Wednesday
October 14, 2015

PSAT/NMSQT®

Preliminary SAT/National Merit Scholarship Qualifying Test

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5KPT04

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1

Reading Test

60 MINUTES, 47 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 1-9 are based on the following passage.

This passage is adapted from Julia Alvarez, *In the Name of Salomé*. ©2000 by Julia Alvarez. The protagonist of this novel, Salomé Ureña, was a well-known poet from the Dominican Republic. She wrote in the latter half of the 1800s, a time of great political unrest in the nation.

Papá was at our door with a copy of *El Nacional* rolled up under one arm and a scared look on his face. When he unrolled the paper, and thrust it before me, my mouth fell open. There, on the front page, was my poem, "Recuerdos a un proscrito," which I had included in the poems I gave to my friend Miguel. It was signed "Herminia."

"¿Qué pasa?" Mamá asked, scouring the paper up and down.

Papá looked at her impatiently, and then glancing over his shoulder and seeing that the top of the Dutch door was still open, he motioned for me to close it. After he had read the poem out loud, my father said, "This is seditious!"

My mother's face shone with fierce pride. "Good for Herminia! She is saying what we all feel and don't have the courage to speak."

Papá looked at her for a long moment, and you could see that he was just now realizing that I had never shared my pen name with my mother. It was our special secret.

Later that night in bed, Ramona and I figured out what must have happened. Miguel had given my poem to his friends at *El Nacional* to publish. All we could hope for was that he had not betrayed my true identity.

The next afternoon at his house, Papá warned me. "You must be careful, Herminia. Báez is not the old Báez. He would not protect his old friend if he were to find out my daughter was sowing seeds of sedition. No more publishing without my permission!"

Of course, I promised not to do what I had never done in the first place. The following week another poem by Herminia was published in the paper. "Una lagrima" was not out-and-out seditious, but no dictator could have read those lines addressed to an exile without feeling challenged. *Your patria*[1] *still in chains . . . The tears you shed for her have never dried . . .* Rumors in the capital were that *El Nacional* would be shut down within the week. But the paper continued publishing. It seemed Báez was showing off how freedom-loving he was.

For several weeks, poems appeared by Herminia in the paper. "Contestación," "A un poeta," "Una esperanza," "Ruego," "Un gemido," and finally, "La gloria del progreso," a poem that caused an uproar. Our old friend Don Eliseo Grullón, a statesman himself, declared whoever this Herminia was, she was going to bring down the regime with pen and paper.

Papá was beside himself. Why was I bent on defying him? Exile would be the least of it. I was going to get us all killed. Finally, I had to confess that it was not my doing. I had allowed some acquaintances to have copies. "I'm sorry, Papá."

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CONTINUE

1

But secretly, I was glad. Poetry, *my* poetry, was waking up the body politic! Instead of letting my father's fears hold me back, I kept writing bolder poems.

Sometimes my hand would shake as I wrote. *Herminia, Herminia, Herminia,* I would whisper to myself. She was the brave one. She was not in thrall to her fears. She did not quail at a harsh word. Or to cry over every little thing, wasting her tears.

Secretly, in the dark cover of the night, Herminia worked at setting la patria free.

And with every link she cracked open for la patria, she was also setting me free.

[1] homeland

1

Which choice best summarizes the passage?

A) A catastrophic event occurs, and the resulting disorder is analyzed.

B) A painful confession is made, and several close relationships unravel.

C) A long-standing commitment is broken, and a series of repercussions follows.

D) An unexpected discovery is made, and the events occurring after that discovery are described.

2

What does the passage suggest about how Papá relates to the narrator compared to how Mamá relates?

A) Papá is a stricter disciplinarian with the narrator than Mamá is.

B) Papá is more privy to the narrator's confidences than Mamá is.

C) Papá is more complimentary of the narrator's poetry than Mamá is.

D) Papá is more tolerant of the narrator's rebellious nature than Mamá is.

3

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

A) Lines 3-4 ("When . . . open")

B) Line 15 ("My . . . pride")

C) Lines 20-21 ("It . . . secret")

D) Lines 51-52 ("Why . . . him")

4

It can reasonably be inferred that Papá's "scared look" (line 2) is caused by his concerns about

A) his friends' and neighbors' opinions.

B) his family's safety and well-being.

C) the relationship between the narrator and her mother.

D) the narrator's desire to become a writer.

5

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

A) Lines 10-13 ("Papá . . . close it")

B) Lines 13-14 ("After . . . seditious")

C) Lines 18-20 ("Papá . . . mother")

D) Lines 52-53 ("I . . . killed")

6

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

A) searching.

B) eroding.

C) purging.

D) waving.

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CONTINUE

1

7

As used in line 15, "fierce" most nearly means

A) distressing.

B) struggling.

C) intense.

D) hostile.

8

The italicized words in lines 37-39 serve mainly to

A) convey the lyrical cadence of Herminia's words.

B) illustrate the defiant nature of Herminia's poetry.

C) represent the urgent wishes of Dominican exiles.

D) demonstrate the uplifting effects of patriotic verse.

9

The main purpose of lines 56-68 is to

A) convey the kind of inspiration the narrator requires to help her write poetry.

B) demonstrate the inhibiting impact that Papá's words have had on the narrator.

C) provide a sense of foreboding about the influence that the narrator's poems may have.

D) reveal the effect that the publication of her poems has had on the narrator.

Questions 10-18 are based on the following passage and supplementary material.

The passage is adapted from Joshua Gowin, "Nature's Bounty: Meet Your Maker." ©2009 by Psychology Today.

From the beginning of the agricultural age to the mid-twentieth century, the majority of our food came from local farms. Following the Second World Line War, the mass cultivation of durable produce in a few locations enabled distribution countrywide to warehouse-like supermarkets. Food shopping became a less frequent event, driven largely by price and other "rational" economic considerations.

Over several decades, taste and quality—and, eventually, nutrition and food safety—were sacrificed to efficiencies of production, including produce monoculture, which weakened crop health. As food anthropologist Amy Trubek points out, America produces a great array of potato chips but only a few varieties of potato.

At some point—perhaps when antibiotics were needed to counter the effects of mass housing of animals—the efficiencies gained by industrialization began yielding diminishing returns. Today, recalls of contaminated meat and produce occur with alarming frequency.

More subtly, however, industrial farming ruptured the rich web of cultural experiences traditionally tied to food—conviviality, a sense of connection, knowledge of food vendors, trust in the provenance of food, and links to the past. Increasingly, consumers crave the personal touch in food shopping and see farmers markets as the way to restore it.

Geographer Robert Feagan surveyed a hundred shoppers at a farmers market in Ontario, Canada. He found that despite having only moderate income, the shoppers were not deterred by the slightly higher prices of farmers markets. When it comes to food, value proves to involve much more than sheer price.

Nor did Feagan's consumers fully endorse environmental matters like organic production or concerns about how far their food had to travel, although such factors are often touted as prime reasons for shopping at farmers markets. However noble, the abstract reasons are not as mouthwatering as more palpable factors like social engagement and fresh flavor.

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CONTINUE

1

"It's fresh produce, it's local, especially in the summertime," says one shopper. "And I like the ambience, I like the atmosphere. It's very personal. It's about being healthy. You're buying healthier food because it's directly from the field."

"It's the whole social aspect, and the culture of eating," says another.

"We know a lot of the vendors," another shopper told Feagan. "And there is interesting interaction, and you are able to talk to them while you're buying your food—it makes them part of your life. It's a social activity, just a great experience."

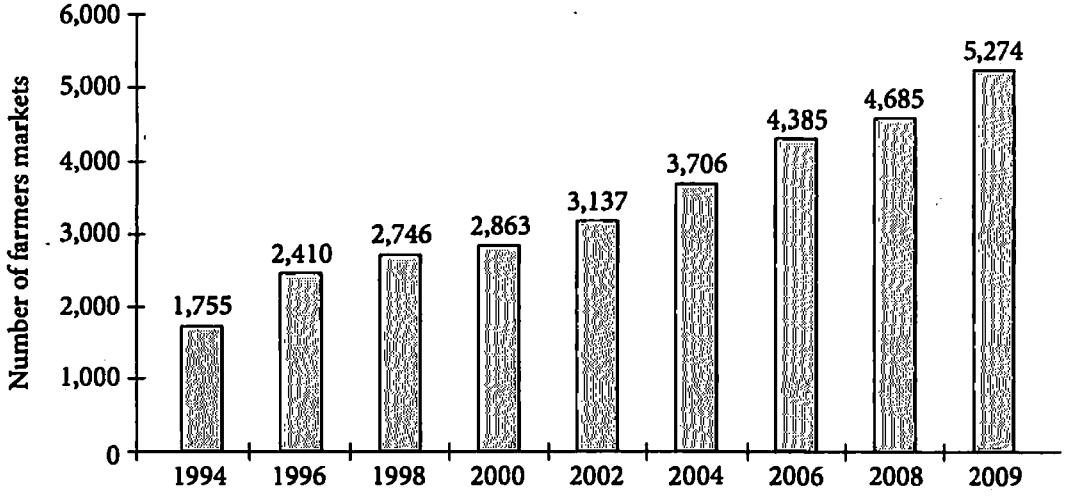
"Supermarkets are busy places that aren't conducive to conversations," says Feagan, a professor of contemporary studies at Wilfrid Laurier University in Brantford, Ontario. Indeed, sociologists have found that patrons have ten times more conversations in farmers markets than in conventional supermarkets.

Farmers are enjoying the resurgence of direct marketing, too. It provides regular income. Many build loyal followings and are able to field and respond to direct consumer requests.

Shopper interaction with food producers can also sweeten the experience of eating. Farmers are often good sources of tips for simple but scrumptious food preparation. The predominance of fruits and vegetables—as compared to conventional markets—encourages consumption of foods that boost health and protect against such chronic diseases as diabetes and heart disease.

Figure 1

United States Farmers Market Growth, 1994–2009



Adapted from USDA, Agricultural Marketing Service, Farmers Market Survey.

