

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 from Elizabeth Gaskell, *North and South*. Originally published in 1854–55. John Thornton would like his mother and his sister Fanny to pay a social visit to his friends the Hales in Crampton.

Mr. Thornton had had some difficulty in working up his mother to the desired point of civility. She did not often make calls; and when she did, it was in heavy state that she went through her
 5 duties. Her son had given her a carriage; but she refused to let him keep horses for it; they were hired for the solemn occasions, when she paid morning or evening visits. She had had horses for three days, not a fortnight before, and had comfortably ‘killed off’ all
 10 her acquaintances, who might now put themselves to trouble and expense in their turn. Yet Crampton was too far off for her to walk; and she had repeatedly questioned her son as to whether his wish that she should call on the Hales was strong enough to bear
 15 the expense of cab-hire. She would have been thankful if it had not; for, as she said, ‘she saw no use in making up friendships and intimacies with all the teachers and masters in Milton; why, he would be wanting her to call on Fanny’s dancing-master’s wife,
 20 the next thing!’

‘And so I would, mother, if Mr. Mason and his wife were friendless in a strange place, like the Hales.’

‘Oh! you need not speak so hastily. I am going tomorrow. I only wanted you exactly to understand
 25 about it.’

‘If you are going tomorrow, I shall order horses.’

‘Nonsense, John. One would think you were made of money.’

‘Not quite, yet. But about the horses I’m
 30 determined. The last time you were out in a cab, you came home with a headache from the jolting.’

‘I never complained of it, I’m sure.’

‘No. My mother is not given to complaints,’ said he, a little proudly. ‘But so much the more I have to
 35 watch over you. Now as for Fanny there, a little hardship would do her good.’

‘She is not made of the same stuff as you are, John. She could not bear it.’ Mrs. Thornton was silent after this; for her last words bore relation to a subject
 40 which mortified her. She had an unconscious contempt for a weak character; and Fanny was weak in the very points in which her mother and brother were strong. Mrs. Thornton was not a woman much given to reasoning; her quick judgment and firm
 45 resolution served her in good stead of any long arguments and discussions with herself; she felt instinctively that nothing could strengthen Fanny to endure hardships patiently, or face difficulties bravely; and though she winced as she made this
 50 acknowledgment to herself about her daughter, it only gave her a kind of pitying tenderness of manner towards her; much of the same description of demeanour with which mothers are wont to treat their weak and sickly children. A stranger, a careless
 55 observer might have considered that Mrs. Thornton’s manner to her children betokened far more love to Fanny than to John. But such a one would have been deeply mistaken. The very daringness with which mother and son spoke out unpalatable truths, the

60 one to the other, showed a reliance on the firm centre
of each other's souls; which the uneasy tenderness of
Mrs. Thornton's manner to her daughter, the shame
with which she thought to hide the poverty of her
child in all the grand qualities which she herself
65 possessed unconsciously, and which she set so high a
value upon in others—this shame, I say, betrayed the
want of a secure resting-place for her affection. She
never called her son by any name but John; 'love,'
and 'dear,' and such like terms, were reserved for
70 Fanny.

1

Based on the passage, it is most likely that Mrs. Thornton resists hiring horses because she

- A) prefers to walk when making social visits.
- B) objects to the costs that are involved.
- C) is ill at ease around carriage horses.
- D) is worried about what other people will think of her.

2

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

- A) Lines 5-8 ("Her son . . . visits")
- B) Lines 11-12 ("Yet Crampton . . . walk")
- C) Lines 15-18 ("She would . . . Milton")
- D) Lines 26-28 ("If you . . . money")

3

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

- A) Mrs. Thornton's social visits to her feelings about her children.
- B) Mrs. Thornton's distrust of her neighbors to her love of her family.
- C) Fanny Thornton's personal shortcomings to her mother's unconditional love.
- D) John Thornton's concerns about his family to Mrs. Thornton's concerns about John.

4

In context, the statement in lines 8-11 ("She had . . . turn") is best interpreted to mean that Mrs. Thornton had

- A) angered nearly all of her acquaintances.
- B) returned the horses without ever using them.
- C) insisted that her friends come to her house.
- D) visited everyone that she felt obliged to visit.

5

As used in line 33, "given" most nearly means

- A) bestowed.
- B) devoted.
- C) conveyed.
- D) inclined.

6

The author's discussion of a "stranger" (line 54) serves mainly to

- A) criticize a regrettable mistake.
- B) correct a possible misinterpretation.
- C) make a sinister observation.
- D) challenge an emotional shortcoming.

