian explosion some 542 million years ago, according to a study published in the *Proceedings of the National Academy of Sciences*.

Led by an international team of researchers, the report reveals that the oxygen content was roughly the same 2.1 billion years ago as 500 million years ago. The finding challenges a long-held theory that the Cambrian explosion was in part triggered by a sudden uptick in the element required by all higher organisms.

"We have examined rocks that are 2.15 billion to 2.08 billion years old," coauthor Emma Hammarlund, a researcher from the Nordic Center for Earth Evolution at the University of Southern Denmark, said in a statement. "They show us that there was oxygen in deep water and thus also in the atmosphere at that time. We cannot say exactly how much, but there was probably ample oxygen and also ample time to permit advanced life to evolve."

Previously, the team discovered a series of unique fossils from the same site they suggest represents evidence of a specimen that attempted to evolve into a multicellular life-form.

"It was not a life-form that in any way is comparable to large life as we know it today," Hammarlund said. "It was rather microbes that experimented with a way to evolve into some form of multicellular existence. It had enough oxygen for the experiment, but its destiny is unknown."

One possible reason for the apparent eruption of life 540 million years ago, the scientists suggest, is simply an absence of fossils from previous life-forms. An organism that lacked bones or a shell would be unlikely to leave any kind of trace behind 2 billion years later, they point out.

Not only does the discovery potentially rewrite the history of evolution, it also offers a new narrative regarding Earth’s development. Atmospheric oxygen, it shows, has fluctuated several times throughout history, rising to 25 percent between 250 million–300 million years ago, up from 21 percent today and more than double the estimated 10 percent of the Cambrian explosion.

43

Passage 1 most strongly suggests that Sperling’s work helped to address which question scientists have had about the Cambrian explosion?

- A) Why were oxygen levels so high during the Cambrian explosion?
- B) Why was the proportion of carnivores higher during the Cambrian explosion than it was later?
- C) Why did insects proliferate faster than did animals with a backbone during the Cambrian explosion?
- D) Why did the Cambrian explosion occur when it did rather than earlier?

44

As used in line 37, “strong” most nearly means

- A) competent.
- B) willful.
- C) persuasive.
- D) energetic.

45

As presented in Passage 1, Butterfield would most likely agree with which statement about Sperling’s explanation of the Cambrian explosion?

- A) It accounts for most of the existing data relevant to the explosion but requires additional data to be fully confirmed.
- B) It overlooks evidence suggesting that the explosion was a very sudden event rather than a gradual event.
- C) It presents a phenomenon as the cause of the explosion when that phenomenon was in fact a consequence of the explosion.
- D) It takes for granted that the explosion occurred when it may be the case that the explosion merely reflects an absence of earlier data.

46

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

- A) Lines 42–43 (“He thinks . . . environment”)
- B) Lines 43–47 (“He contends . . . evolution”)
- C) Lines 47–48 (“It just . . . says”)
- D) Lines 48–50 (“It takes . . . works”)

47

As used in line 58, “roughly” most nearly means

- A) coarsely.
- B) approximately.
- C) violently.
- D) unevenly.

48

Which choice best supports the conclusion that the researchers in Passage 2 think the evidence cited as proof of the Cambrian explosion may have been misinterpreted?

- A) Lines 63–67 (“We have . . . statement”)
- B) Lines 80–81 (“It had . . . unknown”)
- C) Lines 82–84 (“One . . . life-forms”)
- D) Lines 88–90 (“Not . . . development”)

49

The last paragraph of Passage 2 serves mainly to

- A) provide an expert corroboration of the importance of the study discussed in the passage.
- B) acknowledge an exception to generalizations drawn from the study discussed in the passage.
- C) point out the scientific significance of the study discussed in the passage.
- D) concede that the conclusions of the study discussed in the passage are disputed by some scientists.

50

The primary purpose of both passages is to

- A) describe fossil evidence of animal species that emerged during the Cambrian explosion.
- B) argue that changing geological conditions were a factor in the Cambrian explosion.
- C) advance a position on whether the Cambrian explosion actually took place.
- D) discuss research regarding the role of oxygen in the Cambrian explosion.

51

A significant difference in approach between the researchers described in the two passages is that the researchers described in Passage 1

- A) used data about existing animals and oxygen levels to draw conclusions about the past, whereas the researchers described in Passage 2 used fossil evidence and data about past oxygen levels.
- B) focused on the relationship between predators and prey in the Cambrian period, whereas the researchers described in Passage 2 assumed that relationships between Cambrian predators and prey are impossible to reconstruct.
- C) restricted their study to species that lived during the Cambrian explosion, whereas the researchers described in Passage 2 considered species that lived in many different time periods.
- D) measured the levels of oxygen only in shallow marine areas, whereas the researchers described in Passage 2 studied oxygen levels in a wide variety of ecosystems.

52

Butterfield in Passage 1 would most likely view the study described in Passage 2 as

- A) suggesting that the evolution of modern animal species occurred earlier than he had assumed.
- B) describing a viable alternative to his theory that it took a relatively long time for complex animals to evolve from simpler ones.
- C) arguing against his belief that early animals lived in shallow marine areas.
- D) supporting his claim that the evolution of early animals was not impeded by a lack of oxygen.

STOP

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

SAT TESTS FOR FREE

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.

The Carrington Event

Early in the morning of September 2, 1859, long before sunrise, the sky got so light that gold miners in Colorado began preparing their breakfast. All over the world, people **1** wake to see the sky eerily illuminated

1

- A) NO CHANGE.
- B) woke
- C) will wake
- D) are waking

by pulsating red, green, and purple hues. **2** Telegraph operators showed up to work. They found sparks flying from their telegraph machines. In one Boston telegraph office, there was so much electricity in the air that operators were still able to send messages, albeit intermittently, even after the batteries of the telegraph machines had been unplugged. These mysterious events were caused by one of the most significant geomagnetic storms on **3** record; the Carrington event.

The geomagnetic storm was named after English astronomer Richard **4** Carrington, he reported the sunspot activity he had detected from his observatory outside London during the late morning of September 1. After sketching a diagram of the dark spots he had observed on the surface of the Sun, Carrington recorded that he saw eruptions of “two patches of intensely bright and white light.” The flashes disappeared within

5 minutes but, their effects would later be felt on Earth for hours.