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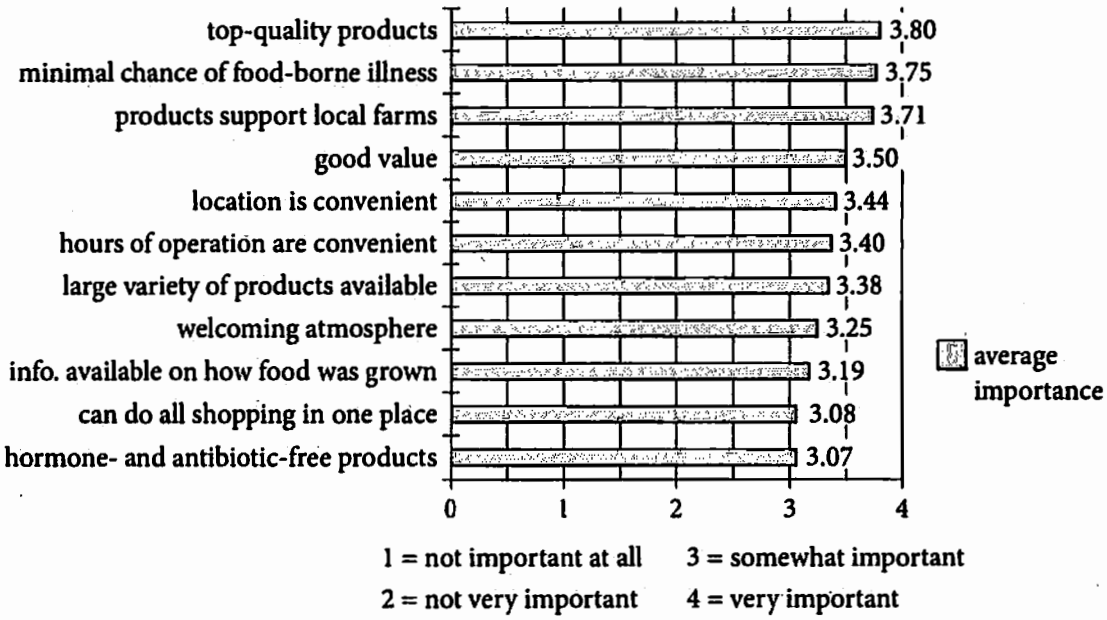
1

Figure 2

Consumers' Ratings of the Importance of Various Factors in Deciding Whether to Shop at a Farmers Market



Adapted from David Conner et al., "Locally Grown Foods and Farmers Markets." ©2010 by Sustainability.

10

In line 8, the author places the word "rational" in quotes to

A) imply that the usage of the word in this instance is a matter of understatement.

B) indicate that a particular assertion will later be disproved.

C) suggest that seemingly reasonable decisions overlooked important factors.

D) emphasize the importance of evidence-based research to economists.

11

According to the passage, the industrialization of food production has recently led to an increase in the

A) availability of fresh foods.

B) risk of food-borne illness.

C) number of food producers.

D) nutritional value of food.

12

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

A) Lines 3-6 ("Following . . . supermarkets")

B) Lines 16-19 ("At . . . returns")

C) Lines 19-21 ("Today . . . frequency")

D) Lines 22-26 ("More . . . past")

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CONTINUE

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13

The author indicates that the cost of food in farmers markets

A) is typically greater than the cost of food in other types of markets.

B) compares favorably to that of food that is mass-produced.

C) is low considering the food's superior quality.

D) has gradually risen over time.

14

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

A) Lines 32-34 ("He . . . markets")

B) Lines 41-43 ("However . . . flavor")

C) Lines 63-64 ("Farmers . . . too")

D) Line 64 ("It . . . income")

15

As used in line 35, "sheer" most nearly means

A) insubstantial.

B) genuine.

C) simple.

D) clear.

16

As used in line 64, "regular" most nearly means

A) common.

B) stereotypical.

C) steady.

D) generous.

17

Which statement from the passage is best supported by figure 1?

A) Lines 1-3 ("From . . . farms")

B) Lines 9-12 ("Over . . . health")

C) Lines 27-29 ("Increasingly . . . it")

D) Lines 34-35 ("When . . . price")

18

Figure 2 provides support for which point made in the passage?

A) The nutritional value of food sold at farmers markets is greater than that of food sold at traditional supermarkets.

B) Environmental concerns are not the primary reason that consumers patronize farmers markets.

C) Getting a good value is more important to consumers than is supporting local farmers.

D) Finding products that are free of hormones and antibiotics is the primary reason that consumers shop at farmers markets.

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Questions 19-28 are based on the following passage and supplementary material.

This passage is adapted from Jason G. Goldman, "Dogs, But Not Wolves, Use Humans As Tools." ©2012 by Jason G. Goldman.

Several years ago, scientists at Eotvos University in Budapest wanted to determine whether the social-cognitive differences between dogs and wolves were primarily genetic or experiential. To do this, they hand-raised a group of dog puppies and a group of wolf pups from birth, resulting in roughly equivalent experiences. Any differences between the two groups' social-cognitive skills, then, would be attributable to genetics.

Wolf and dog pups were raised by humans starting four to six days after birth, before their eyes had fully opened. For the first months of their lives, the wolf and dog pups were in close contact with their human foster parents nearly twenty-four hours per day. They lived in the homes of their caregivers and slept with them at night. They were bottle-fed, and starting on the fourth or fifth week of life, hand fed with solid food. Their human caregivers carried them in a pouch so that the wolf pups and dog puppies could participate in as much of their daily activities as possible: traveling on public transportation, attending classes, visiting friends, and so on. Each of the pups had extensive experience meeting unfamiliar humans, and at least twice a week, they were socialized with each other as well as with unfamiliar adult dogs. The guiding principle for the hand-rearing paradigm, according to the researchers, was based not upon competition or aggressive interactions, but "to behave rather like a mother than a dominant conspecific [member of the same species]."

Would wolves, having been raised by humans, demonstrate social-cognitive skills that approached the sophistication of dogs? Or is social-cognitive aptitude encoded in dogs' genes, a direct result of domestication?

In one simple task, a plate of food was presented to the wolf pups (at 9 weeks) or to the dog puppies (both at 5 weeks and at 9 weeks). However, the food was inaccessible to the animals; human help would be required to access it. The trick to getting the food was simple: all the animals had to do was make eye contact with the experimenter, and he or she would reward the dog with the food from the plate. Initially, all the animals attempted in vain to reach the food. However, by the second minute of testing, dogs began to look towards the humans. This increased over time and by the fourth minute there was a statistical difference. Dogs were more likely to initiate eye contact with the human experimenter than the wolves were. This is no small feat; initiating eye contact with the experimenter requires that the animal refocus its attention from the food to the human. Not only did the wolf pups not spontaneously initiate eye contact with the human experimenter, but they also failed to learn that eye contact was the key to solving their problem. (See figure 1.)

A second experiment, conducted when the wolves and puppies were between four and eleven months old, found similar results. Each animal was presented, in different testing sessions, with two different types of tasks. First, each of the wolves and dogs was trained to retrieve a food reward by opening a bin (in one task) or pulling a rope (in the second task). Then, after they had mastered the task, they were presented with an impossible version of the same problem. After attempting to retrieve the food, the dogs looked back towards the human caregivers. The wolves did no such thing. Dogs spontaneously initiated a communicative interaction with the humans earlier, and maintained it for longer periods of time, than did the human-reared wolves, which all but ignored their human caregivers. (See figure 2.)

Both dogs and wolves were equally adept at learning the two tasks, indicating that there were no group differences in terms of motivation or physical abilities, but large differences emerged when given impossible problems to solve. In both impossible tasks, as well as in the earlier eye contact experiment, dogs instinctively shifted their attention away from the food and towards the humans. Despite the fact that they had been fully socialized, the wolves treated each of the situations as physical problems rather than social ones. Only rarely did they ever attempt to engage in a communicative problem-solving interaction with a human. It's not that wolves are unintelligent; it's quite the opposite, in fact. Wolves are cooperative hunters, skilled at negotiating within their own social networks.

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Figure 1

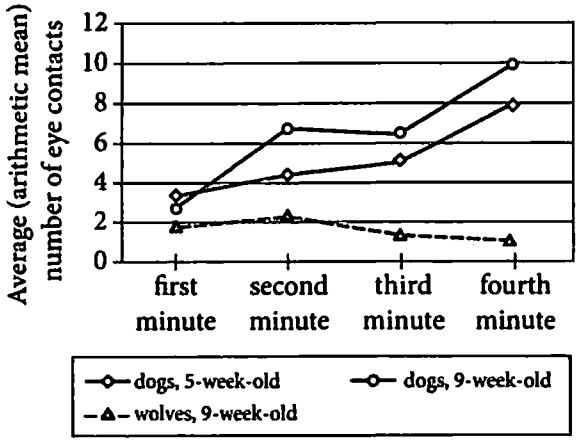
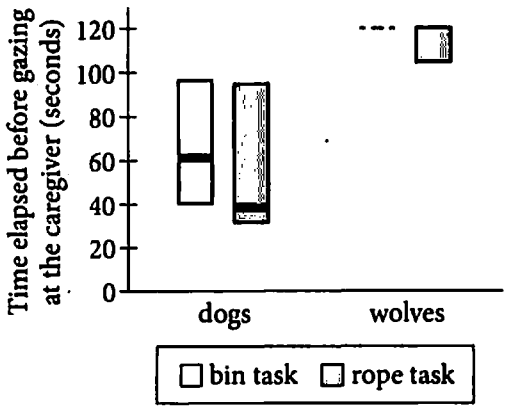


Figure 2



In figure 2, the boxes represent the middle 50 percent of elapsed times, and the thick horizontal lines represent the median elapsed times (up to a maximum of 120 seconds). The dashed line indicates that the wolves did not respond to the bin task within 120 seconds.

Figure 1 adapted from Márta Gácsi et al., "Species-Specific Differences and Similarities in the Behavior of Hand-Raised Dog and Wolf Pups in Social Situations with Humans." ©2005 by Wiley Periodicals, Inc.
Figure 2 adapted from Ádám Miklósi et al., "A Simple Reason for a Big Difference: Wolves Do Not Look Back at Humans, but Dogs Do." ©2003 by Elsevier Science Ltd.

19

Which choice best reflects the overall structure of the passage?

A) A discussion of a scientific premise is followed by a challenge to that premise.

B) A description of an investigation is followed by a report of that investigation's results.

C) A consideration of an abstract theory is followed by an application of that theory.

D) An observation of a natural phenomenon is followed by an analysis of that phenomenon.

20

Which choice is an underlying assumption of the experiments described in the passage?

A) If dogs and wolves meet people early in life, they will be able to learn new skills later in life.

B) If dogs and wolves see people as soon as they open their eyes, both species will rely on people more than they rely on other animals.

C) If dogs and wolves are not well socialized to people, both species will behave aggressively when competing for food.

