CollegeBoard SAT®

NOVEMBER 7, 2020
US

The SAT®

Test Book

IMPORTANT REMINDERS

1

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

2

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

Test begins on the next page.

Reading Test

65 MINUTES, 52 QUESTIONS

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

DIRECTIONS

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

Questions 1-10 are based on the following passage.

This passage is adapted from Paul Laurence Dunbar, "The Visiting of Mother Danbury". Originally published in 1901. This passage is set in a small town in Dunbar's native Ohio. Dunbar was an African American author renowned for his incorporation of regional dialects into traditional literary forms.

There was no lack of village meddling, if meddling it might be called, when Felix Danbury, he who was son of the Widow Danbury and chorister at Cory church, led Martha Dickson to the altar. He it was who had led the fight for an organ to be used in the house of worship, and some of the older heads were still sore upon the subject; but when it was generally known that at last the day was set when he was to leave the state of bachelorhood, all animosities were put aside in the general enthusiasm to assist in such an event.

There was some sorrow too in all this interest, for the marriage of Felix meant his loss to the community. Martha lived at Baldwin's Ford, and thither her betrothed had promised to go and take up his abode. Martha's mother, old Mrs. Dickson, who was also a widow, had protested so loud and long against separation from her only child that the lover was compelled to assure her that she would gain a son rather than lose a daughter. It was very noble indeed, and there had been a beautiful scene in which old Mrs. Dickson had wept on Felix's shoulder and blessed him.

"You're a good boy," she had told him. "I know that the folks air a-goin' to say that you're desertin' yore mother, but 'tain't so; she'll come over here a-visitin', an' we'll go over there, an' it'll be jest like one family; an', besides, yore mother wouldn't be lonely like me, for she's got Melissy."

"Melissy" was Felix's married sister, and on his marriage it was with her that his mother went to live.

There were those who came to condole with Mother Danbury upon the loss of her son, but she was very brave, and they had their trouble for their pay.

"No, no," she would say, rocking complacently, "a man ought to have a wife, an' ef he can't git her to come to him, he's got to go to her. I don't blame Widder Dickson now a bit about Marthy. 'Tain't like me, that's blessed with two children to be the support of my declinin' years."

"But why couldn't she 'a' come over here?" her gossips protested.

"'Twouldn't 'a' been fair to ask her that; for she'd 'a' had to tore up root an' branch, while I ain't got nothin' to do scarcely but to slip out o' my house into Melissy's. An' then it ain't as ef Felix was gone fur good. You see Baldwin's Ford ain't fur away, an' I kin run over an' drop in on 'em almost anytime."

And so, placidly, the old lady went on with her knitting day by day, looking under and over her glasses as often as through them as she paused for little chats with the neighbors or to murmur gentle admonition to Melissy's children.

CONTINUE

Outwardly she was calm, but her soul longed for a sight of this son, whose form had gladdened her eyes every evening as he returned from work, and the honeymoon was hardly over before she had "dropped over" to spend a day with her two dear children.

The day was a joyous one for her—for them all. Felix was radiant, bis wife shyly happy, and the Widow Dickson brought out and spread for her visitor the best that her larder afforded.

All that bothered Mother Danbury was that the Widow insisted upon making company of her. She had assumed an air of possession over Felix that left a little sting in the mother's heart.

Mother Danbury did not want to be company, and she did want to be allowed a part in her son, and, above all, she did not want to sit in the front room and look at the staring wax flowers under their glass case and the shell houses on the mantel, even if she did have on her best alpaca. But when she first essayed forth with her dress tucked up around her waist and her sleeves rolled up, she was conducted—nay, almost carried—back to her prison with many and profuse protestations of horror at letting their guest do anything.

This was all very well for a time. She sat still and knitted, alone save for a minute's peep in from one or the other of her hostesses, until she heard the clatter and clucking of the fowls in the yard. Then she rebelled and, resolutely laying down her knitting, went forth to usefulness. She helped feed the chickens, and after that they all sewed together or knitted. She helped get supper. Felix came home again, as it seemed to her, almost as he used to do. Now, what could the gossips say? thought Mother Danbury.

1

According to the narrator, the community's response to the news of Felix's upcoming marriage demonstrates their

A) willingness to prioritize a happy event over differences in opinion.

B) disregard for the consequences of their unwelcome interference.

C) eagerness to embrace changes in their way of life.

D) tendency to distort the truth by spreading gossip.

2

The characterization of Mrs. Dickson in the passage suggests that the narrator views her as

A) mildly worried about the stability of the Danburys' relationships.

B) eagerly anticipating welcoming Felix into her family.

C) somewhat manipulative in her efforts to keep Martha nearby.

D) rudely dismissive of Mother Danbury's wishes.

3

Which statement best describes what happens in the passage?

A) A character adapts to a significant change that affects her family.

B) A character makes a difficult decision after debating several courses of action.

C) A character's status within her community changes as a result of a life event.

D) A character celebrates an important occasion with her community.

CONTINUE

4

In the context of the passage, the narrator's observation that Mother Danbury's visitors "had their trouble for their pay" (lines 34-35) most likely means that they

A) got no satisfaction from their attempts to provoke Mother Danbury.

B) brought monetary gifts to help Mother Danbury with her expenses.

C) had no idea how best to support Mother Danbury in her distress.

D) listened impatiently to Mother Danbury bemoan her new living arrangement.

5

Which choice best supports the idea that Mother Danbury's friends may be unaware of her mix of emotions?

A) Lines 36-41 ("No, no . . . years")

B) Lines 50-54 ("And so . . . Melissy's children)

C) Lines 55-60 ("Outwardly . . . dear children")

D) Lines 61-64 ("The day . . . afforded")

6

According to the passage, Mother Danbury helps with the tasks in Mrs. Dickson's house because she wants to

A) make sure that each chore is completed properly.

B) prove that she can still excel at domestic activities.

C) establish herself as another member of the household.

D) demonstrate that she has forgiven her host.

7

The narrator's mention of the "staring wax flowers under their glass case and the shell houses on the mantel" (lines 72-73) mainly serves to

A) convey Mother Danbury's approval of the decor in her son's new home.

B) suggest the extent to which Mrs. Dickson has gone to welcome Mother Danbury.

C) echo the formality and distance that Mother Danbury at first experiences in Felix's home.

D) reflect the order that Mother Danbury wishes for in Melissy's house.

8

The description of the actions in lines 74-79 ("But when . . . anything") mainly serves to create a tone of

A) melodrama that suggests Mother Danbury's exaggerated view of the family's treatment of her.

B) stiffness that conveys Mother Danbury's initial reluctance to visit Felix's new home.

C) oppressiveness that contrasts with the apparent warmth of Mrs. Dickson's hospitality.

D) tension that cast doubts on the professed happiness of the newlywed couple.

CONTINUE

9

Based on the passage, it can reasonably be inferred that Mother Danbury's visit results in her

A) heightened concern about her neighbors' opinions.

B) perceived resumption of her relationship with her son.

C) renewed awareness of the tedium of household chores.

D) deepened emotional bond with her son's new family members.

10

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

A) Lines 83-85 ("Then . . . usefulness")

B) Lines 85-87 ("She helped . . . supper")

C) Lines 87-89 ("Felix . . . to do")

D) Lines 89-90 ("Now . . . Danbury")

CONTINUE

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

This passage is adapted from Nicola Twilley, "Accounting for Taste." ©2015 by Condé Nast.

Sitting in a pub one night a dozen years ago, Charles Spence realized that he was in the presence of the ideal experimental model: the Pringles potato chip. Spence, a professor of experimental psychology at Oxford University, runs the Crossmodal Research Lab there, which studies how the brain integrates information from the five human senses to produce a coherent impression of reality. Very often, these modes of perception influence one another on the way to becoming conscious thought. For instance, scientists have long known that whether a strawberry tastes sweet or bland depends in no small part on the kinds of organic molecule detected by olfactory receptors in the nose. Spence had been wondering whether taste might be similarly shaped by sound: Would a potato chip taste different if the sound of its crunch was altered? To explore that question, he needed a chip with a reliably uniform crunch. The Pringle—that thin, homogeneous, stackable paraboloid—was perfect.

Over the next few weeks, Spence invited twenty research subjects to his basement lab and sat them in front of a microphone in a soundproof booth. There they were handed a pair of headphones and instructed to bite, one by one, into nearly two hundred Pringles original-flavor chips. After a single crunch, each subject spat out the chip and gave it a rating: crisper or less crisp, fresh or less fresh. The subjects could hear each crunch as it looped from the mike into the headphones. But, without letting the participants know, Spence funnelled the crunching noises through an amplifier and an equalizer, allowing him to boost or muffle particular frequencies or the over-all volume. About an hour later, released from the booth, each subject was asked whether he or she thought all the chips were the same.

The chips were identical, of course, but nearly all the volunteers reported that they were different—that some had come from cans that had been sitting open awhile and others were fresh. When Spence analyzed his results, he saw that the Pringles that made a louder, higher-pitched crunch were perceived to be a full fifteen percent fresher than the softer-sounding chips. The experiment was the first to successfully demonstrate that food could be made to taste different through the addition or subtraction of sound alone. Spence published his results in the *Journal of Sensory Studies*, in 2004. The paper, written with a postdoctoral researcher, Massimiliano Zampini, was titled "The Role of Auditory Cues in Modulating the Perceived Crispness and Staleness of Potato Chips."

Over the past decade, Spence has found that a strawberry-flavored mousse tastes ten percent sweeter when served from a white container rather than a black one; that coffee tastes nearly twice as intense but only two-thirds as sweet when it is drunk from a white mug rather than a clear glass one; that adding two and a half ounces to the weight of a plastic yogurt container makes the yogurt seem about twenty-five percent more filling, and that bittersweet toffee tastes ten percent more bitter if it is eaten while you're listening to low-pitched music.

It does not require an enormous leap of imagination to see how these kinds of cognitive insights could be incorporated into commercial packaging design, and, gradually, this is exactly what is happening. Americans derive a sizable proportion of their daily calories from food or drinks that are consumed directly from the package, and that is only expected to rise in tandem with the "snackification" of the Western diet. Marketing departments and product-design agencies have an extra incentive to enlist Spence's findings in the cans, packets, tubs, and squeeze tubes that populate grocery-store shelves.