2

Which choice most effectively combines the underlined sentences?

- A) When telegraph operators showed up to work, they found sparks flying from their telegraph machines.
- B) Telegraph operators showed up to work: they found sparks flying from their telegraph machines.
- C) Telegraph operators showed up to work, and when they did, they found sparks flying from their telegraph machines.
- D) When they showed up to work, sparks were found by telegraph operators flying from their telegraph machines.

3

- A) NO CHANGE
- B) record. The
- C) record, it was the
- D) record: the

4

- A) NO CHANGE
- B) Carrington, who
- C) Carrington, which
- D) Carrington; he who

5

- A) NO CHANGE
- B) minutes, but their effects,
- C) minutes, but their effects
- D) minutes; but their effects,



The flashes of light that Carrington had **6** testified were from a solar flare so powerful that it resulted in a coronal mass ejection (CME), a massive cloud of charged particles expelled by the Sun. When the particles released in a CME approach Earth, they can compress Earth's magnetic field, triggering powerful electromagnetic fluctuations called geomagnetic storms. This compression increases the magnetic field in the atmosphere and at Earth's surface. As electric currents come into contact with conductors, such as the wire cables in the telegraph system during the 1859 event, the resultant increase in voltage can damage transmission equipment. **7** Our modern-day electrical grid, which also consists of long transmission lines, would be similarly affected.

8 In addition to damaging the electrical grid, geomagnetic activity could also interrupt radar, cell phone communications, and GPS receivers. To prepare for such events, space research agencies such as NASA are working to monitor solar flare activity. Other

6

- A) NO CHANGE
- B) witnessed
- C) signified
- D) vindicated

7

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

Furthermore, auroral lights, bright waves of colored light, were so intense that reports described birds chirping hours before dawn broke.

Should the writer make this addition here?

- A) Yes, because it provides an additional example of how electronic equipment was disrupted by the storm.
- B) Yes, because it provides a relevant example of the consequences of a CME.
- C) No, because it distracts from the paragraph's discussion of the electrical system.
- D) No, because it does not explain auroral lights carefully enough.

8

Which choice most effectively establishes the main topic of the paragraph?

- A) Thus, researchers today are more confident about the precise causes of the events than were Carrington and his contemporary astronomers.
- B) Researchers in 1859 offered several theories to account for the events Carrington had recorded.
- C) Science historians note that Carrington was the first astronomer to realize that activity on the Sun can cause geomagnetic disturbances on Earth.
- D) Researchers warn that if a similar solar storm were to occur now, our technological infrastructure could be devastated.

agencies are working to preserve the functionality of satellite **9** systems, they recommend having a backup system ready to launch if necessary. **10** Consequently, statisticians surmise that an occurrence as severe as the Carrington event is likely a once-in-a-half-millennium event. **11**

9

- A) NO CHANGE
- B) systems;
- C) systems, which
- D) systems, therefore,

10

- A) NO CHANGE
- B) Fortunately,
- C) Thus,
- D) As a matter of fact,

11

Which choice serves as the most effective conclusion to the paragraph?

- A) If they are correct, there is probably ample time to make our systems more resistant to such disruption.
- B) In response to researchers' warnings, agencies should immediately overhaul communication systems to meet the threat of geomagnetic storms.
- C) In light of his great contributions to scientific understanding, Carrington should be honored as a visionary for his groundbreaking work.
- D) Clearly, much more research is needed before modern scientists will be able to grasp the significance of the Carrington event.

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

A Matter of Degrees

[1] For student-athletes at the college level, tough training schedules and high-pressure competition [12] requires an enormous amount of time and energy. [2] Completing all the course work required to obtain a college degree may seem more like a [13] nuisance than a necessity. [3] Yet numerous studies indicate that earning a college degree offers significant, lifelong advantages to young athletes. [4] By committing themselves fully to the academic and social life of college, student-athletes can earn a degree, develop an identity outside of sports, and learn critical-thinking skills that will be valuable whether or not they go on to play professional sports. [5] This intense focus on athletic achievement can make academics feel like a distraction—something to squeeze in between practices and games. [14]

12

- A) NO CHANGE
- B) has required
- C) require
- D) require's

13

- A) NO CHANGE
- B) nuisance, than
- C) nuisance, then
- D) nuisance then

14

To make the paragraph most logical, sentence 5 should be placed

- A) where it is now.
- B) after sentence 1.
- C) after sentence 2.
- D) after sentence 3.

According to the National Collegiate Athletic Association (NCAA), there are over 400,000 collegiate athletes. The vast majority, however, will never go pro. The NCAA reports that **15** few of the 1.7 million professional football players have college degrees. Lower still, the percentages of young men and women who go from college to pro-level basketball **16** are much less than 1 percent. Student-athletes who finish their degrees, though, have a **17** wide variety of alternate career opportunities.

NCAA sport	Percent of student-athletes who play professionally after college
Men's baseball	11.6
Men's ice hockey	1.3
Football	1.7
Men's soccer	1.0
Men's basketball	1.2
Women's basketball	0.9

Source: Data from "How Do Athletics Scholarships Work?" ©2014 by NCAA.

Even for the talented few who do reach the pros, athletic careers are, on average, brief: 3.5 years for football players, 4.8 years for basketball players, **18** for hockey players it's 5.5 years, and 5.6 years for baseball players. Their playing years quickly behind them, many retired athletes find it difficult to enter the job market without a college degree. Reports show that just a few years after retirement, a high percentage of former professional athletes struggle with joblessness and poverty.

15

Which choice completes the sentence with accurately interpreted data from the table?

- A) NO CHANGE
- B) fewer than 1.7 percent of college football players have athletic scholarships.
- C) only 1.7 percent of college football players will play professionally.
- D) 1.7 percent of professional athletes played football in college.

16

Which choice best completes the sentence with an accurate approximation of relevant information from the table?

- A) NO CHANGE
- B) are close to 1 percent.
- C) differ greatly by gender.
- D) rival the 11.6 percent who go into professional baseball.