D) If dogs and wolves have similar experiences when they are young, then different behavior later must necessarily be innate.

21

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

A) Lines 1-4 ("Several . . . experiential")

B) Lines 7-9 ("Any . . . genetics")

C) Lines 10-12 ("Wolf . . . opened")

D) Lines 12-15 ("For . . . day")

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CONTINUE

1

22

As used in line 10, "raised" most nearly means

A) elevated.

B) built.

C) restored.

D) reared.

23

The primary purpose of the third paragraph (lines 32-36) is to

A) offer alternative solutions.

B) indicate competing hypotheses.

C) describe divergent goals.

D) explain contradictory arguments.

24

As used in line 34, "approached" most nearly means

A) approximated.

B) presented.

C) advanced.

D) followed.

25

It can reasonably be inferred that one of the experimenters' goals in socializing the wolf and dog pups was to encourage their

A) ability to master puzzles given to them by people.

B) development as docile companions of people.

C) sense of comfort with and around people.

D) desire to receive rewards from people.

26

Which choice best supports the claim that wolves possess as much aptitude for acquiring new skills as dogs do?

A) Lines 54-57 ("Not only . . . problem")

B) Lines 66-68 ("Then . . . problem")

C) Lines 76-80 ("Both . . . solve")

D) Lines 86-88 ("Only . . . human")

27

What main purpose do figure 1 and figure 2 serve in relation to the passage as a whole?

A) They illustrate the results of different experiments discussed in the passage.

B) They reconcile the outcomes of different experiments described in the passage.

C) They expand on a set of findings touched upon briefly in the passage.

D) They provide alternative explanations for data analyzed in the passage.

28

Based on the information in the passage and in figure 2, the dogs in the second experiment, in general, were

A) more likely to solve the rope task than the bin task.

B) stymied more quickly by the rope task than they were by the bin task.

C) quicker to attempt solutions not involving humans for the rope task than for the bin task.

D) slower to show affection for their caregivers during the bin task than during the rope task.

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CONTINUE

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Questions 29-38 are based on the following passage.

The following passage is adapted from Frederick Douglass, "What to the Slave Is the Fourth of July?" Originally delivered on July 5, 1852. Douglass, a noted abolitionist and author, was a former slave. He gave this speech to an antislavery group in Rochester, New York.

Fellow-citizens, pardon me, allow me to ask, why am I called upon to speak here to-day? What have I, or those I represent, to do with your national
Line independence? Are the great principles of political
5 freedom and of natural justice, embodied in that Declaration of Independence, extended to us? and am I, therefore, called upon to bring our humble offering to the national altar, and to confess the benefits and express devout gratitude for the
10 blessings resulting from your independence to us?

Would to God, both for your sakes and ours, that an affirmative answer could be truthfully returned to these questions! Then would my task be light, and my burden easy and delightful. For who is there so
15 cold, that a nation's sympathy could not warm him? Who so obdurate and dead to the claims of gratitude, that would not thankfully acknowledge such priceless benefits? Who so stolid and selfish, that would not give his voice to swell the hallelujahs of a nation's
20 jubilee, when the chains of servitude had been torn from his limbs? I am not that man. In a case like that, the dumb might eloquently speak, and the "lame man leap as an hart."[1]

But, such is not the state of the case. I say it with a
25 sad sense of the disparity between us. I am not included within the pale of this glorious anniversary! Your high independence only reveals the immeasurable distance between us. The blessings in which you, this day, rejoice, are not enjoyed in
30 common. —The rich inheritance of justice, liberty, prosperity and independence, bequeathed by your fathers, is shared by you, not by me. The sunlight that brought life and healing to you, has brought stripes and death to me. This Fourth [of] July is
35 *yours*, not *mine*. *You* may rejoice, *I* must mourn. To drag a man in fetters into the grand illuminated temple of liberty, and call upon him to join you in joyous anthems, were inhuman mockery and sacrilegious irony. Do you mean, citizens, to mock
40 me, by asking me to speak to-day? If so, there is a parallel to your conduct. And let me warn you that it is dangerous to copy the example of a nation whose crimes, towering up to heaven, were thrown down by the breath of the Almighty, burying that nation in
45 irrecoverable ruin! I can to-day take up the plaintive lament of a peeled and woe-smitten people!

"By the rivers of Babylon, there we sat down. Yea! we wept when we remembered Zion. We hanged our harps upon the willows in the midst thereof. For
50 there, they that carried us away captive, required of us a song; and they who wasted us required of us mirth, saying, Sing us one of the songs of Zion. How can we sing the Lord's song in a strange land? If I forget thee, O Jerusalem, let my right hand forget her
55 cunning. If I do not remember thee, let my tongue cleave to the roof of my mouth."[2]

Fellow-citizens; above your national, tumultuous joy, I hear the mournful wail of millions! whose chains, heavy and grievous yesterday, are, to-day,
60 rendered more intolerable by the jubilee shouts that reach them. If I do forget, if I do not faithfully remember those bleeding children of sorrow this day, "may my right hand forget her cunning, and may my tongue cleave to the roof of my mouth!" To forget
65 them, to pass lightly over their wrongs, and to chime in with the popular theme, would be treason most scandalous and shocking, and would make me a reproach before God and the world. My subject, then fellow-citizens, is AMERICAN SLAVERY. I shall see,
70 this day, and its popular characteristics, from the slave's point of view. Standing, there, identified with the American bondman,[3] making his wrongs mine, I do not hesitate to declare, with all my soul, that the character and conduct of this nation never looked
75 blacker to me than on this 4th of July!

[1] In this quotation from the Bible, a "hart" is a type of deer.

[2] This quotation from Psalm 137 in the Bible describes the experiences of Jewish exiles in the city of Babylon.

[3] A "bondman" is an adult male slave.

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29

The primary purpose of the passage is to

A) propose an approach to achieving a political change.

B) question the wisdom of celebrating the ideals of an earlier generation.

C) explain the ethical values underlying a national holiday.

D) contrast revered political principles with social reality.

30

The questions in the first paragraph primarily serve to

A) explore an ideal that Douglass will abandon.

B) reveal a motivation that Douglass will analyze.

C) raise a possibility that Douglass will discredit.

D) summarize a claim that Douglass will endorse.

31

In the context of the passage as a whole, the phrases "pardon me" and "allow me to ask" (line 1) serve primarily to

A) project an appearance of courtesy.

B) demonstrate private respect and public mistrust.

C) demand close attention from the audience.

D) encourage curiosity and compassion.

32

Douglass makes which point about the Fourth of July holiday?

A) It gives him a profound feeling of national pride.

B) It should not be celebrated while slavery continues to exist.

C) It impresses upon him the disparities between the lives of different groups within the United States.

D) It inspires him to work hard to eliminate slavery so that the country can live up to its ideals.

33

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

A) Lines 18-21 ("Who so . . . limbs")

B) Lines 27-30 ("Your . . . common")

C) Lines 41-45 ("And let . . . ruin")

D) Lines 68-69 ("My subject . . . SLAVERY")

34

Douglass indicates that expecting him to celebrate the Fourth of July is

A) ironic given his hostility to the ideals that the holiday honors.

B) satisfying in light of the fact that he achieved his freedom through his own efforts.

C) insulting to both him and the values being celebrated.

D) upsetting to people who do not believe that he is their equal.

35

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

A) Lines 24-25 ("I say . . . us")

B) Lines 36-39 ("To drag . . . irony")

C) Lines 55-56 ("If I . . . mouth")

D) Lines 69-71 ("I shall . . . view")

36

A significant contrast that Douglass draws between himself and his audience is that he

A) refuses to rejoice in the country's freedoms while those freedoms are denied to slaves.

B) thinks the holiday should memorialize the nation's founders.

C) questions the value of the United States' founding principles.

D) believes that slavery is a moral issue, not merely a political one.

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37

In saying "I am not that man" (line 21), Douglass suggests that he

A) could not resist a joyful feeling of patriotism if he enjoyed equality with his audience.

B) could not explain the Fourth of July holiday to those who remain enslaved.

C) is not motivated by self-interest when addressing the audience on the Fourth of July.

D) is professing beliefs on this occasion that he has suppressed in the past.

38

As used in line 24, "state" most nearly means

A) nation.

B) rank.

C) condition.

D) imperative.

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1

Questions 39-47 are based on the following passages.

Passage 1 is adapted from John L. Ingraham, *March of the Microbes: Sighting the Unseen*. ©2010 by Harvard University Press. Passage 2 is adapted from Silke Werth and Victoria L. Sork, "Local Genetic Structure in a North American Epiphytic Lichen, Ramalina menziesii (Ramalinaceae)." ©2008 by American Journal of Botany, Inc.

Passage 1

Spanish moss hangs in mood-setting festoons from trees in the southeastern United States and farther south, all the way to Argentina. Neither originating in Spain nor a moss, it is as beautiful as it is badly named. It is a flowering plant belonging to the bromeliads, the family that also includes pineapples. Similar festoons appear on trees in the West and other parts of the country, but although they are also called Spanish moss, they are not even plants.

They are visible aggregations of two kinds of microbial cells: a phototroph capable of photosynthesis (either an alga or a bacterium) and a fungus, living together intimately for their own and the other's benefit, a living arrangement called a *mutualistic symbiosis*. The pair goes by a name that might be more familiar—a lichen. The association is so intimate and the appearance of each pair is so distinctive that biologists name lichens as though they were individual organisms rather than pairs of them. The great eighteenth-century naturalist Carolus Linnaeus, who introduced the logical system of naming organisms that we still use today, started it all. He and his last student, Erik Acharius, who specialized in the study of these intriguing microbial associations, named them as species of a single genus, *Lichen*. Present-day students of these symbioses have carried the concept of classifying these pairs of organisms as though they were a single species even further. Now, lichens are grouped into genera and families within a phylum assigned to the fungi. Individual associations are still assigned Latin binomials according to the Linnaean system. The Spanish moss lichen, for example, is named *Ramalina menziesii*.