CONTINUE

Figure 1

Mean Responses on Crisp–Soft Scale to Sound Volume and Frequency Manipulations

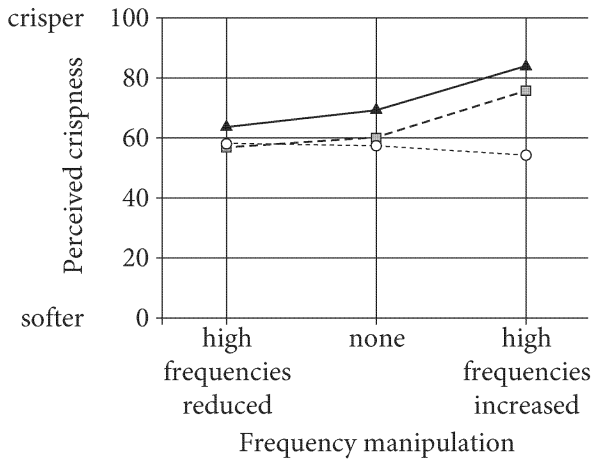
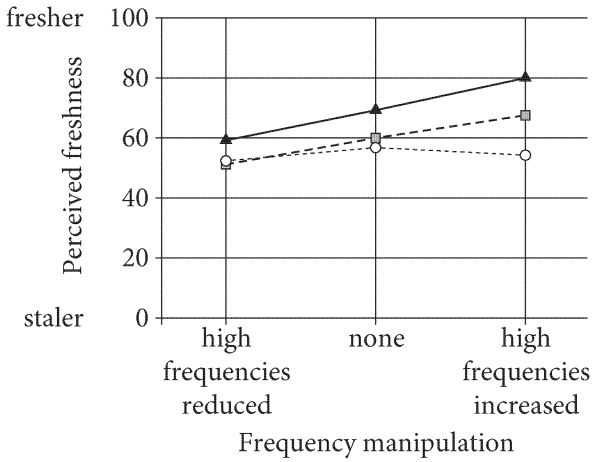


Figure 2

Mean Responses on Fresh–Stale Scale to Sound Volume and Frequency Manipulations



Figures adapted from Massimiliano Zampini and Charles Spence, "The Role of Auditory Cues in Modulating the Perceived Crispness and Staleness of Potato Chips." ©2004 by Blackwell Publishing.

11

Which paragraph best supports the conclusion that Spence has explored how taste is influenced by sounds that are not directly related to the food being consumed?

A) The first paragraph (lines 1-20)

B) The second paragraph (lines 21-37)

C) The fourth paragraph (lines 54-64)

D) The fifth paragraph (lines 65-76)

CONTINUE

12

The author includes the example in lines 10-14 ("For instance . . . nose") most likely to

A) suggest that a widely accepted belief about taste is now being questioned as a result of Spence's theory.

B) introduce a scientific debate about smell that Spence had hoped to settle through his experiment.

C) describe an attempted experiment that Spence hopes he can improve on in the future.

D) identify an earlier finding about the senses that is related to Spence's research.

13

In context, what is the main effect of the phrase "thin, homogeneous, stackable paraboloid" (lines 19-20)?

A) To stress the difficulty of distinguishing a certain food from other foods

B) To combat a common misperception about a well-known food

C) To emphasize the unappealing physical qualities of a widely consumed food

D) To convey a scientific assessment of a food's properties

14

The description of the use of sound in lines 28-34 ("The subjects . . . volume") mainly serves to

A) suggest a potential flaw in Spence's recording method.

B) clarify a distinction between the sound's volume and clarity.

C) indicate how Spence actively manipulated sound in the study.

D) identify the different types of sounds the participants produced.

15

What is the primary purpose of the third paragraph (lines 38-53)?

A) To explain Spence's findings and their significance

B) To note criticisms of Spence's methods

C) To offer an alternative interpretation of Spence's results

D) To identify where Spence and other researchers published their work

16

Based on the passage, one way Spence could expand on his original study on potato chips to obtain a more relevant finding for marketing departments would be to

A) further investigate the effect of auditory input by introducing natural background noise.

B) study how the sound of a food package being opened influences perceptions of food quality.

C) examine the degree to which knowing how a food is produced can affect how it tastes.

D) evaluate how sound alters participants' visual perception when watching an advertisement.

17

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

A) Lines 8-10 ("Very . . . thought")

B) Lines 21-23 ("Over . . . booth")

C) Lines 34-37 ("About . . . same")

D) Lines 65-69 ("It does . . . happening")

CONTINUE

18

In line 72, the author puts the word "snackification" in quotation marks mostly most likely to

A) make it clear that an expert is being quoted.
B) suggest that the word is not being used literally.
C) indicate that the term is informal.
D) emphasize an ironic and unexpected finding.

19

Figure 1 shows that when volume was somewhat reduced but frequency was unchanged, study participants perceived the chips they consumed as being

A) softer than chips consumed when volume and frequency were unchanged.
B) softer than chips consumed when volume was most reduced and high frequencies were increased.
C) crisper than chips consumed when volume was unchanged and high frequencies were reduced.
D) crisper than chips consumed when volume was somewhat reduced and high frequencies were increased.

20

Based on figures 1 and 2, participants' perceptions of both crispness and freshness stayed nearly the same regardless of frequency manipulation when the overall volume was

A) increased.
B) unchanged.
C) reduced somewhat.
D) reduced the most.

21

According to figure 1, at approximately what level of crispness did participants rate chips when the high frequencies were increased with the volume unchanged?

A) 55
B) 70
C) 85
D) 100

CONTINUE

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

This passage is adapted from Katherine Harmon Courage, *Octopus! The Most Mysterious Creature in the Sea*. ©2013 by Katherine Harmon Courage.

In the wild, the octopus often relies on its dexterous arms to go rooting around in crevasses for crabs or other crawling foodstuff. These arms can feel and even taste their way to dinner and then react to capture it. With all of this limb autonomy, octopuses were, for a long time, presumed to be blind (so to speak) about where their arms were and what each one was doing while it felt along for food.

Certainly many small operations are likely being controlled from within the arms themselves—or at least below the brain. But there must be some sort of central perception and processing going on, or else the animal would just be a big eight-armed pile of mess. "If you look at octopus behavior, it does not make a lot of sense" that it would have no idea where any one of its arms is at any given time, Hebrew University's Michael Kuba says. "Anybody who uses common sense should see that an octopus must know where its arm is because otherwise it's very hard to function," he says with a laugh. But "it's one of those problems science sometimes has" in which researchers don't always use common sense in developing hypotheses, he notes. Somehow, "the brain *has* to decide which arm to activate, at what speed," Kuba's colleague Binyamin Hochner explains. How does it know this?

Recent human experiments have shown that if you create the optical illusion for a person of having a third arm, and if it's in a believable location, a person's brain will start to perceive it as part of his or her body plan. The person will even react when the false arm is threatened with a knife. Hochner, Kuba, and their colleagues designed a slightly less violent experiment to test the octopus's ability to visually assess its arms. They drew upon the octopus's natural behavior of sending individual arms into holes to look for food. They built a clear plexiglass maze that had one central vertical tube and three separate compartments just beyond it. They first trained the octopus that food would be waiting in a compartment with a black dot on it. For the experiment, the octopus—upon seeing which compartment had a black dot on it—would need to send one of its arms through one of the tubes, through an air gap (so that it couldn't receive any food smells through the water), and into the compartment where the food was. The researchers randomly changed the location of the dot and food ten times for each animal each day for up to three weeks. Each assay, an octopus got only three minutes to complete the task—and no second guesses. Six out of the seven common octopuses passed the test by getting the right box five times in a row.

Watching footage of the experiment, Hochner and his team noticed that when the animals couldn't see the box with the dot—because they had positioned themselves poorly—they weren't likely to select it. "Animals learned to orient themselves to get an unobstructed view of the target," they noted in their paper. When researchers tried the same experiment with an opaque maze, the octopuses got the answer right only randomly. This suggests not only that octopuses can figure out the location of one of their arms based on visual information but also that they can visually guide it to a target. In the real world, this would mean that being able to spot a tasty crab would help them accurately capture it with an arm. So even though octopuses are impressively skilled at hunting "blind," aided by tactile and taste/smell senses locally on the arms, being able to help guide their body parts centrally with sight makes them even better predators—and improves general coordination to help keep themselves from becoming prey.

CONTINUE

Performance of Six Octopuses on the First 20 and Last 20 Clear-Maze Trials and on the Opaque-Maze Control Trial

	First 20 trials		Last 20 trials		Control opaque maze	
	Correct	Incorrect	Correct	Incorrect	Correct	Incorrect
Octopus 1	6	14	7	13	5	15
Octopus 2	6	14	8	12	6	14
Octopus 3	5	15	13	7	5	15
Octopus 4	5	15	14	6	7	13
Octopus 5	9	11	11	9	6	14
Octopus 6	9	11	5	15	6	14

Adapted from Tamar Gutnick et al., "Octopus vulgaris Uses Visual Information to Determine the Location of Its Arm."

22

The passage indicates that Kuba regards a particular assumption about octopuses held by certain scientists with an attitude of

A) amused dismissiveness.
B) mocking disbelief.
C) mild embarrassment.
D) grudging acceptance.

23

It can reasonably be inferred from the passage that going into the experiment, Hochner and Kuba would most likely have agreed with which statement about the relationship between an octopus's brain and its individual arms?

A) An octopus's brain has more direct control over some arms than others.
B) An octopus's arms can sometimes override signals sent from the brain.
C) An octopus's brain remains largely unaware of individual arm movements.
D) An octopus's arm movements are initiated by the brain.

24

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

A) Lines 5-8 ("With . . . food")
B) Lines 14-17 ("If you . . . says")
C) Lines 20-23 ("But . . . notes")
D) Lines 23-26 ("Somehow . . . explains")

25

Which statement best describes the structure of the passage?

A) It summarizes previous research regarding an octopus behavior, considers recent findings consistent with that research, and proposes a new study to expand on those findings.
B) It describes a theory to explain an octopus behavior, cites a scientist's criticism of that theory, and counters the scientist's criticisms with the results of a recent experiment.
C) It identifies a widely accepted understanding of an octopus behavior, presents an alternative hypothesis about that behavior, and then discusses an experiment designed to test that hypothesis.
D) It reports on a scientific debate about an octopus behavior, quotes researchers with differing opinions about the behavior, and presents the results of the author's own research on that behavior.

CONTINUE

26

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

A) charge.
B) evaluate.
C) calculate.
D) measure.

27

It can reasonably be inferred from the passage that the octopus experiment was designed in such a way as to force each octopus to

A) rely solely on the sense of sight for clues about food location.
B) consider a series of dots that were increasingly difficult to see.
C) search for a variety of different foods not found in the wild.
D) contend with a different number of compartments in each attempt.

28

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

A) Lines 37-39 ("They . . . beyond it")
B) Lines 41-47 ("For the . . . was")
C) Lines 50-51 ("Each . . . guesses")
D) Lines 51-53 ("Six . . . row")

29

As used in line 58, "orient" most nearly means

A) focus.
B) familiarize.
C) align.
D) train.

30

According to the table, which octopus had the poorest performance in the last 20 trials?

A) Octopus 1
B) Octopus 3
C) Octopus 4
D) Octopus 6

CONTINUE

31

The data in the table support which of the following statements about the performance of the octopuses in the clear-maze trials?

A) Less than half performed better in the last 20 trials than in the first 20.

B) Most performed better in the last 20 trials than in the first 20, while the rest performed the same.