17

- A) NO CHANGE
- B) numerous, plentiful multitude
- C) myriad and vast diversity
- D) range of options and choices

18

- A) NO CHANGE
- B) only 5.5 years for careers of hockey players,
- C) 5.5 years for hockey players,
- D) hockey players 5.5 years,

With this problem in mind, **19** however, retired basketball star Kareem Abdul-Jabbar penned an open letter to his fellow **20** athletic peers in 2012. According to Abdul-Jabbar, it's not uncommon for professional athletes to struggle with financial and career-related decisions, but, he claims, "One thing that can change this is taking the time to go to college. Learning about the world and the way it works in and out of the classroom is a great way to figure out the way you want to live your life." Many experts agree with Abdul-Jabbar's assessment. College-educated athletes are better prepared for life, whether **21** their managing the generous paychecks they might receive during their time in the **22** pros, navigating life after retirement, or pursuing a career path outside of professional sports.

19

- A) NO CHANGE
- B) for example,
- C) subsequently,
- D) DELETE the underlined portion.

20

- A) NO CHANGE
- B) peer athletes
- C) athletes
- D) peers in athletics

21

- A) NO CHANGE
- B) they're
- C) its
- D) its'

22

- A) NO CHANGE
- B) pros; navigating life after retirement,
- C) pros, navigating life after retirement;
- D) pros: navigating life after retirement

Questions 23–33 are based on the following passage.

Solitude in a Crowd: The Subway Portraits of Walker Evans

— 1 —

A young woman looks beyond the frame of the photograph, the object of her gaze hidden, her expression inscrutable. A small hat with a veil sits pertly at the back of her head—a suggestion that the black-and-white portrait was taken in another era. A sign behind the woman lists New York City subway stops.

— 2 —

Evans **23** takes the photos in *Many Are Called* between 1938 and 1941. He would eventually achieve fame and critical acclaim for his iconic portraits of destitute Alabama sharecroppers, **24** it was published, along with commentary by writer James Agee, in the book *Let Us Now Praise Famous Men*. During the years that the subway portraits were taken, though, Evans was attempting to find a publisher for the work. *Let Us Now Praise Famous Men* was published in **25** 1941, but despite the attention that work **26** accumulated, *Many Are Called* remained unpublished until 1966.

23

- A) NO CHANGE
- B) took
- C) will take
- D) has taken

24

- A) NO CHANGE
- B) he published it,
- C) its publication,
- D) published,

25

- A) NO CHANGE
- B) 1941, and
- C) 1941; therefore,
- D) 1941: thus,

26

- A) NO CHANGE
- B) garnered,
- C) commended,
- D) gathered,

Many Are Called provides an urban counterpoint to the rural portraits in *Let Us Now Praise Famous Men*.

27 It presents passengers of various ages and walks of life, in a variety of moods, sharing the common demeanor of 28 a person who thinks he or she is alone in the crowd, unwatched. A society matron daydreams, her gloved hands folded neatly on her lap. A dapper businessman reads a novel. A sleepy toddler snuggles with his mother. There are more newspapers and fur coats than one sees 29 today. Almost everyone wears a hat. Despite these differences, the postures and expressions of the riders are strikingly familiar to anyone who has ever been on a subway, bus, train, or airplane.

Evans 30 said—of his fellow riders, “The guard is down and the mask is off: even more than when in lone bedrooms (where there is a mirror), people’s faces are in naked repose down in the subway.” In order to capture this repose, Evans used a camera hidden behind his coat.

Which choice most effectively sets up the examples in the following three sentences?

- A) NO CHANGE
- B) Like the people in the latter work, the subjects of *Many Are Called* often wear worn or defeated expressions,
- C) In addition to sharing space on public transportation, Evans’s subjects are captured
- D) It presents images of people rather like those from a photo booth, but with the subjects

- A) NO CHANGE
- B) people
- C) a person or persons
- D) those

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

- A) today—almost everyone wears a hat—in light of this,
- B) today; almost everyone wears a hat, although
- C) today; as almost everyone wears a hat,
- D) today, and almost everyone wears a hat, but

- A) NO CHANGE
- B) said: of
- C) said of
- D) said, of,

All of the pictures are shot at the subjects' eye level; Evans sat opposite them as he photographed them. In many of the pictures **31** its obvious that the subjects are aware of being photographed; they stare directly, sometimes defiantly, into the camera's lens.

— 5 —

Evans claimed that he waited 25 years to publish the book in order to preserve the anonymity of the subjects, a claim that some critics question. Lack of interest by publishers, they say, really explains why the book remained unpublished for so long. **32** Let Us Now Praise Famous Men is still more inflammatory than Many Are Called, but as the most recent edition of the work, published in 2004, proves, *Many Are Called* remains a compelling portrait of urban life that still resonates with contemporary audiences.

Question **33** asks about the previous passage as a whole.

31

- A) NO CHANGE
- B) its obvious that the subject's
- C) it's obvious that the subjects'
- D) it's obvious that the subjects

32

Which choice most effectively maintains the main focus of the paragraph?

- A) NO CHANGE
- B) It was finally published when the Museum of Modern Art held an exhibition of Evans's subway photos,
- C) The first edition is highly sought after by book and photograph collectors,
- D) The reason for the delayed publication may be disputed,

33

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

This untitled photograph, along with 88 other pictures of New York City subway riders, appears in Walker Evans's book *Many Are Called*.

To make the passage most logical, the sentence should be placed immediately

- A) after the last sentence in paragraph 1.
- B) after the last sentence in paragraph 2.
- C) before the first sentence in paragraph 3.
- D) after the last sentence in paragraph 3.

Questions 34–44 are based on the following passage.

Humanlike Robots: Promise and Problems

The manufacturing sector has long utilized robot

34 technology: taking advantage of robots' ability to carry out tasks too strenuous, repetitive, or dangerous for humans to perform. These industrial robots, first used in automotive plants in the 1960s, were designed to execute a specific task. Today, their descendants dismantle bombs, investigate active volcanoes, and explore outer space, **35** being evinced by the amazing photos sent back by NASA's Mars rover *Curiosity*. One thing these robots have in common is that they all look like the industrial machines they are.

Recently, however, roboticists have begun to design and build robots that more closely resemble humans.

36 These robots look nothing like the industrial robots of the 1960s. Increasingly, robots need to be able to function in environments that were constructed with people in mind—and when working in human settings, it helps to have some human characteristics. **37** Still, for jointless robots to manipulate the doors, switches, and knobs prevalent in people's homes and offices, their "limbs" must mimic **38** a jointed human. Roboticists trumpet the many potential uses for these robots, which

34

- A) NO CHANGE
- B) technology;
- C) technology,
- D) technology

35

- A) NO CHANGE
- B) evincing this
- C) this is evinced
- D) as evinced

36

Which choice most effectively sets up the discussion that follows?