7

The main idea of lines 54-70 is that

- A) John can endure hardship and difficulty in life but lacks the tenderness and kindness of his sister Fanny.
- B) Mrs. Thornton overcompensates for the fact that she feels closer to her son than she does to her daughter.
- C) John is known for his inner fortitude but resents the affection his mother expresses for his sister Fanny.
- D) Mrs. Thornton is unsure which of her two very different children she loves and values more.

8

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

- A) obscurely.
- B) distantly.
- C) profoundly.
- D) sufficiently.

9

According to the passage, the conversations between John Thornton and his mother could generally be described as

- A) lighthearted.
- B) candid.
- C) restrained.
- D) impassioned.

10

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

- A) Lines 1-3 ("Mr. Thornton . . . civility")
- B) Lines 54-57 ("A Stranger . . . John")
- C) Lines 58-61 ("The very . . . souls")
- D) Lines 66-70 ("this shame . . . Fanny")

Questions 11-21 are based on the following passages.

Passage 1 is adapted from a speech delivered to the Governing Board of the Pan-American Union in 1933 by President Franklin D. Roosevelt. Passage 2 is adapted from Carleton Beals, *The Coming Struggle for Latin America*. ©1938 by Carleton Beals. In his speech, Roosevelt formally announced the Good Neighbor Policy.

Passage 1

In my Inaugural Address I stated that I would “dedicate this Nation to the policy of the good neighbor—the neighbor who resolutely respects himself and, because he does so, respects the rights
5 of others—the neighbor who respects his obligations and respects the sanctity of his agreements in and with a world of neighbors.” Never before has the significance of the words “good neighbor” been so manifest in international relations. Never have the
10 need and benefit of neighborly cooperation in every form of human activity been so evident as they are today. . . .

The essential qualities of a true Pan Americanism must be the same as those which constitute a good
15 neighbor, namely, mutual understanding, and, through such understanding, a sympathetic appreciation of the other’s point of view. . . . In this spirit the people of every Republic on our continent are coming to a deep understanding of the fact that
20 the Monroe Doctrine,¹ of which so much has been written and spoken for more than a century, was and is directed at the maintenance of independence by the peoples of the continent. It was aimed and is aimed against the acquisition in any manner of the
25 control of additional territory in this hemisphere by any non-American power.

Hand in hand with this Pan American doctrine of continental self-defense, the peoples of the American Republics understand more clearly, with the passing
30 years, that the independence of each Republic must recognize the independence of every other Republic. Each one of us must grow by an advancement of civilization and social well-being and not by the acquisition of territory at the expense of any
35 neighbor.

In this spirit of mutual understanding and of cooperation on this continent you and I cannot fail to be disturbed by any armed strife between

neighbors. I do not hesitate to say to you, the
40 distinguished members of the Governing Board of the Pan American Union, that I regard existing conflicts between four of our sister Republics as a backward step. . . .

We all of us have peculiar problems, and, to speak
45 frankly, the interest of our own citizens must, in each instance, come first. But it is equally true that it is of vital importance to every Nation of this Continent that the American Governments, individually, take, without further delay, such action as may be possible
50 to abolish all unnecessary and artificial barriers and restrictions which now hamper the healthy flow of trade between the peoples of the American Republics.

¹ An 1823 US policy stating that efforts by European powers to interfere with North or South American nations would be viewed as acts of aggression, requiring US intervention

Passage 2

Our good-neighbor policy rests in great part upon
55 certain falsehoods, misconceptions, and non-existent conditions. Some of these are:

1. *The belief that the Western Hemisphere is a unity, that all countries in it have identical interests, merely because they are in the same
60 part of the world.*
Does France have the same policy as Germany? They have different policies, in part, precisely because they are neighbors. . . .
2. *The belief that the Western Hemisphere is a brotherhood of democracies in contrast to the
65 evil dictatorships of Europe.*
Governments to the south have rarely represented the people less than at present. Some are worse tyrannies than any in Europe, their danger limited merely by their relative weakness in the world scene. . . . The
70 complexion of the various governments differs widely. But it is pure [foolishness] to argue that democracy exists in the Western Hemisphere or even the larger part of it. Few of its
75 governments have the slightest basis in democracy. . . .
3. *The belief that the Western nations are peace-loving as opposed to the war-thirsty nations of
80 Europe.*

85

Recent wars and recent international injustices have shaken the southern continent time and again. . . . Even while Roosevelt was uttering these wrong platitudes . . . Nicaragua and Honduras almost went to war over a postage stamp. Other troubles were brewing and are still brewing along with new ones. Never before have the southern countries put out so much on armaments.