C) Only one performed worse in the last 20 trials than in the first 20.

D) Most showed no change in performance from the first 20 trials to the last 20.

32

The data in the table support which statement about Octopus 4?

A) It was the only octopus to perform worse in the opaque-maze trials than in the last 20 clear-maze trials.

B) It was the only octopus to perform better in the opaque-maze trials than in the first 20 clear-maze trials.

C) It had the best performance in both the first 20 clear-maze trials and in the last 20 clear-maze trials.

D) Its performance in the first 20 clear-maze trials was the same as its performance in the last 20 clear-maze trials.

CONTINUE

Questions 33-42 are based on the following passages.

Passage 1 is adapted from Justice Edward Douglass White's majority opinion in the 1903 US Supreme Court case *Lone Wolf v. Hitchcock*. Passage 2 is adapted from the American Indian Chicago Conference's *Declaration of Indian Purpose: The Voice of the American Indian*. Originally published in 1961. The ruling in *Lone Wolf v. Hitchcock* hinged on the question of whether Congress had the power to cancel US treaties with Native American tribes without the consent of the tribes themselves.

Passage 1

Now, it is true that in decisions of this court, the Indian right of occupancy of tribal lands, whether declared in a treaty or otherwise created, has been stated to be sacred, or, as sometimes expressed, as sacred as the fee [legal possession] of the United States in the same lands. But in none of these cases was there involved a controversy between Indians and the government respecting the power of Congress to administer the property of the Indians. . . . In one of the cited cases it was clearly pointed out that Congress possessed a paramount power over the property of the Indians, by reason of its exercise of guardianship over their interests, and that such authority might be implied, even though opposed to the strict letter of a treaty with the Indians. . . .

Plenary [absolute] authority over the tribal relations of the Indians has been exercised by Congress from the beginning. . . . Until the year 1871 the policy was pursued of dealing with the Indian tribes by means of treaties, and, of course, a moral obligation rested upon Congress to act in good faith in performing the stipulations entered into on its behalf. But, as with treaties made with foreign nations, the legislative power might pass laws in conflict with treaties made with the Indians.

The power exists to abrogate [cancel] the provisions of an Indian treaty, though presumably such power will be exercised only when circumstances arise which will not only justify the government in disregarding the stipulations of the treaty, but may demand, in the interest of the country and the Indians themselves, that it should do so. When, therefore, treaties were entered into between the United States and a tribe of Indians it was never doubted that the power to abrogate existed in Congress, and that in a contingency such power might be availed of from considerations of governmental policy, particularly if consistent with perfect good faith towards the Indians.

Passage 2

It is a universal desire among all Indians that their treaties and trust-protected lands remain intact and beyond the reach of predatory men.

This is not special pleading, though Indians have been told often enough by members of Congress and the courts that the United States has the plenary power to wipe out our treaties at will. Governments, when powerful enough, can act in this arbitrary and immoral manner.

Still we insist that we are not pleading for special treatment at the hands of the American people. . . .

The right of self-government, a right which the Indians possessed before the coming of the white man, has never been extinguished; indeed, it has been repeatedly sustained by the courts of the United States. Our leaders made binding agreements—ceding lands as requested by the United States; keeping the peace; harboring no enemies of the nation. And the people stood with the leaders in accepting these obligations.

A treaty, in the minds of our people, is an eternal word. Events often make it seem expedient to depart from the pledged word, but we are conscious that the first departure creates a logic for the second departure, until there is nothing left of the word.

We recognize that our view of these matters differs at times from the prevailing legal view regarding due process.

When our lands are taken for a declared public purpose, scattering our people and threatening our continued existence, it grieves us to be told that a money payment is the equivalent of all the things we surrender. Our forefathers could be generous when all the continent was theirs. They could cast away whole empires for a handful of trinkets for their children. But in our day, each remaining acre is a promise that we will still be here tomorrow. Were we paid a thousand times the market value of our lost holdings, still the payment would not suffice. Money never mothered the Indian people, as the land has mothered them, nor have any people become more closely attached to the land, religiously and traditionally.

CONTINUE

We insist again that this is not special pleading. We ask only that the United States be true to its own traditions and set an example to the world in fair dealing.

33

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

A) titled.
B) embellished.
C) confessed.
D) asserted.

34

In Passage 1, White argues that court decisions have affirmed Congress's authority to

A) administer tribal property.
B) sell goods to tribal members.
C) purchase land from tribes.
D) permit settlement near tribal lands.

35

As used in line 20, "pursued" most nearly means

A) sought out.
B) persecuted.
C) carried out.
D) appreciated.

36

The authors of Passage 2 make repeated references to "pleading" (lines 44, 50, and 85) most likely to

A) dispel an assumption that they lack sufficient grounds for their petition.
B) ask forgiveness for their minor violations of treaty stipulations.
C) solicit suggestions for how they can improve their circumstances.
D) draw a contrast between their economic needs and those of other US citizens.

37

The authors of Passage 2 imply that departing from the stipulations of a treaty even once may

A) enable future violations of the treaty.
B) reignite hostilities ended by the treaty.
C) prevent future treaties from being signed.
D) require that a new treaty be signed.

38

The authors of Passage 2 fault the US government for failing to understand that the loss of the tribal lands

A) violates tribes' social customs as well as the core beliefs of tribal religions.
B) has consistently met with overwhelming opposition from tribal members.
C) will only attract unwanted attention from the international community.
D) poses a danger to tribes, for which no amount of compensation is adequate.

39

Which of the following provides the best evidence for the answer to the previous question?

A) Lines 61-65 ("A treaty . . . the word")
B) Lines 69-73 ("When . . . surrender")
C) Lines 73-76 ("Our . . . children")
D) Lines 84-87 ("We insist . . . dealing")

CONTINUE

40

It can reasonably be inferred from Passage 2 that its authors would most likely regard the "power" proclaimed in the last paragraph of Passage 1 as representative of which undesirable development?

A) A certain duty the government is obligated to perform is at odds with other duties it must perform.

B) Greater authority is conferred on one branch of the government than on the other branches.

C) A government adopts a course of action regardless of the consensus among citizens.

D) Officials act on the basis of political strength rather than on that of ethical principles.

41

Which choice from Passage 2 provides the best evidence for the answer to the previous question?

A) Lines 44-48 ("This . . . will")

B) Lines 48-49 ("Governments . . . manner")

C) Lines 52-56 ("The right . . . of the United States")

D) Lines 59-60 ("And the . . . obligations")

42

The two passages differ in their treatment of long-standing historical precedent in that Passage 1 invokes it for Congress's

A) authority over tribal relations, whereas Passage 2 invokes it for tribes' authority to govern themselves.

B) defiance of court rulings on tribal matters, whereas Passage 2 invokes it for tribes' defiance of US law.

C) negotiation of treaties with tribal leaders, whereas Passage 2 invokes it for tribes' renegotiation of existing treaties.

D) input on tribes' internal policies, whereas Passage 2 invokes it for tribes' input on US policies pertaining to them.

Questions 43-52 are based on the following passage.

This passage is adapted from "Zoology to the Rescue." ©2015 by the Economist Newspaper Limited.

Adin Ross-Gillespie of Zurich University is a zoologist, not a physician. But his study of co-operative animals such as meerkats and naked mole rats has led him to think about the behaviour of another highly collaborative group, bacteria. He and his colleagues have presented a way of subverting this collaboration to create a new class of drug that seems immune to the processes which cause resistance to evolve.

Antibiotic resistance happens because, when a population of bacteria is attacked with those drugs, the few bugs that, by chance, have a genetic protection against their effects survive and multiply. As in most cases of natural selection, it is the survival of these, the fittest individuals, that spurs the process on. But Dr Ross-Gillespie realised that, in the case of bacteria, there are circumstances when the survival of the fittest cannot easily occur.

One of these is related to the way many bacteria scavenge a crucial nutrient, iron, from the environment. They do it by releasing molecules called siderophores that pick up iron ions and are then, themselves, picked up by bacterial cells. In a colony of bacteria, siderophore production and use is necessarily communal, since the molecule works outside the boundaries of individual cells. All colony members contribute and all benefit.

In theory, that should encourage free riders—bacteria which use siderophores made by others without contributing their own. In practice, perhaps because the bacteria in a colony are close kin, this does not seem to happen. But inverting free riding's logic makes the system vulnerable to attack, for a bug that contributes more than its share does not prosper.

Following this line of thought Dr Ross-Gillespie turned to gallium, ions of which behave a lot like those of iron and can substitute for them in a siderophore, making it useless to a bacterium. In fact, siderophores bind more effectively with gallium than with iron, hijacking the whole process. A judicious dose of gallium nitrate can thus take out an entire bacterial colony, by depriving it of the iron it needs to thrive.

CONTINUE

The crucial point is that, because siderophores are a resource in common, a mutated siderophore that did not bind preferentially to gallium would be swamped by the others, would fail to benefit the bug that produced it, and therefore would not be selected for and spread. At least, that was Dr Ross-Gillespie's theory.

To test this theory out, he and his colleagues grew cultures of an infectious bacterium, *Pseudomonas aeruginosa*. They then exposed these cultures either to ciprofloxacin, an antibiotic, to gentamicin, another such, to both drugs at the same time, to saline as a control, or to gallium nitrate.

As they expected, both the antibiotics and the gallium nitrate curtailed the growth of *Pseudomonas* to start with. As they also expected, resistance to both of the antibiotics built up steadily over the 12-day course of the experiment. But nothing similar happened in the cultures exposed to gallium nitrate. These continued to be suppressed. And when the researchers took a closer look at what was going on, they found that not only were the bacteria in their gallium-laced samples starved of iron, but the bugs were also responding to the crisis by pouring their energy into producing more and more siderophores, thus hastening the colony's demise.

What makes all this more than just a laboratory curiosity is that gallium nitrate is already an established drug. It has been used safely, and for a long time, to treat certain cancers and bone diseases. This suggests (though tests would need to be done) that it might be safe for use against infection. Dr Ross-Gillespie's evolutionary analysis of how to attack antibiotic resistance might therefore have provided the breakthrough the field needs.

43

In the first paragraph, the author includes information about Ross-Gillespie's background and previous research most likely to

A) explain why physicians were initially skeptical of Ross-Gillespie's claims about bacteria.

B) show how Ross-Gillespie's ignorance of research on bacteria turned out to be an advantage.

C) emphasize the long-standing collaboration between Ross-Gillespie and bacteria researchers.

D) suggest that Ross-Gillespie brought an unconventional perspective to the problem of resistant bacteria.

44

As used in line 21, "releasing" most nearly means

A) dismissing.

B) surrendering.

C) relieving.

D) emitting.

45

The primary purpose of the passage is to

A) discuss research challenging how antibiotic resistance develops in bacteria.

B) argue for the need to develop new drugs that prevent bacteria from collaborating.

C) describe a study that suggests a potential new approach to treating bacterial infections.