- A) NO CHANGE
- B) There is a logical reason for this development.
- C) This transformation is unprecedented.
- D) The evidence for this claim is abundant.

37

- A) NO CHANGE
- B) For example,
- C) In addition,
- D) However,

38

- A) NO CHANGE
- B) the joints of a human.
- C) a human's limbs' joints.
- D) those of a jointed human.

can be programmed to work as guides, physical therapists, and mail carriers, among other occupations. French engineers have created a prototype **39** hoping they can one day function as a caregiver and home assistant for the elderly. **40** Similarly, robotics experts in Boston have designed a robot that can prepare a cup of coffee while charming its audience with a friendly, wide-eyed computer-screen face.

For many years, scientists hesitated to create robots that looked too much like humans, citing the concept of the “uncanny valley.” In 1970, Japanese roboticist Masahiro Mori posited that **41** if a robot’s appearance is too lifelike, people become uneasy. **42** The idea that humanlike robots make people uncomfortable has permeated science fiction stories and films. Later studies questioned whether this uncanny valley effect actually exists. Audiences smiled at the antics of the machinelike characters R2-D2 and C-3PO from the *Star Wars* movies but were unsettled by the humanlike cyborgs from the *Terminator* series.

39

- A) NO CHANGE
- B) hoping that
- C) they hope
- D) and hope

40

- A) NO CHANGE
- B) Thus,
- C) Nonetheless,
- D) Conversely,

41

- A) NO CHANGE
- B) the more a robot’s appearance is lifelike,
- C) the more lifelike the robot,
- D) the more a robot appears lifelike,

42

Which choice most effectively combines the underlined sentences?

- A) Although later studies questioned whether this uncanny valley effect actually exists, the idea that humanlike robots make people uncomfortable has permeated science fiction stories and films.
- B) The idea that humanlike robots make people uncomfortable has permeated science fiction stories and films, and later studies questioned whether this uncanny valley effect actually exists.
- C) Later studies questioned whether this uncanny valley effect actually exists because the idea that humanlike robots make people uncomfortable has permeated science fiction stories and films.
- D) The idea that humanlike robots make people uncomfortable has permeated science fiction stories and films; as a result, later studies questioned whether this uncanny valley effect actually exists.

There are other reasons humans may be uneasy about these robots besides the robots' **43** humanlike talents. Critics fear that, like the industrial robots before them, the new robots will prove so effective that they will replace human workers. It is easy to say that having robots perform menial tasks will free up workers for more challenging jobs, but there is no guarantee that such jobs will be available for all job seekers. Given these **44** nuisances, the extent to which humanlike robots will become part of daily life remains to be seen.

43

Which choice most effectively draws on a key concept from earlier in the passage to set up what follows?

- A) NO CHANGE
- B) uncanny appearance.
- C) threatening depiction in movies.
- D) ability to perform important tasks.

44

- A) NO CHANGE
- B) complications,
- C) technicalities,
- D) obfuscations,

STOP

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

SAT TESTS FOR FREE

Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

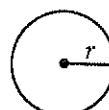
DIRECTIONS

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

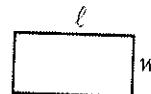
NOTES

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

REFERENCE



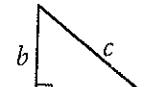
$$A = \pi r^2$$
$$C = 2\pi r$$



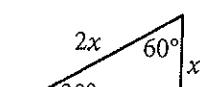
$$A = lw$$



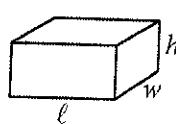
$$A = \frac{1}{2}bh$$



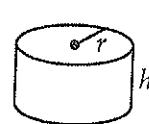
$$c^2 = a^2 + b^2$$



Special Right



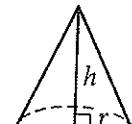
$$V = lwh$$



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



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



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

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

If $2(3x - 6) + 5(2x - 3) = 5$, what is the value of x ?

- A) $\frac{1}{8}$
- B) $\frac{1}{2}$
- C) 2
- D) 8

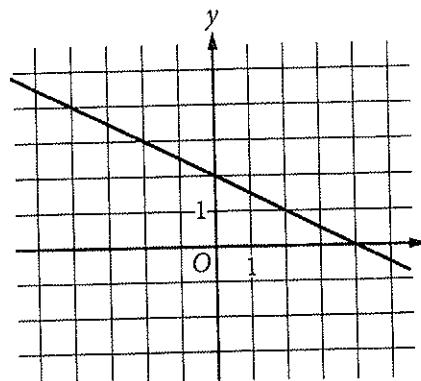
2

x	1	2	3	4	5
$f(x)$	5	15	25	35	45

Which of the following functions expresses a relationship that is satisfied by all pairs $(x, f(x))$ in the table above?

- A) $f(x) = 5x$
- B) $f(x) = 9x$
- C) $f(x) = 10x - 5$
- D) $f(x) = 10x + 5$

3



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

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

13**5****4**

$$w = 2x^2$$

$$y = 4x^2$$

The equations above define w and y in terms of x .
What is $3w - y$ in terms of x ?

- A) x^2
- B) $2x^2$
- C) $5x^2$
- D) $6x^2$

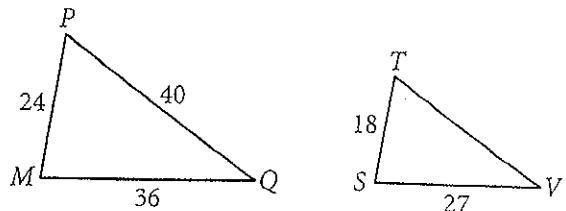
5

$$4x + y = 8$$

$$x^2 + y = 4$$

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

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

6

In the figure above, $\triangle MPQ$ is similar to $\triangle STV$.
What is the length of \overline{TV} ?

- A) 30
- B) 33
- C) 36
- D) 39

7

The equation $A = 30 + 40h$ gives the amount A , in dollars, a mechanic charges a customer for h hours of labor on a project. In the equation, what does the number 40 represent?