11

As used in line 44, “peculiar” most nearly means

- A) specific.
- B) bizarre.
- C) eccentric.
- D) rare.

12

Which choice best supports the idea that Roosevelt believes every nation has a primary responsibility to the needs of its people?

- A) Lines 1-7 (“In my . . . neighbors”)
- B) Lines 17-23 (“In this . . . the continent”)
- C) Lines 36-39 (“In this . . . neighbors”)
- D) Lines 44-46 (“We . . . first”)

13

Based on Passage 1, which choice best describes Roosevelt’s perspective on the Monroe Doctrine?

- A) He fully supports it, considering it a component of his Good Neighbor Policy.
- B) He endorses its application in the United States but not in other parts of the world.
- C) He acknowledges that it was once useful but considers it outdated.
- D) He rejects many of its provisions, especially those that curtail the power of the United States.

14

Which choice best describes the overall structure of Passage 2?

- A) Beals asks and answers a series of rhetorical questions.
- B) Various policies are stated and then supported with historical detail.
- C) Beals presents and responds to a series of notions he considers mistaken.
- D) Various steps to improve a situation are listed in order of importance.

15

According to Beals in Passage 2, being geographically near each other contributes to nations having

- A) overlapping interests.
- B) shared economic concerns.
- C) variations in cultural traditions.
- D) dissimilar policies.

16

Based on Passage 2, what can reasonably be inferred about Beals’s estimation of European dictatorships?

- A) He fears they are dangerous role models to American governments.
- B) He considers them no more tyrannical than many governments in the Americas.
- C) He believes them to be too corrupt to be considered civilized.
- D) He feels they are not concerned about their neighbors’ practices.

17

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

- A) Lines 64-66 (“*The belief . . . Europe*”)
- B) Lines 67-68 (“Governments . . . present”)
- C) Lines 69-71 (“Some . . . scene”)
- D) Lines 75-77 (“Few . . . democracy”)

18

As used in line 70, “limited” most nearly means

- A) restrained.
- B) defined.
- C) terminated.
- D) fixed.

19

Which choice states a main difference in the approaches of the two passages?

- A) Passage 1 analyzes historical data about nations in the Americas, while Passage 2 primarily expresses opinions about those nations.
- B) Passage 1 advocates for extensive changes in political activity, while Passage 2 defends the existing state of affairs.
- C) Passage 1 presents goals Western nations should strive for, while Passage 2 focuses on past actions of those nations.
- D) Passage 1 discusses international relations mainly in general terms, while Passage 2 addresses specific situations.

20

Compared to Beals’s view of international relations in the Americas in Passage 2, the view Roosevelt expresses in Passage 1 is more

- A) idealistic.
- B) critical.
- C) impartial.
- D) urgent.

21

Based on Passage 2, which contention in Passage 1 would Beals most likely view as one of Roosevelt’s “wrong platitudes” (line 84)?

- A) That hostilities exist between American nations
- B) That American nations increasingly value one another’s independence
- C) That the Monroe Doctrine is meant to dissuade international aggression
- D) That a “good neighbor” nation shows respect for itself

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

This passage is adapted from Todd M. Freeberg, Jeffrey R. Lucas, and Indrikis Krams, “The Complex Call of the Carolina Chickadee.” ©2012 by Sigma Xi, The Scientific Research Honor Society. Chickadees are a species of parid, small birds that eat insects and seeds. The labels assigned to *chick-a-dee* notes do not correspond to human musical notation.

Individual parids are often out of sight of flockmates as they move through the environment, so a vocal signaling system that can convey messages related to predators, food, or group movement seems
 Line 5 crucial to obtaining the benefits of group living. Recent studies indicate that variation in Carolina chickadee *chick-a-dee* calls is associated with these social and environmental contexts.

Most studies of these calls in the context of avian
 10 predators have used perched predators or models. Christopher Zachau and Todd Freeberg presented predator and control stimuli that “flew” in the area of Carolina chickadees visiting feeders. Zachau and Freeberg used wooden models shaped like flying
 15 birds and painted to resemble either sharp-shinned hawks (*Accipiter striatus*, a threatening avian predator) or blue jays (*Cyanocitta cristata*, a nonthreatening avian control). The chickadees’ calls were recorded before and after the release and
 20 “flight” of the models down a zipline near the feeders. The calls produced varied with the presence of each model type, but the biggest effect we measured resulted from the flight of any model, irrespective of the species it mimicked. Calls
 25 produced after the model was released contained more A notes compared to calls produced prior to the release of the model. Greater production of A notes in the calls would seem to represent a message of alarm, as opposed to one of mobbing—
 30 behavior that is frequently linked to approaching and harassing predators—or of assembly. Tonal sounds that slowly increase in intensity and that are high frequency (such as the A note) are generally difficult for avian predators, and many other animals, to
 35 locate. In contrast, noisy sounds with rapid increases in intensity, like the D note, are easier to locate. Thus, the production of more A notes in these calls when a flying predator is detected in the area seems adaptive, as it could alert flockmates to the predator’s
 40 presence but not give away the location of the signaler to the predator.