D) address a common misconception about the effectiveness of antibiotics in curing bacterial illnesses.

CONTINUE

46

It can reasonably be inferred from the passage that among bacteria that use siderophores, any individual bacterium is likely to

A) produce significantly fewer siderophores than it must later pick up.

B) be closely related to just a small proportion of bacteria in its colony.

C) absorb iron ions from siderophores that it did not produce.

D) take in an approximately even mix of iron ions and gallium ions.

47

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

A) Lines 21-23 ("They . . . cells")

B) Lines 23-26 ("In a . . . cells")

C) Lines 30-32 ("In practice . . . happen")

D) Lines 39-41 ("In fact . . . process")

48

According to the passage, the genetic relationships among siderophore-producing bacteria in a colony may help to

A) reduce the likelihood that individual bacteria will contribute siderophores that cannot be used by other bacteria in the colony.

B) discourage individual bacteria from attempting to benefit from communal siderophore production without participating in it.

C) promote the rapid spread of mutations that lead to siderophores being unable to bind with gallium.

D) ensure that all bacteria in the colony produce their siderophores at approximately the same time.

49

The passage suggests that gallium nitrate affects *P. aeruginosa* in part by

A) stopping the bacteria from producing siderophores.

B) causing the bacteria to redirect resources normally used for growth.

C) destroying siderophores more quickly than the bacteria can replace them.

D) preventing the bacteria from processing the iron ions they take in.

50

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

A) Lines 54-57 ("They . . . nitrate")

B) Lines 58-62 ("As they . . . experiment")

C) Lines 62-64 ("But nothing . . . suppressed")

D) Lines 64-70 ("And when . . . demise")

CONTINUE

51

As used in line 73, "established" most nearly means

A) created.
B) proven.
C) typical.
D) habitual.

52

The main purpose of the last paragraph of the passage is to

A) identify some possible drawbacks to an approach presented in the passage.
B) emphasize the significance of the study described in the passage.
C) compare the study discussed in the passage with previous research.
D) introduce an alternative to the author's position on the topic discussed in the passage.

STOP

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

Writing and Language Test

35 MINUTES, 44 QUESTIONS

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

DIRECTIONS

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

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

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

Questions 1-11 are based on the following passage.

"What Route I'm Going": Elizabeth Cotten and Her Guitar

Long before she was known for her innovative guitar playing and her songs became standards in American folk 1 music, and Elizabeth Cotten was just a left-handed girl from Chapel Hill, North Carolina, with a drive to make music. "[For] everything I play for y'all tonight," she would later tell her 2 audience, thinking back to her beginnings, "I give myself credit."

1

A) NO CHANGE
B) music,
C) music; also
D) music;

2

A) NO CHANGE
B) audience, thinking back to her beginnings
C) audience thinking back to her beginnings
D) audience thinking back, to her beginnings,

CONTINUE

3 Cotten was born in 1893. Cotten was only eight when she taught herself to play her brother's banjo. Contending with an instrument that was built and strung for a right-handed player, she flipped the banjo upside down and developed her own idiosyncratic way of playing 4 them. Her technique was distinctive not simply because she was a left-handed musician playing a right-handed instrument, but because she 5 adopted the unconventional method of wrapping her right hand around the instrument's neck and playing with both her right thumb and fingers. When she applied this technique to the six-stringed acoustic guitar, 6 even though she was so young, the result was a melodic and technically 7 highfalutin style that would become her signature sound.

This "Cotten style," as it later came to be known, incorporated elements from the African American musical tradition. "Freight Train," a song Cotten wrote when she was only eleven, blends the sing-along quality

3

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

A) When Cotten was born in 1893, she
B) Although Cotten was born in 1893, she
C) She was born in 1893; Cotten
D) Born in 1893, Cotten

4

A) NO CHANGE
B) one.
C) it.
D) these.

5

Which choice best completes the explanation of Cotten's method of playing?

A) NO CHANGE
B) had the habit of whistling while playing, a feature that can be heard in her recordings.
C) came from a musical family with whom she would often spend nights playing music and singing traditional folk songs.
D) was an incredibly fast learner, able to memorize and play songs after hearing them only twice.

6

Which choice provides the best transition from this paragraph to the next one?

A) NO CHANGE
B) as she would a few years later,
C) an instrument she purchased for $3.75,
D) which she also taught herself to play,

7

A) NO CHANGE
B) recondite
C) complex
D) labyrinthine

CONTINUE

of folk music with the quick, jostling rhythms of ragtime. Inspired by the locomotive that would rumble by her window each day, she captured both the **8** sound and speed of its passing as well as the possibility of escape when she sang, "Freight train, freight train, run so fast / Please don't tell what train I'm on / They won't know what route I'm going." As the granddaughter of freed slaves **9** themselves, Cotten was no doubt attuned to the long history trains have had in blues music as symbols of freedom.

[1] As it happened, the route Cotten was on involved a nearly fifty-year detour away from playing guitar, during which she worked and raised a family. [2] She still remembered the songs from her youth but began writing new ones as well. [3] On one such song, "Shake Sugaree," she collaborated with her grandchildren, letting each grandchild write a verse. [4] Later, as the rising popularity of her songs took her across North America, earning her awards and accolades of the highest kind, she would encourage her audiences to sing **10** along with her too. [5] Remembering how she taught herself to play and write her songs, she rightfully gave herself credit; however, seeing how her performances brought people together, Cotten also recognized the communal power of music. **11**

8

Which choice most effectively characterizes the quotation that follows in the sentence?

A) NO CHANGE
B) merriment of springtime as well as the industrial beauty of trains
C) joys of childhood and the danger of trains
D) solemnity of a train's passengers and the noise of the tracks

9

A) NO CHANGE
B) herself,
C) myself,
D) ourselves,

10

A) NO CHANGE
B) along for
C) alongside with
D) alongside for

11

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

> By the time she first performed publicly, she was a grandmother.

The best placement for the sentence is

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

CONTINUE

Questions 12-22 are based on the following passage.

Interpreting Diplomatically at the United Nations

The job of a simultaneous interpreter is to translate a 12 speaker's words' into a language that an audience understands—at the moment the words 13 were spoken. Lynn Visson performs this important task at the United Nations (UN) headquarters. She is one of about 120 language experts employed by the UN to translate diplomats' remarks into the organization's six official languages: Arabic, Chinese, English, French, Russian, and Spanish.

12

A) NO CHANGE
B) speaker's words
C) speakers word's
D) speakers' words

13

A) NO CHANGE
B) had been
C) are
D) will be

CONTINUE

[1] In the first round of screening, candidates **14** and job seekers demonstrate language fluency by interpreting UN speeches delivered in the candidates' acquired languages. [2] A UN interpreter must be able to translate from two acquired languages into the interpreter's "main" or native **15** tongue, all three languages must be among the organization's six official ones. [3] Only 10 percent of candidates make it to the next step, the interview, which tests not only language ability but also knowledge of global current events and cross-cultural sensitivity. [4] Before an interpreter can be hired by the UN's Interpretation Service, the organization screens candidates to ensure that they are both multilingual and impartial. **16**

14

A) NO CHANGE
B) show a demonstration of
C) looking for jobs show
D) demonstrate

15

A) NO CHANGE
B) tougue:
C) tongue;
D) tougue

16

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

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

CONTINUE

The interpreters selected via this process must be capable of withstanding the pressures of the job. The work of translation is always difficult, but **17** their cognitive demands are amplified in simultaneous interpretation, when **18** the words and syntax of different languages must be aligned instantaneously. For example, because Russian verbs come later in sentences than English ones do, presenting a Russian speech in English requires an interpreter to listen for the end of a sentence before beginning to translate it into English syntax—all while continuing to follow the original speech.

The word choices of UN interpreters, **19** moreover, can have far-reaching effects, as was proved in 1995 during a dispute between Greece and the former Yugoslav Republic of Macedonia. The latter wanted to be known simply as Macedonia, **20** but this caused protests from Greece. What Greece said was that it infringed on a territorial claim on a Greek province known by the same

17

A) NO CHANGE
B) they're
C) its
D) it's

18

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

A) NO CHANGE
B) an interpreter with inadequate training or limited experience may make a costly mistake.
C) languages that may be unfamiliar to many listeners pose particular difficulty.
D) negotiations may break down over the inclusion or exclusion of a single word.

19

A) NO CHANGE
B) however,
C) nonetheless,
D) for instance,

20

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

A) and Greece was protesting that its name
B) but Greece protested that such naming
C) and what Greece said was that the name
D) leading to Greece saying that it

CONTINUE

name. Negotiations on the issue were nearly derailed when an interpreter, **21** showing little awareness of the sensitivities of the two nations involved, shortened the former Yugoslav nation's name to "Macedonia." This momentary deviation from carefully negotiated language required the Interpretation Service's leader to offer an in-person apology to the Greek delegation. If this incident highlights the perils of diplomatic language interpretation, though, **22** in addition to underscoring the work's abiding importance: without the help of Visson and her fellow interpreters, those representing the many nations of the UN would be unable to unite through language.

21

Which choice is most consistent with the way the work of UN interpreters is characterized throughout the passage?

A) NO CHANGE
B) trying to translate a fast-paced speech accurately at the moment it was delivered,
C) attempting to translate among languages on the official UN list,
D) possibly forgetting which nation held which point of view on the topic,

22

A) NO CHANGE
B) to underscore simultaneously
C) while also underscoring
D) it also underscores

CONTINUE

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

The Younger Dryas

Nearly 13,000 years ago, as Earth was emerging from its last ice age, large parts of the globe were plunged back into cold temperatures in a climatic event called the Younger Dryas. Scientists have long debated the cause of this sudden reversal of the warming 23 trend. A 2015 study published in the journal *Nature Geoscience* claims that the Younger Dryas cannot be explained by a single cause; only the 24 junction of multiple factors could have created this climatic reversal.

23

A) NO CHANGE
B) trend for a long time.
C) trend at great length.
D) trend and have argued over it.

24

A) NO CHANGE
B) socializing
C) confluence
D) gathering

CONTINUE

One long-standing explanation for the Younger Dryas is a disruption of ocean currents. Normally, ocean currents flow in a pattern called the Atlantic Meridional Overturning Circulation (AMOC). Warm salt water flows north from the tropics into the North Atlantic Ocean, where some warmth is transferred to the atmosphere. At the end of the ice age, glaciers melted, causing cold freshwater to flow into the Atlantic and 25 disrupted the AMOC. When researchers ran a computer model to estimate the effects of these freshwater flows, however, 26 they realized that the theory of ocean current disruption was entirely wrong: in the model, the freshwater entering the Atlantic did not by itself cause enough cooling 27 in accounting for the Younger Dryas.

25

A) NO CHANGE
B) disrupt
C) would disrupt
D) it disrupted

26

Which choice provides the most effective transition to the rest of the paragraph?