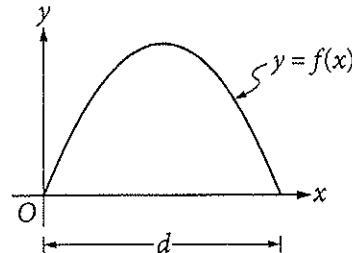
- A) The number of hours of labor spent on a project
- B) A flat fee, in dollars, that the mechanic charges for starting a project
- C) The dollar amount that the mechanic charges for each hour of labor spent on a project
- D) The total amount, in dollars, that the mechanic charges for h hours of labor spent on a project

8

Susan invested a total of \$5,000 in two different bank accounts and earned interest on both accounts. She earned 1.5% interest on Account A and 4% interest on Account B. She earned 3% interest on the total amount invested. Which equation can be used to determine the amount of money, x , that she invested in Account A?

- A) $1.015x = 5,150$
- B) $\left(\frac{0.015 + 0.04}{2}\right)x = 150$
- C) $0.015x + 0.04(5,000 - x) = 150$
- D) $1.04 + 1.015x(5,000 - x) = 5,150$

9



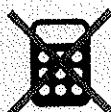
An architect designs an archway by resting the two bases of an arch on the floor. The shape of the arch can be modeled by the graph of the function f in the xy -plane above. If f is defined by $f(x) = -2x^2 + 20x$, where x is in feet, what is the value of the distance d , in feet, between the two base of the arch?

- A) 2
- B) 10
- C) 20
- D) 40

10

Which of the following is a factor of $6xy - 9y + 8x - 12$?

- A) $2x - 3$
- B) $2x + 3$
- C) $2y - 3$
- D) $3y - 4$



11

Einstein's theory of special relativity gives the relationship between the time t measured by a stationary clock and the time m measured by a clock moving at velocity v by the formula $m = t\sqrt{1 - v^2}$, where v is measured as a proportion of the speed of light. Which of the following equations can be used to find the velocity of the moving clock in terms of the different times measured?

A) $v = \sqrt{1 + m^2t^2}$

B) $v = \sqrt{1 - m^2t^2}$

C) $v = \sqrt{1 - \frac{m^2}{t^2}}$

D) $v = \sqrt{1 + \frac{m^2}{t^2}}$

12

The total energy of an electron in orbit is the sum of its potential energy $\frac{-e^2}{r}$, in joules, and its kinetic energy $\frac{e^2}{2r}$, in joules. Which of the following gives the total energy, in joules, of an electron in orbit?

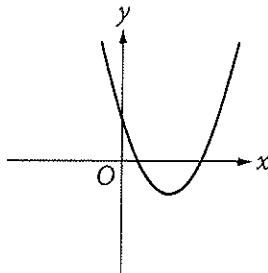
A) $\frac{-e^2}{2r}$

B) 0

C) $\frac{3e^2}{2r}$

D) $\frac{e^2(1 - r)}{2r^2}$

13



Which of the following could be an equation of the parabola in the xy -plane above?

- A) $y = x(x + 4)$
- B) $y = (x + 1)(x + 4)$
- C) $y = 2(x - 1)(x + 4)$
- D) $y = 2(x - 1)(x - 4)$

14

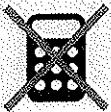
An electronics store offers its employees two different compensation plans. Employees on Plan A earn \$500 per week plus a 25% commission on their weekly sales of the products. Employees on Plan B earn \$750 per week plus a 15% commission on their weekly sales of the products. Which inequality describes the amount in sales each week, x dollars, for which employees on Plan A earn more than employees on Plan B?

- A) $x < 1,250$
- B) $x > 1,250$
- C) $x < 2,500$
- D) $x > 2,500$

15

Which of the following is equivalent to $x^{\frac{3}{4}}(x^{\frac{1}{2}})^{\frac{3}{2}}$?

- A) $\sqrt{x^3}$
- B) $\sqrt[3]{x^2}$
- C) $\sqrt[4]{x^3}$
- D) $\sqrt[6]{x^5}$



DIRECTIONS

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

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

Write ___
answer
in boxes

Grid in result.

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

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

Answer: 2.5

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

← Decimal point

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

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

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

Answer: 201 – either position is correct

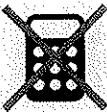
A 4x4 grid puzzle titled "201". The grid contains the following values:

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

The first row has values 2, 0, 1, and an empty cell. The second row has four 0's. The third row has four 0's. The fourth row has four 0's.

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

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



16

$$\begin{aligned}x &= 0.5 \\y &= x + 5.5\end{aligned}$$

In the xy -plane, what is the y -coordinate of the point of intersection of the graphs of the equations above?

19

If $a = 0.8c$, $b = 0.4c - 3$, and $-100 \leq c \leq 200$, what is the greatest possible value of $a + b$?

20

What is the product of the complex numbers $-2i + 26$ and $i + 13$? (Note: $i = \sqrt{-1}$)

17

If $\frac{x}{x+1} = \frac{3}{x+1}$, where $x \neq -1$, what is the value of x^2 ?

18

In the xy -plane, what is the x -coordinate of the center of the circle with equation $x^2 - 6x + y^2 + 2y = -1$?

STOP

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



Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

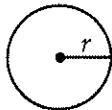
DIRECTIONS

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

NOTES

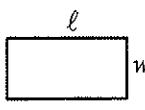
1. The use of a calculator is permitted.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the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

REFERENCE

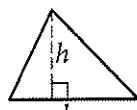


$$A = \pi r^2$$

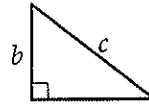
$$C = 2\pi r$$



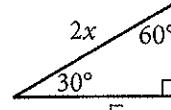
$$A = lw$$



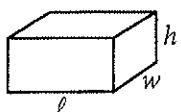
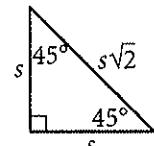
$$A = \frac{1}{2}bh$$



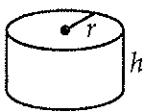
$$c^2 = a^2 + b^2$$



Special Right Triangles



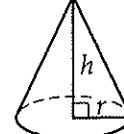
$$V = lwh$$



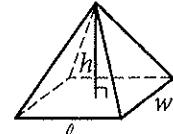
$$V = \pi r^2 h$$



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



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



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

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

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

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

4



4

1

Doctors recommend that a five-year-old child consume at least 1,000 milligrams (mg), but no more than 2,500 mg, of calcium per day. A slice of cheese contains 290 mg of calcium. If a five-year-old child's calcium consumption comes solely from c slices of cheese and stays within the recommended daily allowance of calcium, which of the following inequalities must be true?