Passage 2

In a given locality, *Ramalina menziesii* tends to specialize on a few host plant species, but the host species vary across its range. In California, this lichen is found mainly on canopy branches of three host species, the California valley oak, the blue oak, and the coastal live oak, and the mutualistic association seems to benefit both the lichen and the host trees. The lichen benefits from the structured space and microclimate created by the oak canopy. The California valley oak and the blue oak are winter-deciduous white oaks that differ slightly in bark texture. The California valley oak is usually found in valleys, while the blue oak occurs more commonly on the adjacent slopes. The coastal live oak, an evergreen oak belonging to the black oaks group, does not have strong habitat preferences. This species has a very dense canopy and smoother bark textures than the white oak species. In Californian inland localities, such as our study area, *R. menziesii* grows mostly during the winter season, and winter rainfall provides most of its water. Thus, in these inland localities, the deciduous oaks may be a more beneficial substrate during the growing season of *R. menziesii* because they shed their leaves in winter, allowing ample light for the lichen's phototroph. In contrast, light may be a limiting factor for photosynthesis of *R. menziesii*'s phototroph in the canopy of the evergreen oak, the coastal live oak. Differences in the bark chemistry of the three oak species could be another factor influencing habitat quality for the lichen.

The trees benefit from the input of the lichens: oaks colonized by lichens received an increased deposition of nitrogen, phosphorus, and water from local rainfall and fog dripping. Sometimes amounting to 78% of total canopy lichen biomass (about 299 kg/ha dry mass), *R. menziesii* can contribute markedly to nutrient cycling in California oak woodland ecosystems. Thus, the association of *R. menziesii* and oaks can lead to a small mutual benefit of all involved taxa and is not highly specific; we consider this association to be an example of a weak mutualism.

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CONTINUE

1

39

The main purpose of both Passage 1 and Passage 2 is to

A) question whether mosses are considered plants.

B) discuss an advantageous interaction between two types of organisms.

C) argue that organisms living in pairs are often harmful to one another.

D) explain the change over time in the naming systems for classifying organisms.

40

As used in line 15, "arrangement" most nearly means

A) layout.

B) situation.

C) alignment.

D) display.

41

As used in line 39, "host" most nearly means

A) inviting.

B) presenting.

C) multitude.

D) harboring.

42

The authors of Passage 2 indicate that the leaves and branches of oak trees provide which resource for *R. menziesii*?

A) Light

B) Water

C) Nutrients

D) A place to grow

43

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

A) Lines 43-44 ("The lichen . . . canopy")

B) Lines 53-56 ("In Californian . . . water")

C) Lines 56-60 ("Thus . . . phototroph")

D) Lines 67-70 ("The trees . . . dripping")

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CONTINUE

1

44

A student claimed that, during winter, *R. menziesii* is exposed to more light if associated with a California valley oak than with a coastal live oak. Would the authors of Passage 2 most likely agree with the student's claim?

A) Yes, because the authors state that California valley oaks grow in an environment with a longer growing season.

B) Yes, because the authors state that California valley oaks are deciduous oaks that lose their leaves in winter.

C) No, because the authors state that California valley oaks grow in an environment with a shorter growing season.

D) No, because the authors state that California valley oaks live in valleys and thus do not receive as much sunlight as coastal live oaks.

45

In Passage 2, which choice provides the best support for the authors' implication that *R. menziesii* is one of the most abundant lichens in Californian oak forests?

A) Lines 38-42 ("In California . . . trees")

B) Lines 47-49 ("The California . . . slopes")

C) Lines 64-66 ("Differences . . . lichen")

D) Lines 70-74 ("Sometimes . . . ecosystems")

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CONTINUE

1

46

Based on the information provided in Passage 1, the species named in line 36 is also called

A) Spanish moss.

B) bromeliad.

C) blue oak.

D) coastal live oak.

47

Based on Passages 1 and 2, the phototroph referred to in line 60 could be which one of the following types of organisms?

A) Alga

B) Moss

C) Fungus

D) Evergreen oak tree

STOP

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

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2

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.

Let Music Change Your Mind

[1] In the early 1990s, much was made of the so-called Mozart effect, whereby listening to Mozart's music for ten minutes boosted a person's spatial intelligence. [2] The effect, however, 1 came up short, lasting for only about ten to fifteen minutes after the listening period. [3] Nevertheless, the discovery inspired other efforts to understand the effects of music on human brain function. [4] Research indicates that learning to play a musical instrument has profound implications for

1

A) NO CHANGE
B) was a flash in the pan,
C) proved temporary,
D) had a short shelf life,

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CONTINUE

2

the mind and that musicians reap lifelong benefits from their craft. [5] Recent scientific interest has spread beyond the effects of just listening to music. 2

Most research addressing the cognitive benefits of playing musical instruments finds that music lessons have positive effects on school-age children, as the formative years facilitate easy absorption of new skills. Young people who learn to play an instrument 3 strengthen auditory skills, 4 memory and cognitive, development, sensory abilities, creativity, and problem solving. 5 By contrast, some of these improvements occur because the act of playing music

2

To make the paragraph most logical, sentence 5 should be

A) placed where it is now.
B) placed after sentence 2.
C) placed after sentence 3.
D) DELETED from the paragraph.

3

A) NO CHANGE
B) to strengthen
C) strengthens
D) is strengthening

4

A) NO CHANGE
B) memory but cognitive development,
C) memory and cognitive development,
D) memory, and cognitive development

5

A) NO CHANGE
B) In fact,
C) However,
D) Similarly,

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CONTINUE

changes the way the mind itself works. 6 Brain function in areas such as verbal memory and visual-spatial judgment is enhanced in a way that results in significant differences 7 from a musician's brain and a nonmusician's.

6

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

> Scientists who study perfect pitch, which is the ability to identify any tone, are attempting to determine how much of a role early musical training plays in the development of perfect pitch in children already genetically predisposed to it.

Should the writer make this addition here?

A) Yes, because it offers another example of skills strengthened by children who learn to play music.

B) Yes, because it introduces information about brain function that is discussed in the next sentence.

C) No, because it details scientific findings that call into question the benefits of learning to play music.

D) No, because it blurs the paragraph's focus by introducing new information that is unaddressed elsewhere.

7

A) NO CHANGE

B) than

C) between

D) to

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2

8 Adults also receive many of the same cognitive advantages by continuing to refine musical skills formed in childhood or even by beginning to play later in life. 9 For instance, musicians tend to show increased aptitude for spatial reasoning. Musicians have better verbal memory and motor skills well into adulthood. Due to the fact that musical skill increases and preserves

8

Which choice best introduces the paragraph?

A) Children are not the only ones who gain from learning to play a musical instrument.

B) After adolescence, young people often become too busy to play music.

C) Most studies on the benefits of playing music yield a consistent body of results.

D) Curiosity about musical skill should be encouraged at all stages of life.

9

Which choice most effectively combines the underlined sentences?

A) For instance, musicians well into adulthood tend to show greater aptitude for spatial reasoning, and also with better verbal memory and motor skills.

B) In addition to verbal memory and motor skills, when they are well into adulthood, musicians tend to show greater aptitude for spatial reasoning.

C) Musicians tend to show greater aptitude for spatial reasoning, for instance, when they are well into adulthood with better verbal memory and motor skills.

D) For instance, musicians tend to show increased aptitude for spatial reasoning, verbal memory, and motor skills well into adulthood.

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CONTINUE

2

neuroplasticity—the 10 brains' ability to reorganize functions in response to stimuli—continued practice may also help to lessen the ordinary deterioration of cognitive ability that can accompany age.

In addition to the many advantages conferred by playing music, musicians young and old may also build important strengths such as organization and perseverance because mastering a musical instrument takes time. Some other 11 affects are less strictly mental. Skill with certain instruments, such as the guitar, flute, or drums, helps to improve hand-eye coordination, lung capacity, breath control, or manual dexterity. With all that may be gained from learning to play a musical instrument, its value as an important part of mental well-being warrants the consideration of anyone looking to adopt a truly rewarding hobby.

10

A) NO CHANGE
B) brains ability
C) brain's ability
D) brains' abilities

11

A) NO CHANGE
B) effects are
C) effects is
D) affections are

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CONTINUE

2

Questions 12-22 are based on the following passage.

Walk Away from the Wild Side

To twentieth-century conservationists, the idea of raising fish to sell seemed like the perfect response to the rapid depopulation of wild fish. Fish 12 farming, or aquaculture, was hailed as an environmentally sound way to save overfished species such as salmon, sea bass, and tuna while meeting the human demand for seafood. On farms located near natural bodies of water, elaborate systems of pens would hold the fish as they grew from small fry to market weight. In open-air markets or grocery stores, these fish would be sold like their wild-caught cousins.

However, 13 some fish farms have proved to be financially unsuccessful. Raised as a cash "crop," thousands of fish were unhealthily crowded together in pens. Waste products, including feces, uneaten food, and dead fish, were flushed from the pens into the ocean, lake, and stream water near the farms, contaminating the water supply. 14 While pests such as sea lice, capable of eating a live fish to the bone, thrived in the artificial environment, as did viral, fungal, and bacterial diseases, which spread to wild fish populations. 15 They often escaped from farms and competed with native species in local waters for food. Pesticides and drugs used to treat afflicted fish 16 effected the entire ecosystem. One domino after another was falling.

Fortunately, these catastrophic developments prompted creative solutions. To begin with, the industry moved inland, at least partially addressing one of

12

A) NO CHANGE
B) farming or aquaculture,
C) farming—or aquaculture,
D) farming or aquaculture

13

Which choice establishes the best transition from the previous paragraph to this paragraph?

A) NO CHANGE
B) many people prefer wild-caught fish.
C) several problems manifested themselves almost immediately.
D) fish farmers must take numerous precautions to be successful.

14

A) NO CHANGE
B) Besides pests
C) Since pests
D) Pests

15

A) NO CHANGE
B) Nonnative fish
C) Others
D) Some

16

A) NO CHANGE
B) affected
C) affecting
D) affect

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CONTINUE

aquaculture's greatest challenges: keeping contaminated water 17 held. Innovation has taken other forms, too. 18 Therefore, Dave Roeser, owner of Garden Fresh Farms, has created a unique farm-in-a-bubble system in which plants and fish meet each other's needs. In this system, fish exhale what plants inhale, excrete what plants eat, and swim in water that plants clean. Such cycling is evident throughout the farm. Rainbow trout are supplied with cold water pulled directly from Minnesota lakes, because 19 trout is one of the most popular lake fish. After the trout heat the water, it is piped to 20 tilapia pens, a tropical fish that needs warmer water. Tilapia wastewater is treated and enriched by beneficial bacteria 21 known to be helpful and then forced through pipes to an indoor garden, where it fertilizes tens of thousands of heads of lettuce and herbs. These plants filter the water, which is piped back to the fish tanks, renewing the cycle. Roeser's delicate animal-plant balance produces 40,000 fish and 460,000 edible plants a year in an area the size of four semitrailer trucks. While unique in its particulars, Garden Fresh Farms signals a broader trend: once primarily a wild food caught with nets and hooks and luck, fish on the dinner table today were likely ordered wholesale.