A) NO CHANGE
B) they found a problem with the ocean current theory:
C) it showed that in fact the opposite was true:
D) the commonly held belief about ocean currents was proven accurate:

27

A) NO CHANGE
B) for accounting
C) to account
D) to account for

CONTINUE

Other computer models measured the possible effects of either a complete shutdown of the AMOC or a significant change in negative radiative forcing—the tendency of the atmosphere to reflect rather than absorb energy from the Sun. 28 Next, none of these models provided a good fit with the actual temperature changes recorded from geological findings. But when researchers designed a computer 29 model, that accounted for both freshwater infusions associated with melting glaciers and changes in negative radiative forcing, the results were a good fit for the geological data.

28

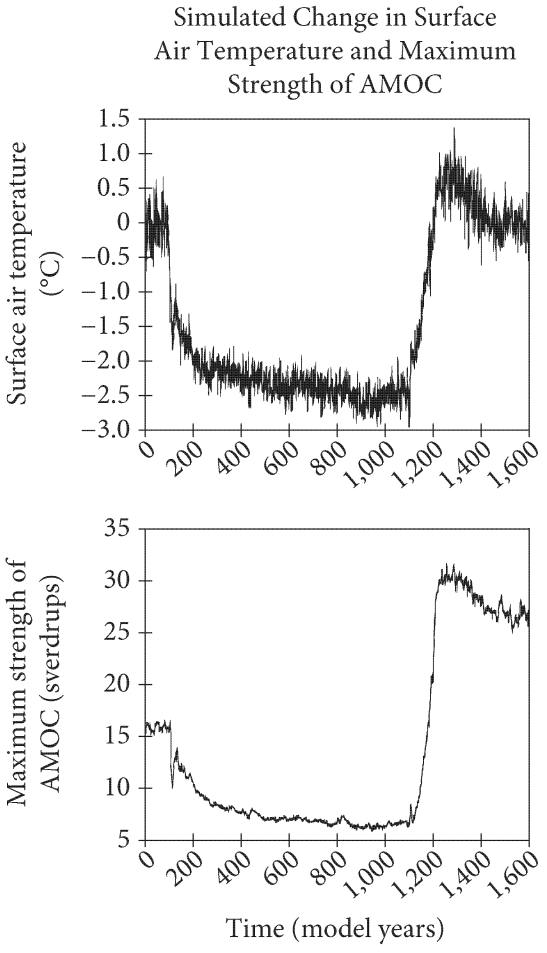
A) NO CHANGE
B) In addition,
C) Conversely,
D) Still,

29

A) NO CHANGE
B) model that—
C) model that
D) model, that,

CONTINUE

The combined model starts at a baseline state derived from geological data. As the model includes freshwater infusions and stronger negative radiative forcing, after **30** 400 years, the air temperature and maximum strength of the AMOC begin to fall. Both **31** vary wildly over a period of about 1,000 years. Finally, temperature and AMOC strength climb sharply starting at approximately 1,100 years. These results match the geological record **32** well; and are not reflected in any other computer models.



Adapted from Hans Renssen et al., "Multiple Causes of the Younger Dryas Cold Period." ©2015 by Macmillan Publishers Limited.

30

Which choice provides accurate information from the figure?

A) NO CHANGE
B) 100
C) 300
D) 600

31

Which choice provides an accurate interpretation of the information in the figure?

A) NO CHANGE
B) drop even lower after
C) remain low for
D) show dramatic spikes over

32

A) NO CHANGE
B) well, they
C) well and
D) well which

CONTINUE

The researchers concluded that more than one factor contributed to the Younger Dryas. Glacial melt played a role, but so did changes in atmospheric conditions. Scientists hope to build on this more complicated model of climate change in the Younger 33 Dryas by: studying the causes of atmospheric change during this period and the relative importance of the different contributing factors.

33

A) NO CHANGE
B) Dryas, by
C) Dryas: by
D) Dryas by

CONTINUE

Questions 34-44 are based on the following passage.

Testing the Limits of Artificial Intelligence

Among computer scientists who are working to develop artificial intelligence, there is debate over the best way to judge when such intelligence has been achieved. According to some, the most promising approach dates back to the mid-nineteenth century. Ada Lovelace is frequently credited as the world's first computer programmer, but her importance as a theorist of what differentiates human thought from computer programs 34 are less often recognized. In fact, her writing on this distinction provides today's computer scientists with one of the clearest pictures of what true artificial intelligence entails.

35 In 1843 Lovelace wrote a commentary on a proposed computing device. In this commentary, Lovelace stated that the device "has no pretensions whatever to *originate* anything. It can do whatever we *know how to order it* to perform." Lovelace's contrast between a human mind capable of original thought and a computer that can do only as it has been instructed remains highly relevant. In 2001 her analysis inspired a team of computer scientists to develop what they called the Lovelace test. According to this test, a computer program 36 was judged intelligent only if it is capable of producing some sort of output that its programmer cannot explain.

34

A) NO CHANGE
B) have been
C) were
D) is

35

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

A) When a computing device was proposed, Lovelace wrote a commentary about it in 1843, stating
B) Lovelace wrote about a proposed computing device in 1843; in her commentary, she stated
C) In her 1843 commentary on a proposed computing device, Lovelace wrote
D) The proposal of a computing device led to an 1843 commentary by Lovelace in which she wrote

36

A) NO CHANGE
B) would have been
C) had been
D) can be

CONTINUE

37 The math that Lovelace used in her work on computers was an early version of calculus. An earlier and more well-known measure is the Turing test, which holds that artificial intelligence is achieved when a computer program successfully convinces a human conversational partner that he or she is talking with another person. The test 38 was not the sole contribution that Alan Turing made to the field of computer science. For one thing, it cannot ultimately determine whether 39 it is capable of independent thought, merely whether the program is able to

37

Which choice provides the most effective transition from the previous paragraph to the sentence that follows in this paragraph?

A) NO CHANGE

B) Lovelace's ideas about artificial intelligence were inspired by her work on Charles Babbage's Analytical Engine.

C) Lovelace was one of the first mathematicians to speculate that computers could do more than perform calculations.

D) The Lovelace test is neither the first nor the only established standard of artificial intelligence.

38

Which choice most effectively sets up the information provided in the next two sentences?

A) NO CHANGE

B) relies on keyboards and screens rather than vocal speech.

C) has some drawbacks compared with the Lovelace test, though.

D) is also related to how computers and humans interact.

39

A) NO CHANGE

B) a program

C) the test

D) anyone

CONTINUE

persuasively impersonate such thought. For another, its assessment of intelligence is based on **40** users' reactions rather than on programmers' knowledge. By **41** emphasizing the programmers, the Lovelace test produces a more definitive measure of intelligence. The programmer knows everything that has been put into the **42** system, he or she is in the best position to judge whether something inexplicably original has been generated.

40

A) NO CHANGE
B) user's reaction's rather on programmers
C) users reactions rather on programmer's
D) users' reactions' rather on programmers'

41

Which choice provides the most effective transition to the sentence that follows in the paragraph?

A) NO CHANGE
B) training carefully, programmers can avoid making the kinds of mistakes that render computer programs inoperative.
C) possessing a certain degree of free will, machines may be able to pass the Lovelace test.
D) making creativity the crucial sign of intelligence, the Lovelace test proves more difficult for machines to master.

42

A) NO CHANGE
B) system, therefore,
C) system; so that
D) system, so

CONTINUE

Some computer scientists argue that 43 products claiming to use artificial intelligence today possess little or no true intelligence, but their objections should not be seen as 44 trashing the value of Lovelace's influence. Rather, the difficulty of passing the Lovelace test reflects just how rigorous the test is and how far away the achievement of true artificial intelligence remains. Should the goal ever be reached, Lovelace's contributions will have helped ensure that the milestone represents the highest possible standard and is truly meaningful.

43

Which choice best sets up the claim that follows in the sentence?

A) NO CHANGE
B) it may be impossible for a computer to pass the Lovelace test,
C) it is only a matter of time until electronic devices are able to originate ideas as humans can,
D) if a machine were to pass the Lovelace test, it would be able to produce works of literature,

44

A) NO CHANGE
B) dissing
C) undermining
D) shooting down

STOP

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

Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

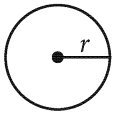
DIRECTIONS

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

NOTES

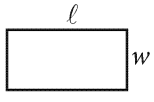
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

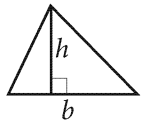


$A = \pi r^2$

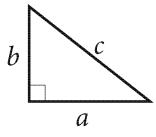
$C = 2\pi r$



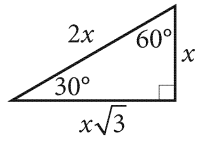
$A = \ell w$

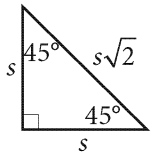


$A = \frac{1}{2}bh$

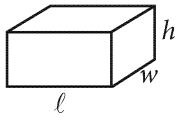


$c^2 = a^2 + b^2$

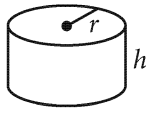




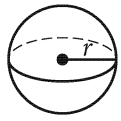
Special Right Triangles



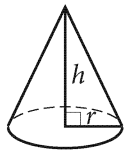
$V = \ell wh$



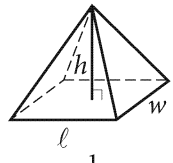
$V = \pi r^2 h$



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



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



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

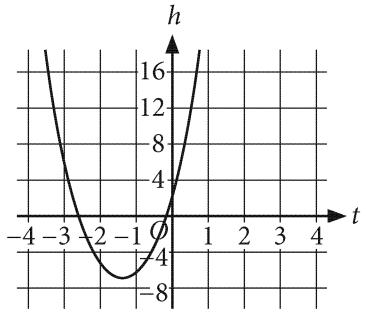
The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

CONTINUE

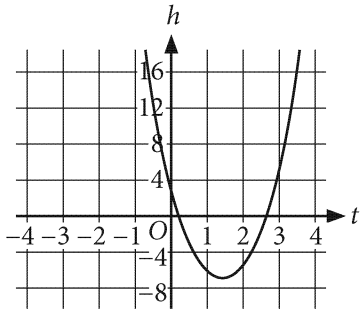
1

A ball is thrown straight up into the air at an initial velocity of 14 meters per second from a height of 3 meters above ground. The height of the ball can be modeled by the equation $h = -5t^2 + 14t + 3$, where h represents the height of the ball, in meters, after t seconds. Which graph represents the equation?