- A) $290 \leq 1,000c \leq 2,500$
- B) $500 \leq 290c \leq 1,000$
- C) $1,000 \leq 290c \leq 2,500$
- D) $1,000c \geq 2,500$

2

Abraham Lincoln delivered a speech in which he referenced the Declaration of Independence, which had been written 87 years before. Instead of saying "87 years ago," Lincoln said, "4 score and 7 years ago." How many years are in 3 score?

- A) 20 years
- B) 30 years
- C) 40 years
- D) 60 years

3

Line ℓ has slope 2 and y -intercept -2 in the xy -plane. Which of the following is an equation of line ℓ ?

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

4

$$(x^2 + 5x - 6)(x + 7)$$

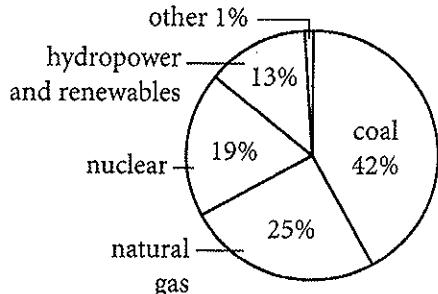
Which of the following expressions is equivalent to the one above?

- A) $x^3 + 5x^2 + 1$
- B) $x^3 + 5x^2 - 42$
- C) $x^3 + 5x^2 - 6x + 7$
- D) $x^3 + 12x^2 + 29x - 42$



5

United States Net Electric Power Generation by Energy Source, 2011



Based on the graph above, what fraction of the net electric power generation in the United States in 2011 came from hydropower, renewables, and nuclear combined?

- A) $\frac{1}{4}$
- B) $\frac{3}{10}$
- C) $\frac{8}{25}$
- D) $\frac{33}{100}$

6

If $\frac{2}{3} = \frac{t}{18}$ and $\frac{3}{2} = \frac{u}{6}$, what is the value of $3t - 2u$?

- A) 3
- B) 9
- C) 12
- D) 18

7

Farm Acreage for Three Crops

	2008	2009	2010	2011	2012
Strawberries	15	30	25	30	30
Soybeans	85	95	95	90	95
Corn	220	215	220	240	235
Total	320	340	340	360	360

The table above shows the acreages devoted to planting three crops on a farm for each of five years.

In what year did corn represent exactly $\frac{2}{3}$ of the total acreage planted that year?

- A) 2008
- B) 2009
- C) 2010
- D) 2011



10

$$36 = \frac{3}{2}x^2 - \frac{15}{2}x$$

What is the sum of the solutions to the equation above?

- A) 2
- B) 5
- C) 10
- D) 23

x	$f(x)$	$g(x)$
a	h	c
b	a	b
c	c	h
m	k	k
p	b	a

The functions f and g are defined in the table above, where a , b , c , m , p , h , and k are different constants. For what value of x does $f(x) = g(x)$?

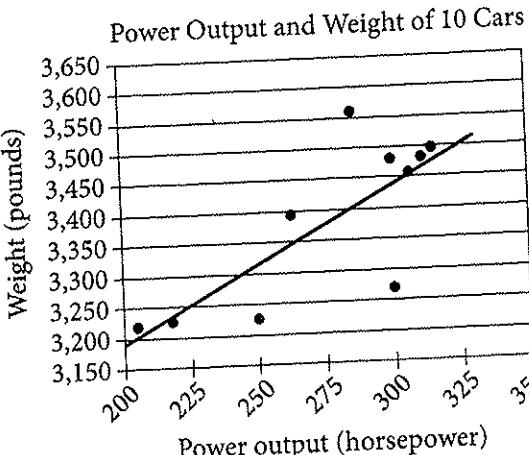
- A) a
- B) b
- C) c
- D) m

9

A poll was conducted to find the percent of residents in a community who support an increase in taxes to help pay for the construction of alternative energy sources. Of the 1,200 residents selected at random to be polled, 57% were in favor of the tax increase. The poll had a margin of error of 3 percentage points. Which of the following conclusions is most appropriate about all residents of the community, based on the results of the poll?

- A) The percent of all residents who favor the tax increase is 57%.
- B) The percent of all residents who favor the tax increase is likely less than 54%.
- C) The percent of all residents who favor the tax increase is likely between 54% and 60%.
- D) The percent of all residents who favor the tax increase is likely either less than 54% or greater than 60%.

11



Based on the line of best fit in the scatterplot above, which of the following best predicts the weight, in pounds, of a car with a power output of 275 horsepower?

- A) 3,350
- B) 3,375
- C) 3,400
- D) 3,425



Questions 12–14 refer to the following information.

$$G = 450 - 3.25t$$

Amaka planted tomatoes in her garden. The equation above relates the area G , in square feet, of the unplanted space in the garden to the number of minutes t after Amaka began planting.

12

How many minutes after Amaka began planting were there 255 square feet of unplanted space in the garden?

- A) 30
- B) 40
- C) 50
- D) 60

13

In the equation, what does the number 3.25 represent?

- A) The rate, in square feet per minute, at which Amaka planted her garden
- B) The rate, in minutes per square foot, at which Amaka planted her garden
- C) The area, in square yards, of Amaka's garden
- D) The average number of tomato plants that Amaka planted, per minute, in her garden

14

Amaka's friend Juanita began planting her 375-square-foot garden with tomatoes at the same time as Amaka began, but Juanita worked at one-half Amaka's rate. If the area of unplanted space in each garden was the same m minutes after both Amaka and Juanita began planting, which of the following is closest to the value of m ?

- A) 40
- B) 43
- C) 46
- D) 50



Questions 15–17 refer to the following information.

Energy Usage for Sorayda's Apartment

Type	Month			
	March	April	May	June
Electricity (kWh)	222	225	240	253
Gas (kWh)	1,992	1,846	1,904	1,690

The table above shows the total energy usage, in kilowatt-hours (kWh), in Sorayda's apartment during each of four months.

15

In April, the cost of electricity was \$0.154 per kilowatt-hour. What was the cost of electricity in April for Sorayda's apartment?