17

A) NO CHANGE
B) contained.
C) restrained.
D) encompassed.

18

A) NO CHANGE
B) Nonetheless,
C) For example,
D) Subsequently,

19

Which choice establishes the most critical reason for the action described earlier in the sentence?

A) NO CHANGE
B) cold water has the high oxygen level trout need.
C) Roeser's operation is located near these lakes.
D) there is no seawater available.

20

A) NO CHANGE
B) tropical fish that need warm water in pens called tilapia.
C) pens holding tilapia, a tropical fish that needs warm water.
D) pens of tropical fish that need warmer water known as tilapia.

21

A) NO CHANGE
B) that have been identified as helpful
C) treating the water
D) DELETE the underlined portion.

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CONTINUE

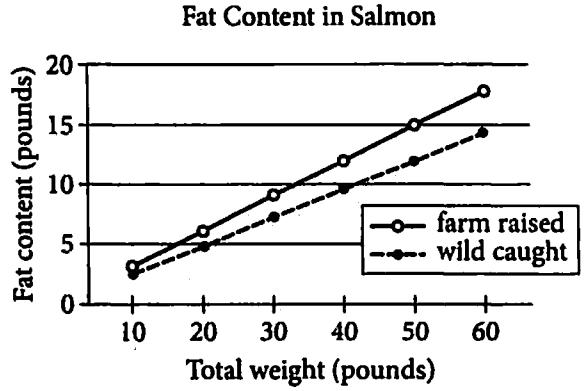
2

Question 22 asks about the previous passage as a whole.

Think about the previous passage as a whole as you answer question 22.

22

During further research into the passage's topic, the writer finds the following graphic.



Should the writer include this graphic along with the passage?

A) Yes, because it offers additional data defining wild-caught and farm-raised fish.

B) Yes, because it shows that farm-raised salmon have a higher fat content than do wild-caught salmon.

C) No, because it weakens a point the passage makes about farm-raised fish.

D) No, because it lacks clear relevance to the main focus of the passage.

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CONTINUE

2

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

Digital Image Processing

Zoltan Levay spends much of his time visualizing space. As imaging group lead for the Hubble Space Telescope, he oversees the processing of data captured by the 23 telescope's digital detector's. Levay and his team take these data and create stunning astronomical images for use in news stories and scientific research.

Photos taken with consumer digital cameras, smartphones, and tablets use only one "multichannel" color detector. Levay's team, on the other hand, begins with scientific data from a set of single-channel, black-and-white images captured using different filters. A single image can be made up of multiple exposures. Sometimes, when the subject is especially large, multiple images are stitched together to create a mosaic. Additional steps are then taken to optimize the black-and-white images for tonal balance. 24 However, color is added to the single-channel images, and they are merged to produce a composite image. Final adjustments are made to highlight the specific details of interest.

As one might imagine, constructing digital images requires a thorough understanding of the computer software used in 25 imaging and familiarity with the instruments that initially collect the data. Basic mathematical skills and an understanding of the scientific

23

A) NO CHANGE
B) telescopes' digital detector's.
C) telescope's digital detectors.
D) telescopes' digital detectors'.

24

A) NO CHANGE
B) Next,
C) Therefore,
D) Nonetheless,

25

A) NO CHANGE
B) imaging; and
C) imaging also
D) imaging; also

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CONTINUE

2

principles being investigated are essential, but so is the eye of an artist. 26 The goal is to produce a beautiful image. It also presents scientific information accurately. Anyone wanting to learn more about image processing can search the online MAST astronomical data archive and use free software to create and share images. In fact, professionals in image processing are even available through social media to answer questions and share 27 his or her thoughts.

Using digital imaging techniques to interpret scientific information is important in other disciplines too. One of the most familiar is medical imaging. The use of medical imaging technology for noninjury emergency room visits 28 have grown significantly, 29 and there is a need for skilled technologists to operate the imaging devices that help provide accurate diagnoses. The US Bureau of Labor Statistics projects that job growth

26

Which choice most effectively combines the underlined sentences?

A) The goal is to produce a beautiful image that also presents scientific information accurately.

B) The goal is to produce a beautiful image—it also presents scientific information accurately.

C) The goal is to produce a beautiful image; the image also presents scientific information accurately.

D) The goal is to produce a beautiful image, and the goal also presents scientific information accurately.

27

A) NO CHANGE

B) their

C) our

D) your

28

A) NO CHANGE

B) are being

C) has

D) were

29

Which choice most effectively sets up the information that follows?

A) NO CHANGE

B) which is most likely due to an increase in age-related injuries as people live longer.

C) probably because of the rise in the number of patients visiting emergency rooms each year.

D) but the production of new imaging machines has not kept pace with this demand.

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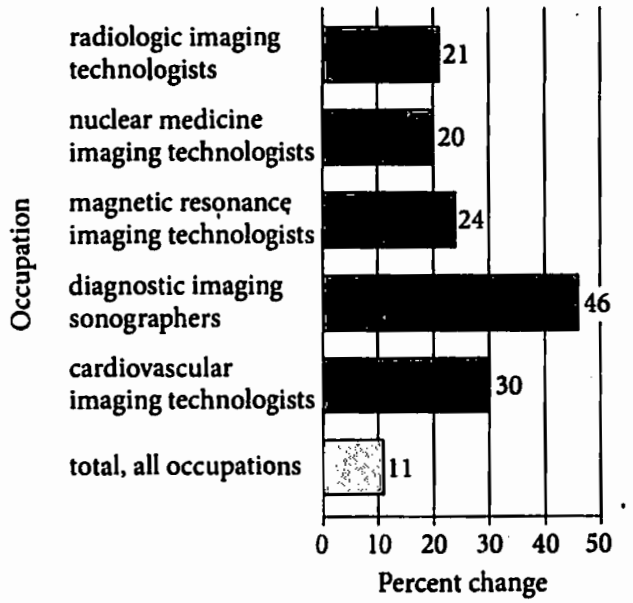
CONTINUE

between 2012 and 2022 is expected to be 30 20 percent for diagnostic imaging sonographers and 31 many sonographers earn above the average salary of US workers.

Percent Change in Employment Projected 2012–2022



Source: *Occupational Outlook Handbook*. ©2014 by the Bureau of Labor Statistics, US Department of Labor.

In addition to being used in astronomy and 32 medicine. Digital image processing techniques are used in fields as diverse as conservation, industrial inspection, law enforcement, the fine arts, and the design of human-computer interfaces. With so much variety, 33 there's an assortment; careers involving digital image processing may be easier to find than you think.

30

After reviewing the chart included in the passage, the writer realizes the information provided in the underlined portion is not accurate. Which of the following changes would correct the inaccuracy?

A) Change "20 percent" to "11 percent"
B) Change "20 percent" to "21 percent"
C) Change "20 percent" to "24 percent"
D) Change "20 percent" to "46 percent"

31

Which of the following choices most effectively supports the paragraph's claim about job growth with accurate and relevant data from the chart included in the passage?

A) NO CHANGE
B) 24 percent for magnetic resonance imaging technologists.
C) most sonographers complete training in less than three years.
D) may include working evenings, overnight shifts, and weekends.

32

A) NO CHANGE
B) medicine; digital
C) medicine: digital
D) medicine, digital

33

A) NO CHANGE
B) there are lots of choices;
C) it's a multitude of options;
D) DELETE the underlined portion.

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CONTINUE

2

Questions 34-44 are based on the following passage.

The Texas Longhorn of Dinosaurs

Of all the horned dinosaurs, *Triceratops* is probably best known. But even that behemoth's impressive three bony spikes 34 pales by comparison to the massive horns found atop a newly discovered dinosaur, the *Nasutoceratops titusi*. When paleontologists unearthed the fossils of a *Nasutoceratops* in the Utah desert in 2013, they said it was unlike anything they had seen before. The *Nasutoceratops*'s intimidatingly large horns were forward pointing, curving nearly all the way to the tip of the dinosaur's outsized nose. These horns immediately became this dinosaur's primary identifying feature: Its name, *Nasutoceratops*, is Latin for "big-nosed horn face." *Nasutoceratops* was even 35 nicknamed "the Texas longhorn of dinosaurs," because of 36 it's horns similarity to those that adorn the heads of that breed of Texas cattle.

37 *Nasutoceratops* lived some 76 million years ago. *Nasutoceratops* lived during the late Cretaceous period. It had a wide body, weighed as much as two and a half tons, and 38 a length of fifteen feet. Like its "cousin" *Triceratops*, *Nasutoceratops* was also part of the ceratopsid group—rhinoceros-like dinosaurs that walked on four legs and ate plants. Evidence indicates that *Nasutoceratops* inhabited what is now the western United

34

A) NO CHANGE
B) pale in
C) pales of
D) pales in

35

A) NO CHANGE
B) nicknamed, "the Texas longhorn of dinosaurs,"
C) nicknamed, "the Texas longhorn of dinosaurs"
D) nicknamed "the Texas longhorn of dinosaurs"

36

A) NO CHANGE
B) it's horns'
C) its horns'
D) its horns

37

Which choice most effectively combines the underlined sentences?

A) *Nasutoceratops* lived some 76 million years ago, during the late Cretaceous period.
B) *Nasutoceratops* lived some 76 million years ago, and that was during the late Cretaceous period.
C) When *Nasutoceratops* lived some 76 million years ago; that was during the late Cretaceous period.
D) During the time when *Nasutoceratops* lived, it was some 76 million years ago during the late Cretaceous period.

38

A) NO CHANGE
B) growth to fifteen feet in length.
C) growing a length of fifteen feet.
D) grew to fifteen feet in length.

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CONTINUE

2

States, a region that was once as verdant and wet as [39] what the Mississippi Delta is like.

Along with its impressive horns, *Nasutoceratops* had [40] a massive nose. Researchers remain uncertain about the purpose of *Nasutoceratops*'s enormous snout. Its olfactory receptors were further back in the head, refuting the theory that the big nose may have led to a heightened sense of smell. The reason for the dinosaur's large nose remains a mystery.

[41] Similarly unknown is which of the *Nasutoceratops* had those characteristic horns atop their heads. Was it only the males of the species that had horns, the way male elk and deer do in modern times? Or did both *Nasutoceratops* sexes wear those horns, as male and female water buffalo do today? [42] Scientists wonder if it was just older *Nasutoceratops* that grew the horns or did the young ones, too? Scientists aren't completely sure.