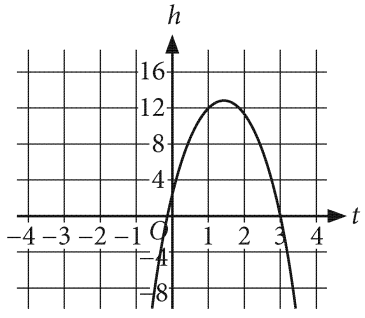
A)



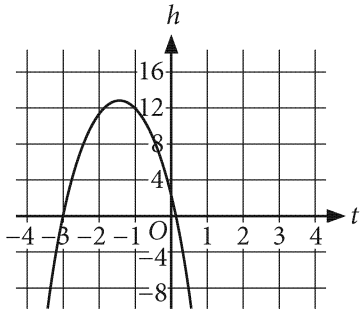
B)



C)



D)



2

$$4y + 2x = 8$$
$$-4y + x = 13$$

The solution to the given system of equations is (x, y). What is the value of x?

A) 3

B) 7

C) 12

D) 21

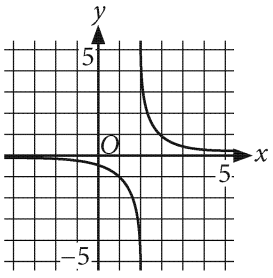
CONTINUE

3

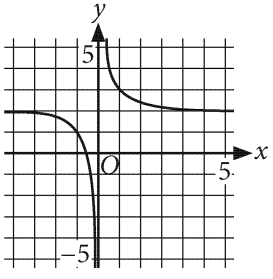
x	-4	0	4
$f(x)$	$-\frac{1}{6}$	$-\frac{1}{2}$	$\frac{1}{2}$

For a rational function f, the table shows some values of x and their corresponding values of $f(x)$. Which of the following could be the graph of $y = f(x)$?

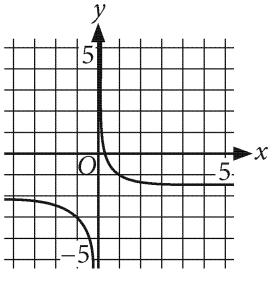
A)



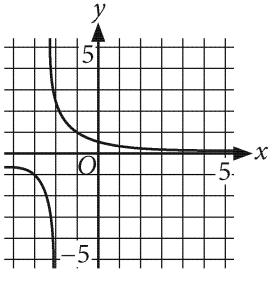
B)



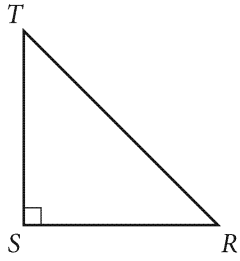
C)



D)



4



Note: Figure not drawn to scale.

The figure shows right triangle RST, where angle S is a right angle. Which of the following measurements is(are) needed to determine all the side lengths of triangle RST ?

I. The measure of one of the acute angles of the triangle

II. The length of one of the sides of the triangle

A) I only

B) II only

C) I and II

D) Neither I nor II

CONTINUE

5

The function g is defined by $g(x) = 2^x - 1$. What is the value of $g(3)$?

A) 4

B) 5

C) 7

D) 8

6

$$a = b - 3c$$

The given equation relates the variables a, b, and c. Which equation correctly expresses c in terms of a and b, where $b > 3$?

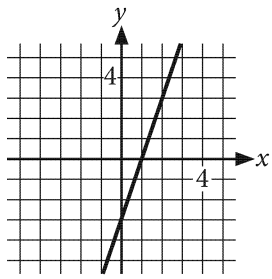
A) $c = \dfrac{-a-b}{3}$

B) $c = \dfrac{-a+b}{3}$

C) $c = \dfrac{a}{b-3}$

D) $c = \dfrac{a}{b} + 3$

7



What is an equation of the graph shown?

A) $3x - y = 3$

B) $3x + y = -3$

C) $x - 3y = 3$

D) $x + 3y = -3$

CONTINUE

8

$$C(t) = 47t + 246$$

The function shown gives the amount budgeted for a company's professional development costs, $C(t)$, in thousands of dollars, where t represents the number of years since 1986. Which of the following is the best interpretation of the number 47 in this context?

A) The number of years since 1986 until the amount budgeted will exceed $246,000

B) The amount budgeted, in thousands of dollars, by the company in 1986

C) The amount that will be budgeted, in thousands of dollars, by the company in 2033

D) The increase in the amount budgeted each year, in thousands of dollars, by the company since 1986

9

What is the sum of ab^2 and a^2b ?

A) $3ab$

B) a^3b^3

C) $ab + a^2b^2$

D) $ab^2 + a^2b$

10

The population of a town was 26,267 in the year 2000 and 26,668 in the year 2010. The equation $10x + 26,267 = 26,668$ describes this situation. Which of the following is the best interpretation of x in this context?

A) The total increase in population between 2000 and 2010

B) The projected population of the town 10 years after 2010

C) The average increase per year of the population between 2000 and 2010

D) The percentage by which the population of the town increased each year between 2000 and 2010

11

$$x^2 + y^2 - 2x + 6y + 1 = 0$$

In the xy-plane, the graph of the given equation is a circle. What is the length of the radius of the circle?

A) 3

B) 5

C) 6

D) 9

CONTINUE

12

Which expression is equivalent to $\sqrt[3]{8x^4}$?

A) $2x^{\frac{3}{4}}$

B) $2x^{\frac{4}{3}}$

C) $8x^{\frac{3}{4}}$

D) $8x^{\frac{4}{3}}$

13

$$x+2y=8$$
$$kx+3y=9$$

In the given system of equations, k is a constant. If the system has no solution, what is the value of k ?

A) $\frac{2}{3}$

B) $\frac{3}{2}$

C) 8

D) 9

14

Rectangle A has an area of 18 square inches. The lengths of the sides of rectangle B are 3 times the lengths of the corresponding sides of rectangle A. What is the area, in square inches, of rectangle B?

A) 6

B) 54

C) 108

D) 162

15

$$x^2+4x-20=0$$

What is a value of x that satisfies the given equation?

A) 2

B) $2+2\sqrt{6}$

C) $-2-2\sqrt{2}$

D) $-2+2\sqrt{6}$

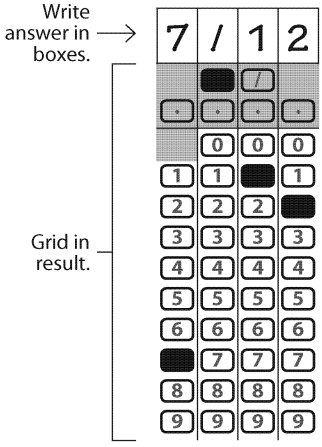
CONTINUE

DIRECTIONS

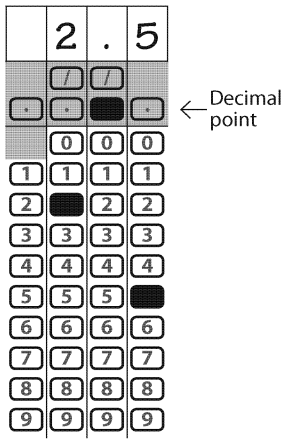
For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
2. Mark no more than one bubble 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.

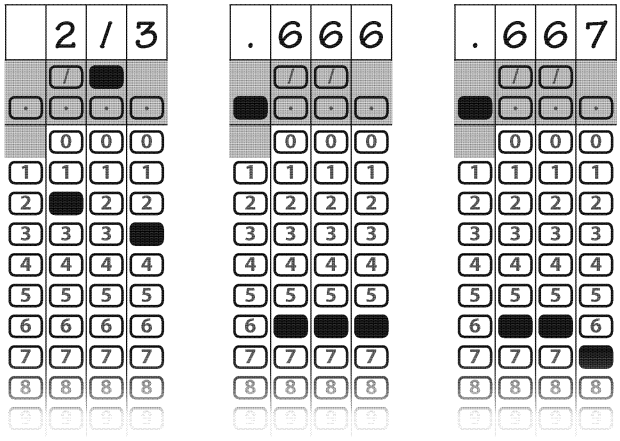
Answer: $\frac{7}{12}$ are:



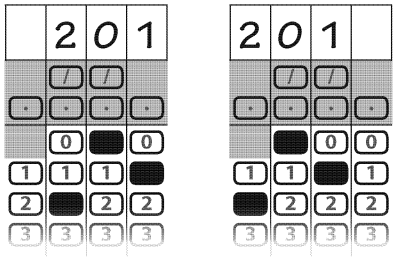
Answer: 2.5



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



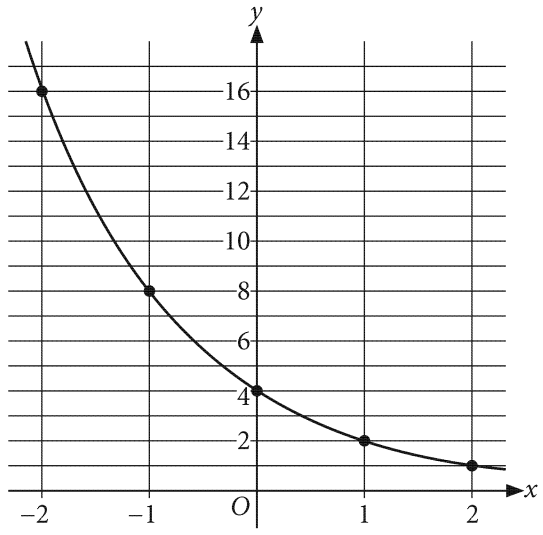
Answer: 201 – either position is correct



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

CONTINUE

16



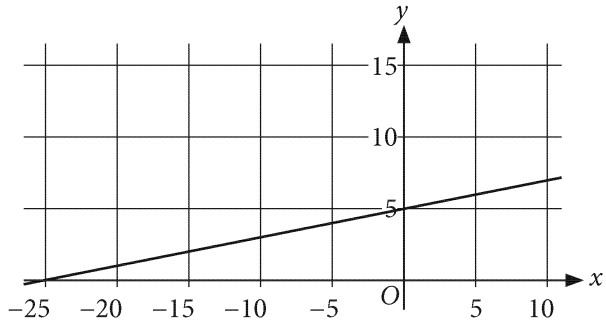
An equation of the curve shown in the xy-plane is $y = k\left(\frac{1}{2}\right)^x$, where k is a positive constant. What is the value of k ?

17

$$\frac{1}{2}(2-3n) = -1$$

What is the solution to the given equation?

18



What is the slope of the line shown?

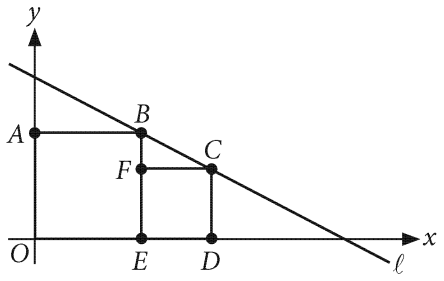
CONTINUE

19

$$|x-7|=9$$

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

20



In the xy-plane above, $OABE$ and $EFCD$ are squares with areas 25 and 9, respectively. Points B and C lie on line ℓ, which has the equation $y = mx + b$, where m and b are constants. What is the value of b ?