- A) \$14.61
- B) \$34.65
- C) \$68.44
- D) \$146.10

17

Which of the following best approximates the percent decrease in gas used from May to June in Sorayda's apartment?

- A) 11%
- B) 13%
- C) 17%
- D) 21%

What fraction of the energy used in March in Sorayda's apartment was from electricity?

- A) $\frac{222}{1,992}$
- B) $\frac{222}{2,214}$
- C) $\frac{1,770}{1,992}$
- D) $\frac{1,992}{2,214}$



18

$$x, 24, 32, 33, 37, 42, 45$$

The list above consists of seven integers that increase in value from left to right. If the range of the list is equal to one of the values in the list, what is the greatest possible value of x ?

- A) 23
- B) 21
- C) 12
- D) 0

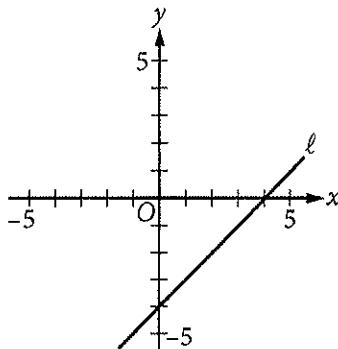
19

$$R = \frac{1}{\frac{1}{x} + \frac{1}{y}}$$

An electrical engineer uses the formula above to determine the total resistance, R , in a circuit with parallel resistors having individual resistances x and y , where $x \neq 0$ and $y \neq 0$. Which of the following represents y in terms of x and R ?

- A) $R - x$
- B) $\frac{xR}{x - R}$
- C) $\frac{1 - xR}{R}$
- D) $\frac{x - R}{xR}$

20

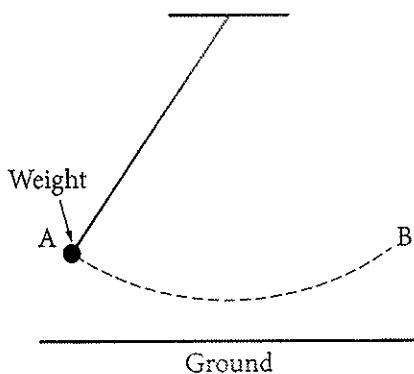


Line ℓ is shown in the xy -plane above. If line ℓ has equation $ax + by = 12$, where a and b are constants, which of the following is true about a and b ?

- A) $a < 0$ and $b < 0$
- B) $a < 0$ and $b > 0$
- C) $a > 0$ and $b < 0$
- D) $a > 0$ and $b > 0$

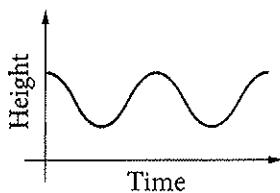


21

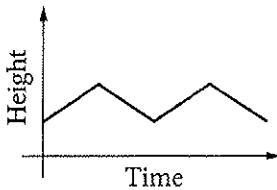


The figure above shows a pendulum, in which a hanging weight is released at point A and swings back and forth above the ground from point A to point B. Which of the following best models the height of the weight above the ground for one swing from A to B and then back to A?

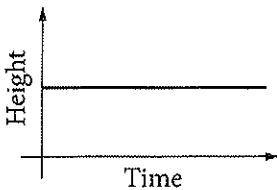
A)



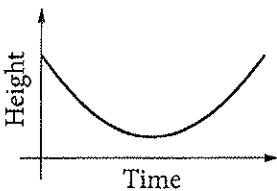
B)



C)



D)



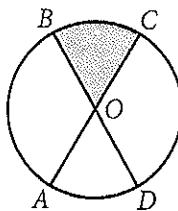
22

The tallest student in Class A is 50 inches tall, and the tallest student in Class B is 48 inches tall. Each class has 25 students, and the shortest student in each class is the same height. Which of the following statements must be true?

- I. The range of the heights for students in Class A is greater than that in Class B.
 - II. The median of the heights for students in Class A is greater than that in Class B.
 - III. The mean of the heights for students in Class A is greater than that in Class B.
- A) I only
B) III only
C) I and II only
D) I, II, and III



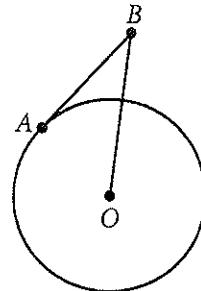
23



In the figure above, O is the center of the circle and \overline{AC} and \overline{BD} are diameters of the circle. The measure of $\angle AOB$ is twice the measure of $\angle BOC$, and the radius of the circle is 3. What is the area of the shaded region?

- A) 9π
- B) 6π
- C) $\frac{9}{2}\pi$
- D) $\frac{3}{2}\pi$

25



Note: Figure not drawn to scale.

In the figure above, point O is the center of the circle that has radius 1, and \overline{AB} is tangent to the circle at point A . If $AB = 1$, what is the length of \overline{OB} ?

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

24

$$y = 7x^2 - 28x + 21$$

The graph of the equation above is a parabola in the xy -plane. In which of the following equivalent forms of the equation do the x -intercepts of the parabola appear as constants or coefficients?

- A) $y = 7(x^2 - 4x) + 21$
- B) $y = 7x(x - 4) + 21$
- C) $y = 7(x - 2)^2 - 7$
- D) $y = 7(x - 1)(x - 3)$



26

A balloon descends from an altitude of 5,000 feet at a constant rate of 500 feet every 10 minutes. Which of the following models the balloon's altitude, in feet, as a function of the time t , in minutes, since the beginning of its descent?

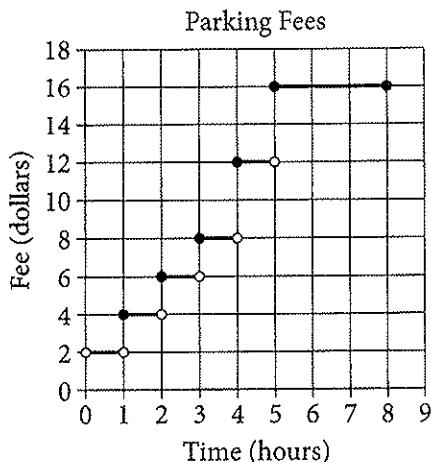
- A) $h(t) = 5,000 - 50t$
- B) $h(t) = 5,000 - 500t$
- C) $h(t) = 5,000 - \frac{500}{t}$
- D) $h(t) = 5,000 - \frac{50}{t}$

27

In 2010, the population of a small town was 455. The population is projected to increase by 3% each year from the preceding year's population for the next 20 years. Which of the following equations can be used to estimate the population P of the town n years after 2010 for $0 \leq n \leq 20$?