39

A) NO CHANGE
B) where the Mississippi Delta region is.
C) those of the Mississippi Delta.
D) the Mississippi Delta.

40

Given that all the choices are accurate, which one most effectively completes the sentence so that it introduces the main topic of the paragraph?

A) NO CHANGE
B) a low and narrow horn on its nose.
C) features similar to those of modern cattle.
D) a unique combination of features.

41

A) NO CHANGE
B) Therefore, it is unknown
C) In sharp contrast, it is unknown
D) Yet it is unknown

42

Which choice most closely maintains the sentence pattern established in this paragraph?

A) NO CHANGE
B) There are questions about whether it was just older *Nasutoceratops* that grew the horns or if the young ones did, too.
C) Was it just older *Nasutoceratops* that grew the horns or did the young ones, too?
D) Scientists are wondering, "Was it just older *Nasutoceratops* that grew the horns or did the young ones, too?"

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CONTINUE

2

More obvious to the researchers, however, is why the Texas longhorn of dinosaurs had such large horns atop its head. They believe *Nasutoceratops*'s horns had a variety of functions. The horns most likely served to ward off predators that may have been considering an attack. 43 Whatever their function during *Nasutoceratops*'s lifetime, the horns have since accomplished one thing: 44 the deserts of Utah have yielded a fascinating discovery.

43

At this point, the writer wants to add another example of a likely function of *Nasutoceratops*'s horns. Which choice best accomplishes this goal?

A) Researchers have proposed several likely functions of *Nasutoceratops*'s horns.

B) *Nasutoceratops*'s horns could have been used for any number of purposes.

C) They were also probably used to battle with rival dinosaurs for dominance.

D) But it's likely that warding off predators wasn't the horns' only function.

44

Which choice best concludes the essay and recalls a point made early in the essay?

A) NO CHANGE

B) *Triceratops* may now have some competition for most famous horned dinosaur.

C) the *Nasutoceratops* is now known as a great example of the ceratopsid family.

D) the *Nasutoceratops*'s horns were unlike those of any other dinosaur yet discovered.

STOP

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

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Math Test – No Calculator

25 MINUTES, 17 QUESTIONS

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

DIRECTIONS

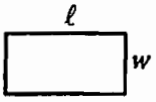
For questions 1-13, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 14-17,** solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 14 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

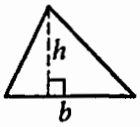
1. The use of a calculator **is not permitted.**
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

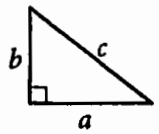
$A = \pi r^2$
$C = 2\pi r$



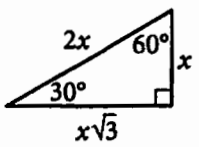
$A = \ell w$

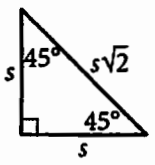


$A = \frac{1}{2}bh$

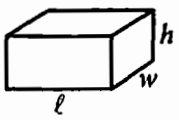


$c^2 = a^2 + b^2$

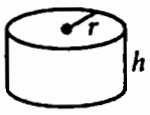




Special Right Triangles

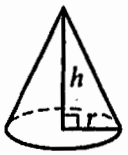


$V = \ell wh$

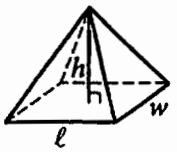


$V = \pi r^2 h$

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



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



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

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

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CONTINUE

1

$$\frac{5}{6}x + 7 = 12 - \frac{5}{12}x$$

What is the value of x in the equation above?

A) 4

B) 12

C) $\frac{75}{12}$

D) $\frac{228}{15}$

2

What are the solutions to the equation $2x^2 - 72 = 0$?

A) $-\sqrt{72}$ and $\sqrt{72}$

B) $-\frac{\sqrt{72}}{2}$ and $\frac{\sqrt{72}}{2}$

C) -36 and 36

D) -6 and 6

3

During a file transfer, a computer sends on average 340 kilobytes of data per second. A file has a size of 1.2 megabytes. Which function can be used to estimate how many kilobytes, $B(t)$, remain to be sent after t seconds?
(1 megabyte is approximately equal to 1,000 kilobytes.)

A) $B(t) = 1{,}200 - 340t$

B) $B(t) = 340 - 1{,}200t$

C) $B(t) = 1.2 - 0.34t$

D) $B(t) = 0.34 - 1.2t$

4

Which of the following is equivalent to the expression $x^2y + x + 2xy + 2$?

A) $xy(x + 2 + y)$

B) $(x + y)(x + 2)$

C) $(xy + 1)(x + 2)$

D) $x(xy + 1) + 2x(y + 1)$

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CONTINUE

5

Which of the following values is a solution of

$\frac{1}{3}(5x-6) < x$?

A) 6

B) 4

C) 3

D) 2

6

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

Which of the following is equivalent to the expression above?

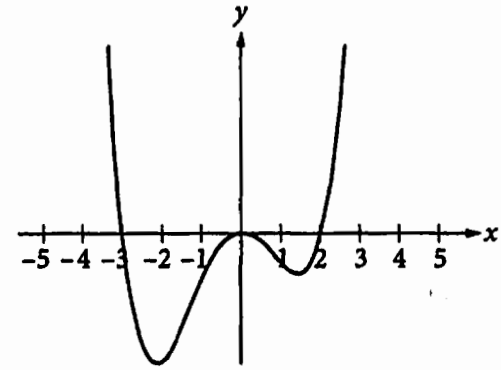
A) $(x-2)^2-8$

B) $x^2-3x-x-11$

C) $(x-5)(x+1)$

D) $(x-1)(x+5)$

7



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

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

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

C) $y = x^2(x+3)(x-2)$

D) $y = x^2(x+2)(x-3)$

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CONTINUE

8

$$5x + 4y = 12$$

The graph of the equation above in the xy-plane is a line, ℓ. Line ℓ intersects line m at point $\left(2, \frac{1}{2}\right)$. Which of the following could be an equation of line m ?

A) $2x = \frac{y}{2}$

B) $2y = 3 - x$

C) $2x + 4y = 8$

D) $y = 4 - \frac{5}{4}x$

9

The function f is defined by $f(x) = |x - 2| - 3$. If $f(a) = f(0)$ and $a > 0$, what is the value of a ?

A) 3

B) 4

C) 5

D) 6

10

For $x > 0$, which of the following is equivalent to $\frac{1}{\frac{1}{4x} + \frac{1}{x+2}}$?

A) $\frac{4x^2 + 8x}{5x + 2}$

B) $\frac{5x + 2}{4x^2 + 8x}$

C) $4x^2 + 8x$

D) $5x + 2$

11

If $\sqrt[5]{a^4} \cdot \sqrt[3]{a^2} = a^n$ for all values of a, what is the value of n ?

A) $\frac{8}{15}$

B) $\frac{3}{4}$

C) $\frac{22}{15}$

D) $\frac{11}{4}$

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CONTINUE

12

$$t = 0.06(a - m)$$

A state legislature is considering a new state income tax proposal. The equation above, where $a > m$, gives the proposed amount of income tax, t dollars, based on a dollars, the amount of income, and m dollars, the maximum nontaxable income. Based on the equation, if there is a tax of $300 on $30,000 of income, what is the maximum nontaxable income?

A) $1,500

B) $1,782

C) $5,000

D) $25,000

13

$$C = 57{,}740 - 1{,}158n$$

The equation above estimates the total number of newspapers, C, in thousands, that were sold in the United States in the nth year after the year 2000. The number 1,158 in the equation above gives which of the following estimates?

A) Every year the circulation decreases by 1,158 newspapers.

B) Every year the circulation decreases by 1,158,000 newspapers.

C) For every decrease of 1,158 newspapers, there are 57,740 fewer readers.

D) For every decrease of 1,158,000 newspapers, there are 57,740 fewer readers.

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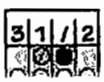
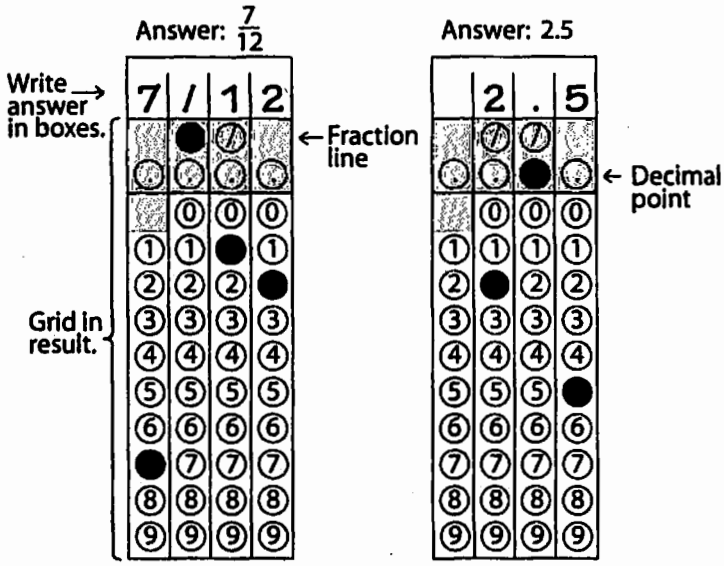
CONTINUE

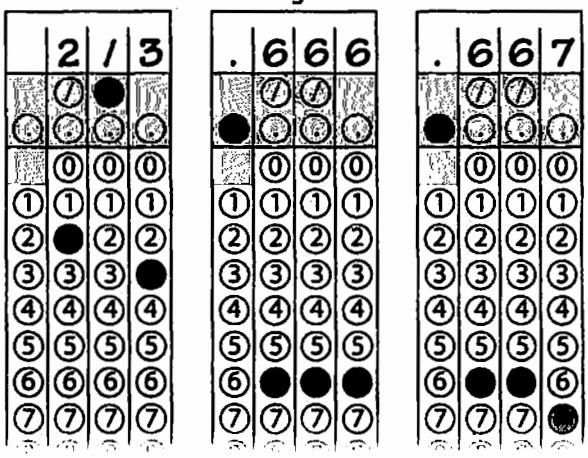
DIRECTIONS

For questions 14-17, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

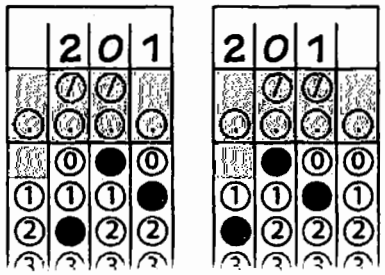
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
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.