STOP

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

No Test Material On This Page

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

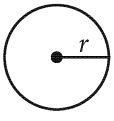
DIRECTIONS

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

NOTES

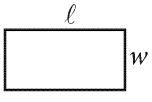
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

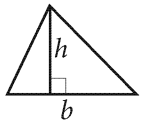


$A = \pi r^2$

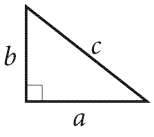
$C = 2\pi r$



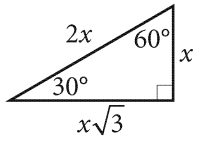
$A = \ell w$

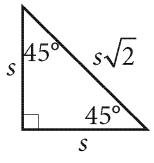


$A = \frac{1}{2}bh$

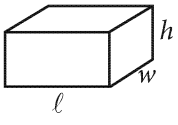


$c^2 = a^2 + b^2$

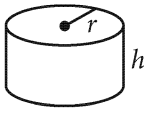




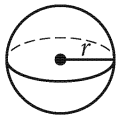
Special Right Triangles



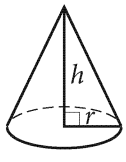
$V = \ell wh$



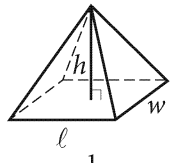
$V = \pi r^2 h$



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



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



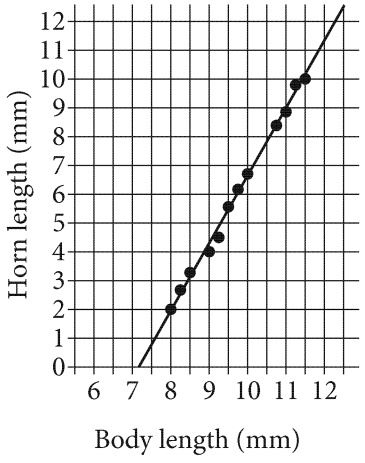
$V = \frac{1}{3}\ell wh$

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.

CONTINUE

1

The scatterplot shows the measurements, in millimeters (mm), of the body lengths and horn lengths of 12 male horned beetles. A line of best fit is also shown.



Which of the following is closest to the predicted horn length, in mm, of a male beetle that has a body length of 10.5 mm?

A) 5.5

B) 7.8

C) 10.4

D) 11.8

2

Function f is defined by $f(x) = 3x - 7$. In the xy-plane, what is the y-intercept of the graph of function f, where $y = f(x)$?

A) (0, 3)

B) (0, −7)

C) (3, 0)

D) (−7, 0)

3

Jeremiah walked for 20 seconds at a rate of 5 feet per second. What distance, in feet, did Jeremiah walk?

A) 0.25

B) 4

C) 25

D) 100

CONTINUE

4

The function f is defined by $f(x)=\frac{1}{3}x-3$. What is the value of $f(27)$?

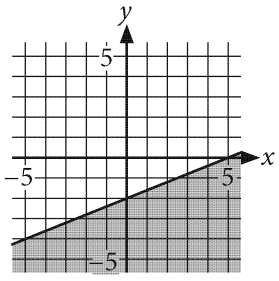
A) 6

B) 8

C) 12

D) 78

5



The shaded region shown represents all the solutions to an inequality. Which of the following points is a solution to this inequality?

A) (0, 3)

B) (0, −3)

C) (−3, 0)

D) (3, 0)

6

In 1927, a tailor purchased 10 yards of fabric consisting of r yards of rayon and s yards of silk. The cost per yard of rayon was \$0.22, and the cost per yard of silk was \$1.00. The total cost of the fabric was \$6.88. How many yards of rayon did the tailor purchase?

A) 2

B) 4

C) 6

D) 9

7

The list gives the diameter, in inches, of the five aspen trees at a farm.

14.4, 14.9, 14.9, 15.6, 16.2

Another aspen tree with a diameter of 10.6 inches is planted at the farm. How does the median diameter of the aspen trees at this farm change when the sixth tree is added?

A) The median increases.

B) The median decreases.

C) The median does not change.

D) There is not enough information to determine how the median changes.

CONTINUE

8

Data set A: 1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4

Data set B: 1, 2, 3, 4

Which of the following statements best compares the means and the medians of data sets A and B?

A) Both the means and medians of data sets A and B are the same.

B) Both the means and medians of data sets A and B are the different.

C) The means of data sets A and B are the same, but the medians of the sets are different.

D) The means of data sets A and B are different, but the medians of the sets are the same.

Questions 9 and 10 refer to the following information.

$$m = 220 - a$$

The given equation models a person's maximum heart rate m, in beats per minute, based on the person's age a, in years. The National Institutes of Health (NIH) recommends that a person's target heart rate while exercising be at least 50% but no more than 75% of the person's maximum heart rate.

9

Tom is 44 years old. What is his maximum heart rate, in beats per minute?

A) 176

B) 165

C) 132

D) 121

10

The NIH recommends that Luisa's target heart rate while exercising, in beats per minute, should be at least 98 but no more than 147. Based on the given information, what is Luisa's maximum heart rate?

A) 122

B) 147

C) 196

D) 220

CONTINUE

11

Triangle ABC is similar to triangle DEF, where A corresponds to D, and B corresponds to E. The measure of angle A is 12°, and $DE = 3AB$. What is the measure of angle D?

A) 4°

B) 12°

C) 15°

D) 36°

12

In 2016 the speed-knitting champion could knit 253 stitches in 3 minutes. At this rate of knitting, which expression represents the total number of stitches that the champion could knit in t minutes?

A) $\frac{253t}{3}$

B) $253\left(\frac{3}{t}\right)$

C) $253t$

D) $253(3t)$

13

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

Which of the following statements about the solutions to the given equation is(are) true?

I. The equation has a solution equal to 1.

II. The equation has a solution greater than 1.

A) I only

B) II only

C) I and II

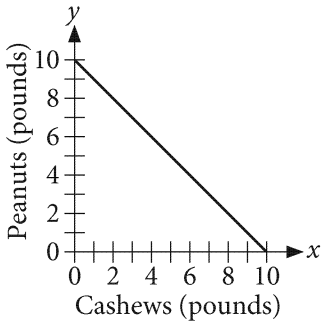
D) Neither I nor II

CONTINUE

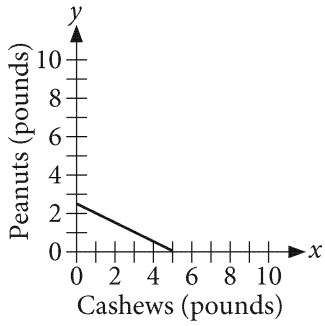
14

Jomay has $10 to spend on cashews and peanuts for a snack mix. Cashews cost twice as much per pound as peanuts. Which of the following graphs could represent the possible amounts of cashews and peanuts Jomay could buy for $10 ?

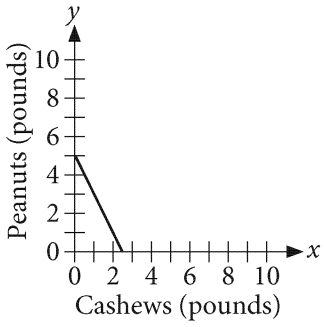
A)



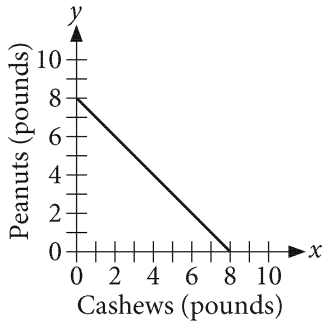
B)



C)

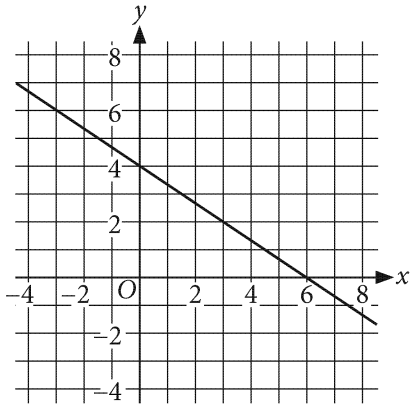


D)



CONTINUE

15



Which of the following is an equation of the line shown?

A) $2x+3y=12$

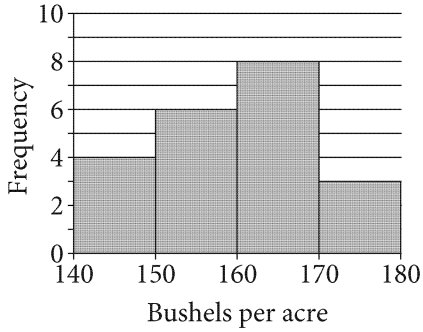
B) $2x-3y=12$

C) $-2x+3y=12$

D) $-2x-3y=12$

16

The histogram summarizes the distribution of corn production, in bushels per acre, over a 21-acre farm. The first bar represents the number of acres that produced at least 140 bushels but less than 150 bushels. The second bar represents the number of acres that produced at least 150 bushels but less than 160 bushels, and so on.



The median production, in bushels per acre, of these 21 acres is included in which interval?

A) At least 140 but less than 150

B) At least 150 but less than 160

C) At least 160 but less than 170

D) At least 170 but less than 180

17

$$y=x+1$$
$$y=-x+3$$

The solution to the given system of equations is (x, y). What is the value of $2y$?

A) −2

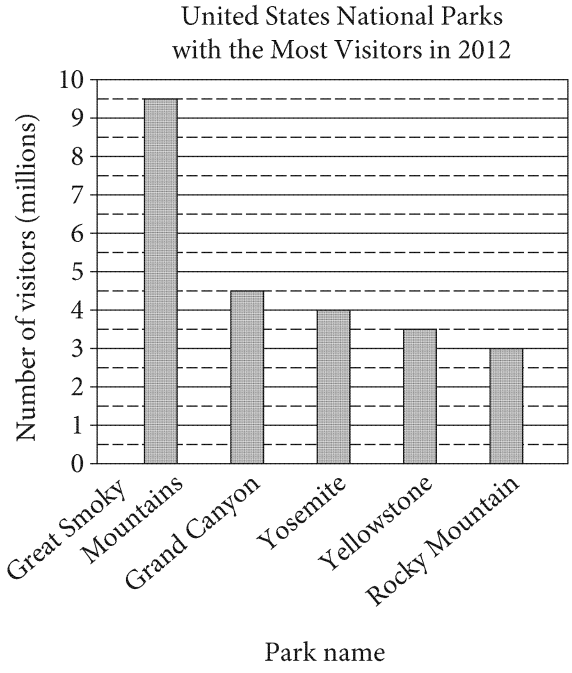
B) 1

C) 3

D) 4

CONTINUE

Questions 18 and 19 refer to the following information.



The bar graph shows the number of visitors, rounded to the nearest half million, to the five most visited national parks in 2012. The line graph shows the number of visitors to Great Smoky Mountains National Park for seven consecutive months in 2012.

18

Based on the data in the bar graph, which of the following is the best approximation for the mean number of visitors to the five most visited national parks during 2012?