Carolina chickadees produce more calls, and often more D notes in those calls, when they detect a perched avian predator model than when no model
 45 is present. For example, in a 2009 study, Chad Soard and Gary Ritchison of Eastern Kentucky University placed six perched avian-predator models in the habitat of Carolina chickadees. The models, all of which represented hawk and owl species, ranged in
 50 size and type from small, agile predators like Eastern screech owls (*Megascops asio*) and sharp-shinned hawks to large, relatively slow-moving predators like great horned owls (*Bubo virginianus*) and red-tailed hawks (*Buteo jamaicensis*). The former predators
 55 represent real threats to small songbird species, whereas the latter do not. Chickadees produced more D notes in their calls when smaller, more threatening avian predators were present. Later the researchers played back *chick-a-dee* calls recorded in these
 60 different threat contexts to chickadees in their habitat. The authors found that chickadees were more likely to mob the playback speaker—to approach it closely in large numbers—when it was playing calls recorded when a small predator model
 65 was present than when the speaker was playing calls recorded when a large predator model was present. This work suggests that easy-to-localize D notes are used more often in calls when those calls might serve a mobbing function—bringing flockmates to a
 70 particular location to drive a predator away. These findings make it clear that Carolina chickadees vary the note composition of their *chick-a-dee* calls in the high arousal contexts of predator detection and mobbing.

Figure 1

Mean Number of D Notes per *Chick-a-dee* Call Relation to Body Length of Predator Model

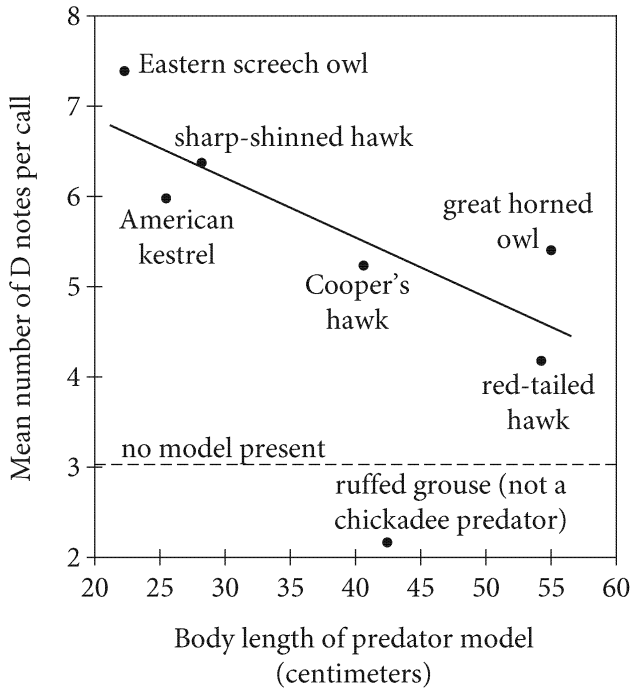
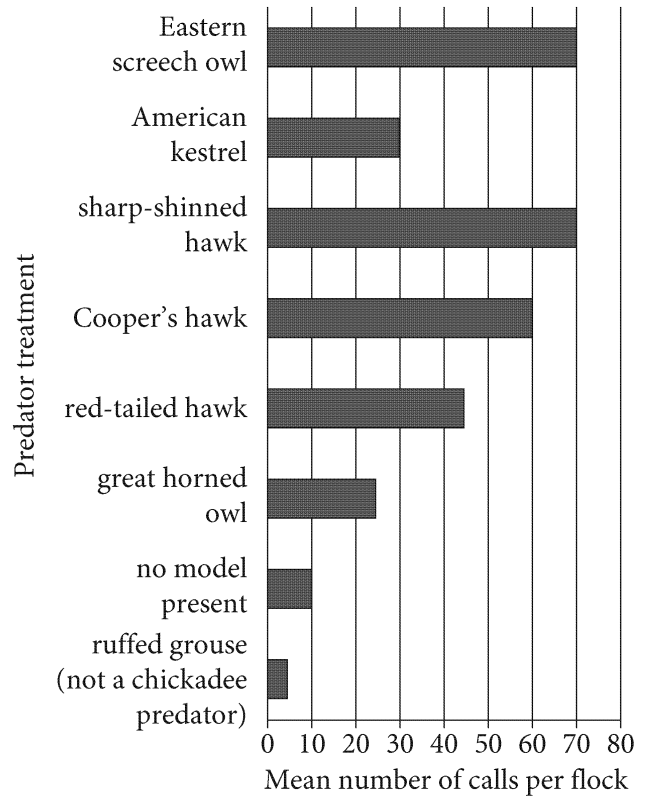