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



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.

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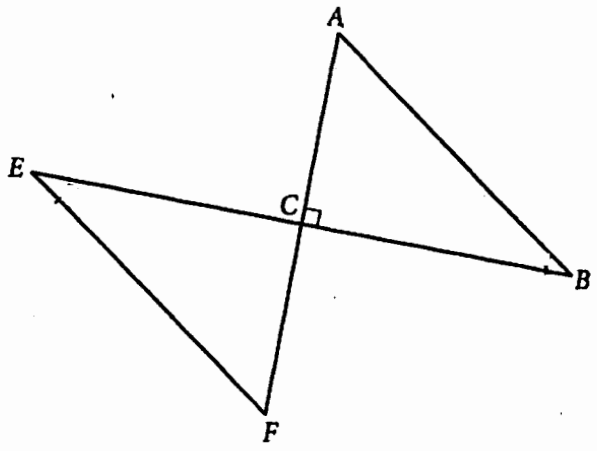
CONTINUE

14



In the figure above, line segments $\overline{AF}$ and $\overline{BE}$ are perpendicular and intersect at point C. Angle B is congruent to angle E, and the measure of angle A is 55°. What is the measure, in degrees, of angle E ? (Disregard the degree sign when gridding your answer.)

15

$$x + y = 1$$
$$5x - y = 23$$

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

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CONTINUE

16

If a and b are positive numbers such that $2b = 3a$, what is the value of $\frac{a+b}{b}$?

17

A publishing company ships hard-cover textbooks in boxes that weigh 56 pounds each, and soft-cover workbooks in boxes that weigh 35 pounds each. A shipment going to several schools weighs 2604 pounds total and contains 60 boxes. How many boxes of soft-cover workbooks are in the shipment?

STOP

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

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Math Test – Calculator

45 MINUTES, 31 QUESTIONS

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

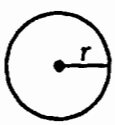
DIRECTIONS

For questions 1-27, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 28-31,** solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 28 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

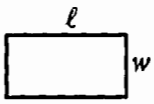
NOTES

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

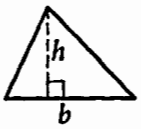
REFERENCE



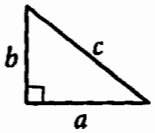
$A = \pi r^2$
$C = 2\pi r$



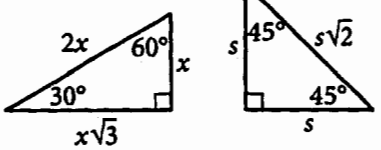
$A = \ell w$



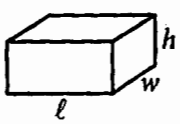
$A = \frac{1}{2}bh$



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



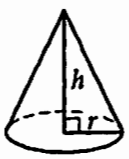
Special Right Triangles



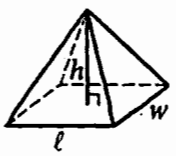
$V = \ell wh$

$V = \pi r^2 h$

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



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



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

The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

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CONTINUE

1

A pharmacist filled 5 prescriptions in 20 minutes. At this rate, how many prescriptions would the pharmacist expect to fill in 2 hours?

A) 15
B) 25
C) 30
D) 35

2

Which of the following is equivalent to $3(x+5)-6$?

A) $3x-3$
B) $3x-1$
C) $3x+9$
D) $15x-6$

3

Night crawlers, a type of worm, are capable of digging to a depth of 6.5 feet below the ground. Approximately how deep below the ground are they capable of digging, in meters? (1 meter $\approx$ 3.28 feet)

A) 0.50
B) 1.98
C) 3.22
D) 21.32

4

$$(x+2)^2-9=0$$

Which of the following is a value of x that satisfies the equation above?

A) -5
B) -2
C) 5
D) 7

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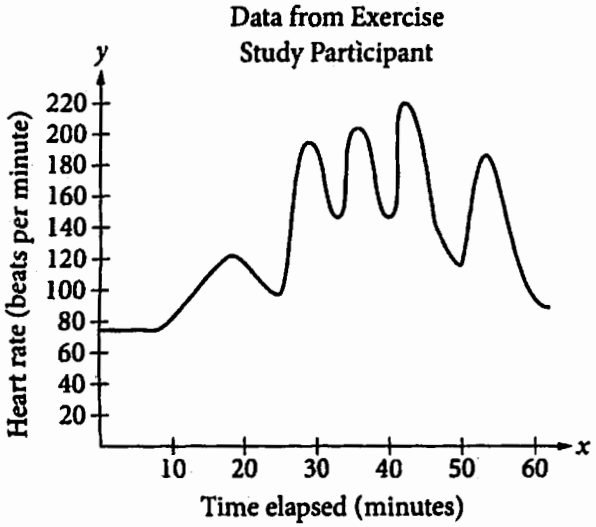
CONTINUE

5

A medical research study tracked the heart rate, in beats per minute, of a participant engaged in various types of exercise. The data are graphed on the set of axes below with the time elapsed during the observation on the x-axis and the participant's heart rate on the y-axis.



Based on the graph, which statement is true?

A) The participant's maximum heart rate in the first 20 minutes of the observation is about 120 beats per minute.

B) The participant's minimum heart rate is reached about 50 minutes after the observation begins.

C) The participant's heart rate steadily increases between 25 and 40 minutes during the observation.

D) The participant's resting heart rate is given by the x-intercept of the graph.

6

If $6x = 25$, what is the value of $3\left(x + \frac{1}{2}\right)$?

A) $\frac{53}{6}$

B) $\frac{51}{2}$

C) 13

D) 14

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Questions 7-9 refer to the following information.

Favorite High School Subjects

	English	Fine Arts	Math	History	Science	Total
Seniors	20	13	35	14	38	120
Freshmen	31	36	30	17	16	130
Total	51	49	65	31	54	250

The table above lists the results of a survey of a random sample of 250 high school seniors and freshmen. Each student selected one subject that was his or her favorite.

7

How many freshmen selected English, math, or science as their favorite high school subject?

A) 31
B) 64
C) 77
D) 93

8

If the sample is representative of a high school with 2,000 freshmen and seniors, then based on the table, what is the predicted number of freshmen at the high school who would select math as their favorite high school subject?

A) 520
B) 240
C) 65
D) 30

9

If one of the seniors from the sample is selected at random, which of the following is closest to the probability the student selected science as his or her favorite high school subject?

A) 0.48
B) 0.26
C) 0.32
D) 0.15

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CONTINUE

Questions 10 and 11 refer to the following information.

Thad ordered lunch for a meeting; his bill is shown below.

Order Details	
17	Sandwiches
4	Salads
21	Water bottles
25	Cookies
Delivery Fee	$ 19.46
Grand Total	$149.21

The delivery fee is calculated as a percentage of the cost of Thad's order. The grand total is the sum of the cost of Thad's order and the delivery fee.

10

What percentage of the cost of Thad's order was used to calculate the delivery fee?

A) 10%

B) 15%

C) 19%

D) 29%

11

The total amount Thad paid for water bottles and cookies was $45. If the combined cost of one water bottle and one cookie is $2, what is the cost of one cookie?

A) $0.75

B) $0.91

C) $1.09

D) $1.25

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CONTINUE

12

Martin spent $855 on expenses for a trip. The expenses included hotel, rental car, and meals. He spent 50 percent more for the hotel than for the rental car and meals combined. What did Martin spend on his hotel?

A) $570

B) $513

C) $214

D) $155

13

A tank is completely filled with water. A pump is used to drain the tank. The amount of water remaining in the tank is given by the equation $y = 600 - 25x$, where x is the number of minutes since the pump started and y is the volume, in gallons, of water remaining in the tank. In the equation, what are the meanings of the numbers 25 and 600 ?

A) The number 25 is the number of minutes it will take to drain the tank, which holds 600 gallons of water.

B) The number 25 is the rate of increase, in gallons per minute, of the flow from the tank, which holds 600 gallons of water.

C) The number 25 is the rate of increase, in gallons per minute, in the volume of water in the tank, which started at 600 gallons.

D) The number 25 is the rate of decrease, in gallons per minute, in the volume of water in the tank, which started at 600 gallons.

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CONTINUE

Questions 14 and 15 refer to the following information.

The director of an art museum collected data on visitors who purchased tickets to the museum. Each visitor is required to purchase a ticket for admission to the museum and must purchase a new ticket for each visit. The cost of tickets did not change during the year. The director collected the data shown below over one year.

	Stayed up to four hours	Stayed more than four hours	Total tickets purchased	Total money earned from tickets ($)	Repeat visitors
Children younger than fourteen	7,381	5,863	13,244	86,086	2,913
Males of age fourteen or older	7,640	9,951	17,591	158,319	6,787
Females of age fourteen or older	8,756	9,387	18,143	163,287	8,922
Total	23,777	25,201	48,978	407,692	18,622

14

What was the cost of one ticket for a child younger than fourteen?

A) $0.15
B) $6.50
C) $8.30
D) $11.65

15

Based on the table, what is the approximate probability that a visitor will stay for more than four hours, if the visitor is fourteen or older?

A) 0.46
B) 0.51
C) 0.54
D) 0.57

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CONTINUE

16

$$y = x - 4$$
$$4x - 4y = 12$$

The system of equations above consists of two equations, and the graph of each equation in the xy-plane is a line. Which of the following statements is true about these two lines?

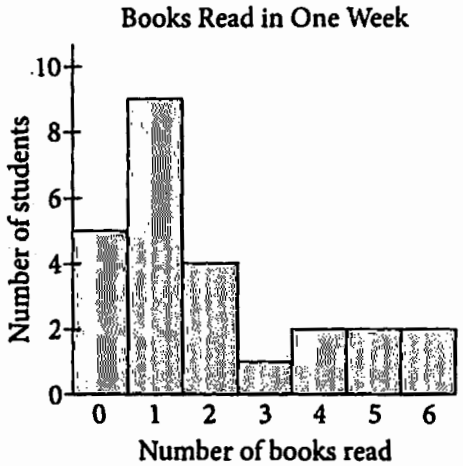
A) The lines are parallel.

B) The lines are the same.

C) The lines are perpendicular.

D) The lines intersect at $(-4, -3)$.

17



The histogram above shows the distribution of the number of books read by 25 college students during one week. Which of the following is true for this group of 25 students?