A) 3.5 million
B) 4.0 million
C) 4.5 million
D) 5.0 million

19

For the seven months shown in the line graph, which month had the median number of visitors to Great Smoky Mountains National Park?

A) May
B) June
C) August
D) September

CONTINUE

20

In a particular city, weather data were collected for the month of August over a 10-year period. The table summarizes the number of days of rainfall by low temperature.

Low temperature	Rain	No rain	Total
75°F or above	22	33	55
Below 75°F	96	159	255
Total	118	192	310

If a day is selected at random from those days with rain, what is the probability that the selected day also had a low temperature of 75°F or above?

A) $\frac{22}{310}$

B) $\frac{22}{118}$

C) $\frac{118}{310}$

D) $\frac{22}{55}$

21

$$9x - 3 = cx + 4$$

In the equation shown, c is a constant. If the equation has no solution, what is the value of c ?

A) 3

B) 4

C) 7

D) 9

22

Which of the following expressions is a factor of $2x^2 - 7x - 4$?

I. $x - 4$

II. $2x - 1$

A) I only

B) II only

C) I and II

D) Neither I nor II

23

33 miles per gallon is approximately equal to how many kilometers per liter? (Use 1 kilometer = 0.62 mile and 1 gallon = 3.79 liters.)

A) 5

B) 14

C) 78

D) 202

CONTINUE

24

Which of the following situations is best modeled by an exponential function?

A) Each year, the number of people in a program decreases by 10% of the number of people in the program the preceding year.

B) Each year, the number of people in a program decreases by 20% of the original number of people in the program.

C) The number of people in a program is 10 fewer each year compared to the preceding year.

D) The number of people in a program decreases by 20 people each year.

25

The function R gives the revenue $R(x)$, in thousands of dollars, when x units of a particular product are made and sold. Which of the following best describes the meaning of $R(600) = 400$?

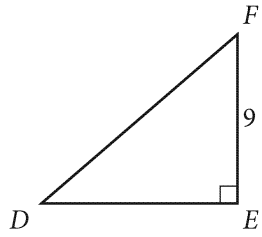
A) When 400 units are made and sold, the revenue is \$600,000.

B) When 400 units are made and sold, the revenue is \$240,000.

C) When 600 units are made and sold, the revenue is \$400,000.

D) When 600 units are made and sold, the revenue is \$150,000.

26



In triangle DEF, which expression represents the length of line segment DF ?

A) $9\cos F$

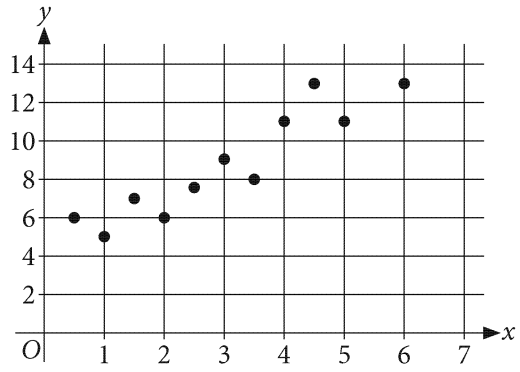
B) $9\sin F$

C) $\dfrac{\cos F}{9}$

D) $\dfrac{9}{\cos F}$

CONTINUE

27



The scatterplot shows 11 data values. Which equation is the most appropriate linear model for the data shown?

A) $y = 0.6 + 4x$

B) $y = 1.6 + 4x$

C) $y = 4 + 0.6x$

D) $y = 4 + 1.6x$

28

Renata produces her own music and makes it available online to her subscribers. In November, she had 2.3 times as many subscribers as she had in May. What was the percent increase in her number of subscribers for this time period?

A) 2.3%

B) 23.0%

C) 123.0%

D) 130.0%

29

What is the y-intercept of the graph of $y = 5^x - 5$ in the xy-plane?

A) $(0, -5)$

B) $(0, -4)$

C) $(0, 1)$

D) $(0, 5)$

30

A researcher predicts that the population of a certain city will double every 70 years. In 1946, the population was 1.8 million. Which equation models the population $P(t)$, in millions, where t represents the number of years after 1946?

A) $P(t) = 2(1.8)^{\frac{t}{70}}$

B) $P(t) = 2(1.8)^{70t}$

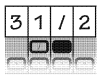
C) $P(t) = 1.8(2)^{\frac{t}{70}}$

D) $P(t) = 1.8(2)^{70t}$

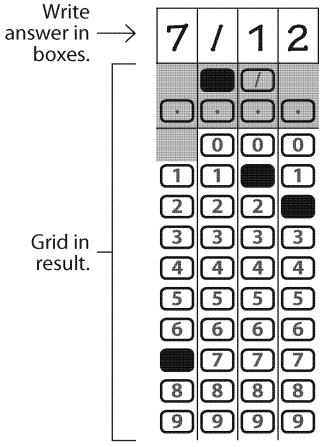
CONTINUE

DIRECTIONS

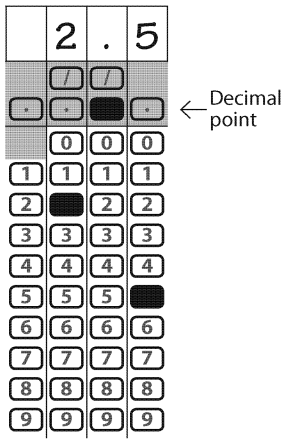
For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
2. Mark no more than one bubble 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.

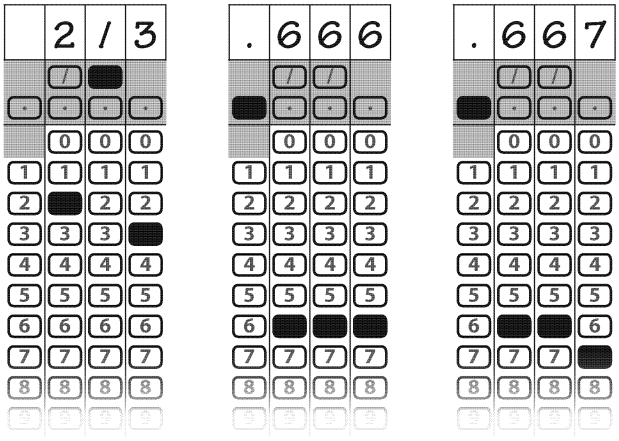
Answer: $\frac{7}{12}$ are:



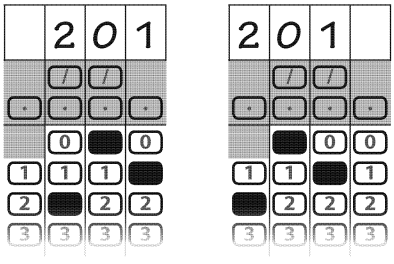
Answer: 2.5



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



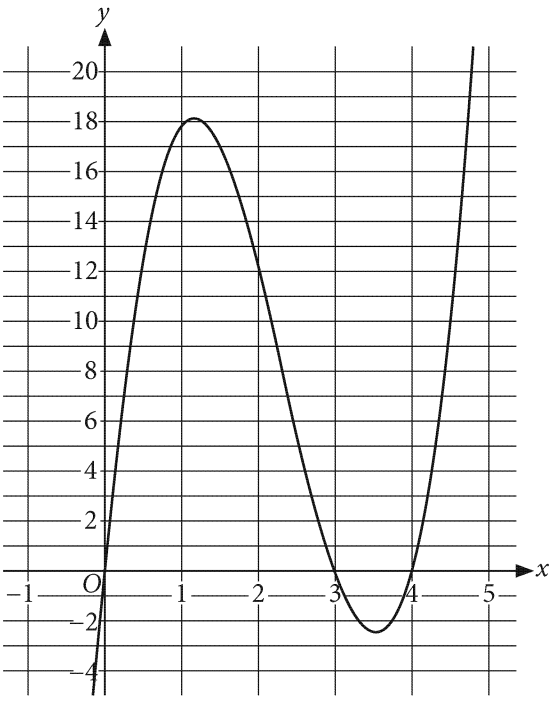
Answer: 201 – either position is correct



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

CONTINUE

31



The graph of the cubic polynomial function f is shown in the xy-plane, where $y = f(x)$. When $f(x) = 0$, the value of x is an integer. What is the greatest value of x such that $f(x) = 0$?

32

The price of a book increased by p% from \$24 to \$27. What is the value of p ?

33

The value of y is proportional to the value of x. For each increase in the value of x by 6, the value of y increases by 8. When the value of x increases by 12, what is the increase in value of y ?

34

If $\frac{x}{5} - \frac{x}{10} = \frac{1}{2}$, what is the value of $\frac{x}{5}$?

CONTINUE

35

$$C(x)=\frac{5}{9}(x-32)$$

The function C gives the temperature in degrees Celsius that corresponds to a temperature of x degrees Fahrenheit. If a temperature increases by 9.9 degrees Fahrenheit, what is the corresponding temperature increase in degrees Celsius?

36

In the xy-plane, the unit circle with center at the origin O contains point A with coordinates (1, 0) and point B with coordinates $\left(\frac{3}{5},\frac{4}{5}\right)$. What is the value of the sine of $\angle AOB$?

37

A bag contains red and yellow slips of paper, each labeled with a letter: A, B, or C. The table shows the distribution of colors and letters for the slips of paper in the bag.

Letter	Color		Total
	Red	Yellow	
A	5	5	10
B	7	2	9
C	3	1	4
Total	15	8	23

If a yellow slip is selected at random from the bag, what is the probability that the selected slip is labeled B?

38

$$4(x-100)^2=16$$

What is the larger of the two solutions of the equation shown?

STOP

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

November 7, 2020 US

ANSWER KEY

Reading Test Answers

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

READING TEST RAW SCORE (NUMBER OF CORRECT ANSWERS)

Writing and Language Test Answers

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

WRITING AND LANGUAGE TEST RAW SCORE (NUMBER OF CORRECT ANSWERS)

Math Test – No Calculator Answers

1	C	11	A
2	B	12	B
3	A	13	B
4	C	14	D
5	C	15	D
6	B	16	4
7	A	17	4/3, 1.33, 1.34
8	D	18	1/5, .2
9	D	19	14
10	C	20	25/3, 8.33, 8.34

MATH TEST – NO CALCULATOR RAW SCORE (NUMBER OF CORRECT ANSWERS)

Math Test – Calculator Answers

1	B	11	B	21	D	31	4
2	B	12	A	22	A	32	12.5
3	D	13	A	23	B	33	16
4	A	14	C	24	A	34	1
5	B	15	A	25	C	35	5.5, 11/2
6	B	16	C	26	D	36	4/5, .8
7	C	17	D	27	D	37	1/4, .25
8	A	18	D	28	D	38	102
9	A	19	D	29	B		
10	C	20	B	30	C		

MATH TEST – CALCULATOR RAW SCORE (NUMBER OF CORRECT ANSWERS)