- A) $P = 455n^3$
- B) $P = 455(0.03)^n$
- C) $P = 455(1.03)^n$
- D) $P = 455(3)^n$

28



Customers can park in the Ace Parking Garage for a maximum of 8 hours, and the fees charged for parking depend on the length of time parked, as shown in the graph above. According to the graph, which of the following is NOT true?

- A) The fee for 2 hours of parking is twice the fee for 1 hour of parking.
- B) The fee for 4 hours of parking is twice the fee for 2 hours of parking.
- C) The fee for 3 hours of parking is the same as the fee for $3\frac{1}{2}$ hours of parking.
- D) The maximum fee for parking is 16 dollars.



29

A group of teachers and students will take a bus trip to a museum, and each teacher will lead a group of no more than 4 students. The bus can hold a maximum of 54 teachers and students. If t represents the number of teachers and s represents the number of students, which of the following systems of inequalities best describes the possible numbers of teachers and students who can go on the trip?

A) $t + s \geq 54$
 $t \leq 4s$

B) $t + s \leq 54$
 $t \geq 4s$

C) $t + s \leq 54$
 $t \leq \frac{s}{4}$

D) $t + s \leq 54$
 $t \geq \frac{s}{4}$

30

A landscape-supply company sells mulch at a rate of \$30 per cubic yard. What price does the company charge for 54 cubic feet of mulch? (1 yard = 3 feet)

A) \$54

B) \$60

C) \$810

D) \$1,620





DIRECTIONS

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

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

Write →
answer
in boxes.

Grid in result.

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

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

← Fraction
line

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

.	6	6	6
●	○	○	○
①	①	①	①
②	②	②	②
③	③	③	③
④	④	④	④
⑤	⑤	⑤	⑤
⑥	●	●	●
⑦	7	7	7

.	6	6	7
	7	7	
●			
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
7	7	7	●

Answer: 201 ~ either position is correct

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



31

To compete against other boxers in the welterweight class, a boxer must weigh at least 140 pounds but no more than 147 pounds. If 1 stone is equal to 14 pounds, what is one possible weight, in stones, for a welterweight boxer?

32

The product of x and 4 is 9 more than twice x . What is the value of x ?

33

$$\frac{x^2 - 3x + a}{x - 1}$$

In the expression above, $x \neq 1$ and a is a positive constant. For what value of a is the expression equivalent to $x - 2$?

34

Each month Luke earns a salary of \$3500 plus 15% of the total amount of his sales for the month. Luke earned \$4760 in March. What was the total amount of Luke's sales, in dollars, for March? (Disregard the \$ sign when gridding your answer.)

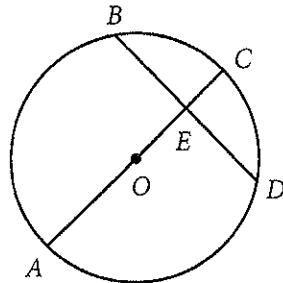


35

$$\begin{aligned}2x + y &= 8 \\x + 4y &= 11\end{aligned}$$

If the x - and y -coordinates of a point in the xy -plane satisfy the system of equations above, what is the value of $6x + 10y$?

36



Note: Figure not drawn to scale.

In the circle above, point O is the center, and diameter \overline{AC} bisects \overline{BD} at point E . The radius of the circle is 8, and $EC = 1$. If $BE = \sqrt{k}$, what is the value of k ?



Questions 37 and 38 refer to the following information.

Time (minutes)	Bacterial density (OD)
0	0.032
16	0.048
32	0.072
48	0.108
64	0.162
80	0.243

The bacterial density of a sample of a certain marine bacterium can be measured by its optical density. The table above gives the bacterial density of a sample, measured in optical density (OD), at 16-minute intervals.

37

When the first measurement of the bacterial density of the sample is taken at time $t = 0$, the mass of the sample is 0.0033 grams. If the mass of the sample is directly proportional to its bacterial density, in optical density, what is the mass, in grams, of the sample 80 minutes after the first measurement of density? (Round your answer to the nearest thousandth.)

38

According to the table, at the end of every 16-minute interval, the bacterial density is p percent greater than the bacterial density at the beginning of the interval. At that rate, what will be the bacterial density, in optical density, 96 minutes after the first observation? (Round your answer to the nearest thousandth.)

STOP

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

October 2016 Answer Key

ANSWER KEY

Reading Test Answers

1	C	12	B	23	B	34	C	45	C
2	D	13	C	24	B	35	B	46	A
3	C	14	A	25	A	36	D	47	B
4	C	15	B	26	D	37	C	48	C
5	D	16	A	27	D	38	B	49	C
6	B	17	B	28	B	39	B	50	D
7	C	18	D	29	B	40	C	51	A
8	D	19	C	30	D	41	A	52	D
9	B	20	B	31	C	42	D		
10	A	21	B	32	A	43	D		
11	C	22	C	33	A	44	C		

Writing and Language Test Answers

1	B	12	C	23	C	34	D
2	A	13	A	24	D	35	D
3	D	14	B	25	A	36	B
4	B	15	B	26	B	37	B
5	C	16	B	27	A	38	D
6	B	17	A	28	A	39	C
7	C	18	C	29	D	40	A
8	D	19	A	30	C	41	A
9	B	20	C	31	D	42	A
10	B	21	B	32	D	43	B
11	A	22	A	33	A	44	B

Math Test – No Calculator Answers

1	C	11	C
2	C	12	A
3	D	13	D
4	B	14	D
5	C	15	A
6	A	16	6
7	C	17	9
8	C	18	3
9	B	19	237
10	A	20	340

Math Test – Calculator Answers

1	C	11	B	21	A	31	10 or 10.5
2	D	12	D	22	A	32	9/2
3	B	13	A	23	D	33	2
4	D	14	C	24	D	34	8400
5	C	15	B	25	C	35	38
6	D	16	B	26	A	36	15
7	D	17	A	27	C	37	0.025
8	D	18	B	28	A	38	0.365
9	C	19	B	29	C		
10	C	20	C	30	B		

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