I. The mean number of books read is equal to the median number of books read.

II. The mode number of books read is equal to the median number of books read.

III. The range of the number of books read is 6.

A) I and II only

B) I and III only

C) II and III only

D) I, II, and III

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CONTINUE

18

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

The kinetic energy of an object in motion can be calculated using the formula above, where K is the kinetic energy of the object in joules, m is the mass of the object in kilograms, and v is the speed of the object in meters per second. Which of the following is equivalent to one joule? (Assume the object is moving at a constant speed without friction.)

A) The kinetic energy of an object with a mass of 1 kilogram moving at 2 meters per second

B) The kinetic energy of an object with a mass of 1 kilogram moving at 1 meter per second

C) The kinetic energy of an object with a mass of 1 kilogram moving at 0.5 kilometer per hour

D) The kinetic energy of an object with a mass of 2 kilograms moving at 1 meter per second

19

Luis bought two movies at his local store. The regular price for each movie was r dollars. The store charged Luis the regular price for the first movie and gave him a 25 percent discount on the second movie. He was charged 8 percent sales tax on the entire purchase. Which of the following expressions gives the total, in dollars, Luis paid, including sales tax?

A) $1.08r + 0.75r$

B) $1.08(2(0.75r))$

C) $1.08(r + 0.75r)$

D) $1.08(r - 0.25r)$

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20

Types of seats	Percent of seats
Balcony	35%
Lower level	50%
Luxury suite	5%
Orchestra	10%

The table above shows the distribution of the four types of seats in a theater. If there are 180 more lower-level seats than balcony seats, how many seats are in the theater?

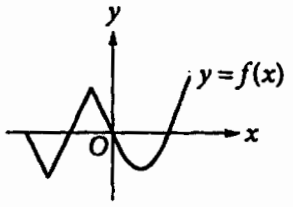
A) 360

B) 515

C) 800

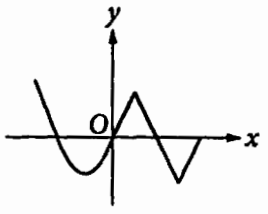
D) 1,200

21

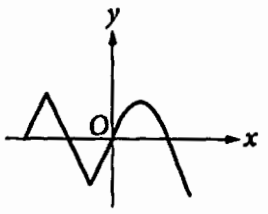


The graph of $y = f(x)$ is shown in the xy-plane above. If $g(x) = |f(x)|$, which of the following graphs best represents the graph of $y = g(x)$?

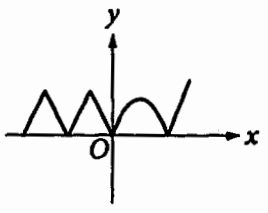
A)



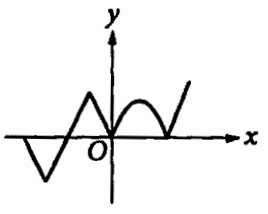
B)



C)



D)



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CONTINUE

22

A gasoline with an octane rating of n is a mixture that contains n% octane. Two different types of gasoline, type A and type B, have octane ratings of 79 and 93, respectively. Joe wants to make a blend of no more than 5 gallons from the two types of gasoline that has an octane rating of at least 86. Let x be the quantity of type A gasoline, in gallons, and y be the quantity of type B gasoline, in gallons, in the blend. Which of the following systems represents all the constraints that x and y must satisfy?

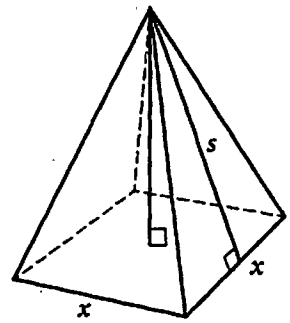
A) $\begin{cases} x > 0 \\ y > 0 \\ x + y = 5 \\ 79x + 93y \leq 86 \end{cases}$

B) $\begin{cases} x > 0 \\ y > 0 \\ x + y \leq 5 \\ 79x + 93y \geq 86 \end{cases}$

C) $\begin{cases} x > 0 \\ y > 0 \\ x + y \leq 5 \\ 79x + 93y \geq 86(x + y) \end{cases}$

D) $\begin{cases} 0 < x < 5 \\ 0 < y < 5 \\ \dfrac{79x + 93y}{x + y} \geq 86 \end{cases}$

23



$$SA = 4\left(\frac{sx}{2}\right) + x^2$$

The formula above can be used to calculate the total surface area of the right square pyramid shown, where x is the length of a side of the square base, and s is the slant height of a lateral face. What must the expression $2xs$ represent?

A) The sum of the areas of the lateral faces

B) The area of one lateral face

C) The area of the base

D) The area of the base and one lateral face

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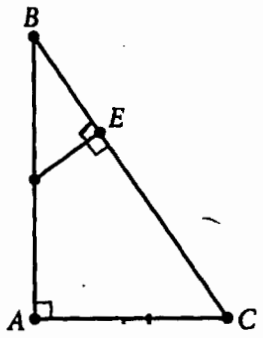
CONTINUE

24



Note: Figure not drawn to scale.

In the right triangle ABC above, $BE = 5$, and $AB = 12$. If the length of $\overline{AC}$ is 1 unit more than twice the length of $\overline{DE}$, what is the length of $\overline{DE}$?

A) $\frac{1}{2}$

B) $\frac{5}{2}$

C) 3

D) 4

25

The resale value of a car is expected to decrease by 15 percent from one year to the next from the year the car is purchased. What type of relationship should be expected between the age of a car and the resale value?

A) Linear relationship whose graph has a positive slope

B) Linear relationship whose graph has a negative slope

C) Quadratic relationship in which higher resale values of a car correspond to lower age values of the car

D) Exponential relationship in which lower resale values of a car correspond to higher age values of the car

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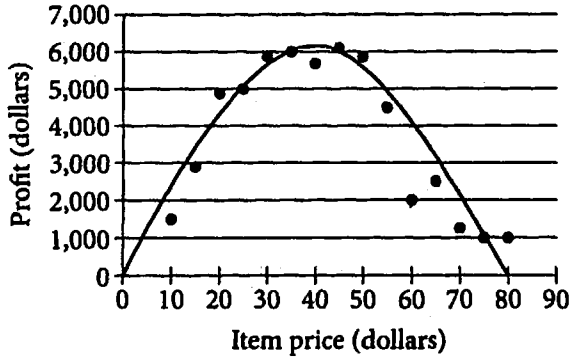
CONTINUE

26



A company test-marketed an item at different prices in a region of the country. The scatterplot above shows the item prices and the profit made by the company when the item was sold at the different item prices. A quadratic model that best fits the data is also shown. For a price of $60, which of the following best approximates the percent increase from the test-market profit to the profit that the model predicts?

A) 50%

B) 75%

C) 100%

D) 200%

27

Which of the following is an equivalent form of the expression $(2x-2)^2-(2x-2)$?

A) $2x-2$

B) $2x^2-6x+6$

C) $4x^2-10x+2$

D) $(2x-3)(2x-2)$

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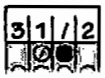
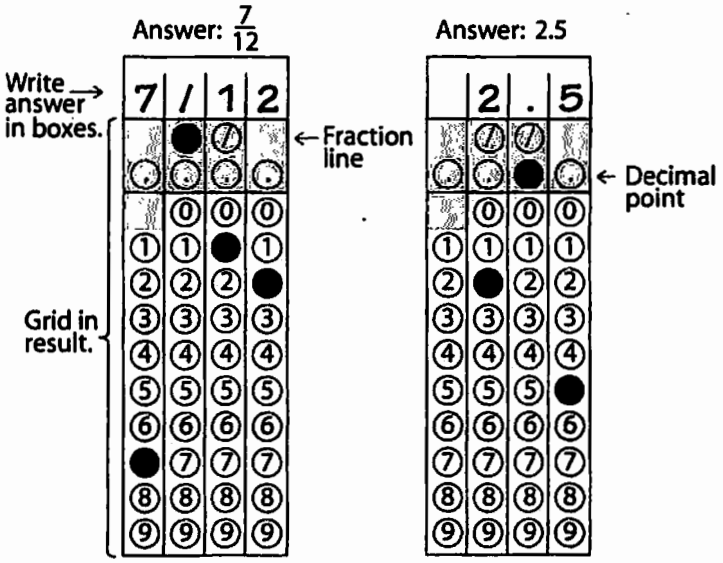
CONTINUE

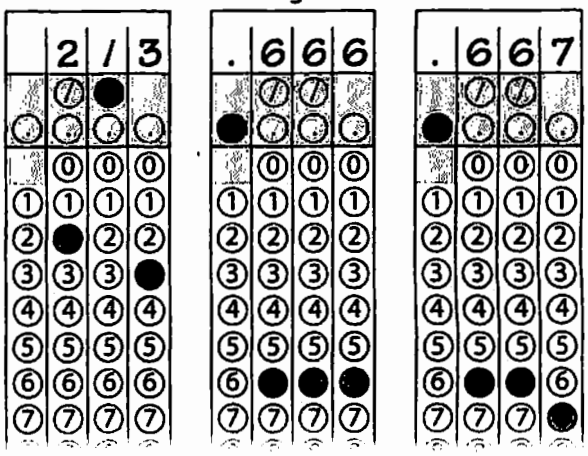
DIRECTIONS

For questions 28-31, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

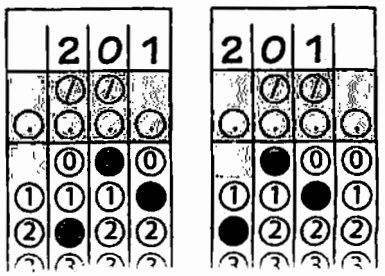
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.
2. Mark no more than one circle in any column.
3. No question has a negative answer.
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.



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



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.

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CONTINUE

28

$$3x + 2y = 9$$
$$5x - y = -11$$

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

29

A certain rectangular prism has a height of h inches, a width that is 3 inches less than its height, and a length that is 4 inches more than its height. If the area of the base of the prism is 60 square inches, what is the volume of the prism, in cubic inches?

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CONTINUE

Questions 30 and 31 refer to the following information.

In an Italian class, 65 percent of the students were women. At the end of the class, 52 percent of the men and 44 percent of the women received a certificate.

30

What percentage of the class received a certificate? (Ignore the percent symbol when entering your answer. For example, if the answer is 42.1%, enter 42.1)

31

What percentage of those who received a certificate were men? (Ignore the percent symbol when entering your answer. For example, if the answer is 42.1%, enter 42.1)

STOP

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

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