Figure 2

Mean Number of *Chick-a-dee* Calls per Flock during 5-Minute Predator Presentation Trials



Figures adapted from Chad M. Soard and Gary Ritchison, "Chick-a-dee' Calls of Carolina Chickadees Convey Information about Degree of Threat Posed by Avian Predators." ©2009 by the Association for the Study of Animal Behaviour.

22

The primary purpose of the passage is to

- A) describe studies that identified the function of particular note patterns in *chick-a-dee* calls.
- B) summarize competing hypotheses intended to account for the variety of note types in *chick-a-dee* calls.
- C) account for a discrepancy between the results obtained by two teams of scientists studying notes in *chick-a-dee* calls.
- D) compare the note patterns detected in *chick-a-dee* calls with those detected in the calls of other bird species.

23

According to the passage, a vocal signaling system is useful to Carolina chickadees because it enables individual chickadees to

- A) establish signals that are understood by both chickadee and nonchickadee parids.
- B) attract chickadees from other flocks during the mating season.
- C) produce sounds that are intimidating to potential predators.
- D) indicate the nature of a situation that may not be visible to other flock members.

24

One function of the parenthetical information in lines 16-18 is to

- A) provide the definition of some scientific terms relevant to Zachau and Freeberg's experiment design.
- B) describe the physical characteristics that distinguish sharp-shinned hawks and blue jays from Carolina chickadees.
- C) emphasize that vocal signaling systems are found in both predatory and nonpredatory bird species.
- D) clarify the significance of the different species chosen as models for Zachau and Freeberg's experiment.

25

As used in line 49, "represented" most nearly means

- A) performed.
- B) depicted.
- C) enacted.
- D) described.

26

As used in line 40, "give away" most nearly means

- A) award.
- B) reveal.
- C) donate.
- D) assign.

27

Which choice best supports the idea that the difference in size between chickadees and potential avian predators influences whether those potential predators are likely to hunt chickadees?

- A) Lines 42-45 ("Carolina . . . present")
- B) Lines 45-48 ("For example . . . chickadees")
- C) Lines 48-54 ("The models . . . *jamaicensis*")
- D) Lines 54-56 ("The former . . . not")

28

It can reasonably be inferred from the passage that Soard and Ritchison included the playback-speaker experiment in their study in order to

- A) determine whether the absence of immediate threats would alter the makeup of notes produced during the perched-predator experiment.
- B) clarify whether the size of models in the perched-predator experiment affects the pattern of notes in *chick-a-dee* calls.
- C) resolve contradictory results produced during the perched-predator experiment.
- D) confirm the significance of one of the findings of the perched-predator experiment.

29

According to figure 1, the lowest mean number of D notes per call was recorded in response to which model?

- A) The American kestrel
- B) The Cooper's hawk
- C) The ruffed grouse
- D) The red-tailed hawk

30

Which conclusion about chickadee behavior is supported by both the data in figure 1 and the passage?

- A) Chickadees would likely approach the American kestrel model more closely than they would the red-tailed hawk model.
- B) Chickadees would be more likely to mob the great horned owl model than they would the Cooper's hawk model.
- C) Chickadees would be more likely to signal a flight response in the presence of the red-tailed hawk model than in the presence of any other model.
- D) Chickadees would likely ignore the presence of larger birds of prey like the great horned owl and red-tailed hawk.

31

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

- A) Lines 56-58 ("Chickadees . . . present")
- B) Lines 58-61 ("Later . . . habitat")
- C) Lines 61-66 ("The authors . . . present")
- D) Lines 70-74 ("These . . . mobbing")

32

According to figure 2, the mean number of *chick-a-dee* calls per flock during the Cooper's hawk treatment was

- A) 40.
- B) 50.
- C) 60.
- D) 70.

Questions 33-42 are based on the following passage and supplementary material.

This passage is adapted from Thalma Lobel, *Sensation: The New Science of Physical Intelligence*. ©2014 by Thalma Lobel.

In 2008, at Yale University, a student named Lawrence Williams and his professor John Bargh recruited forty-one students for a psychology study.

Line One by one, the students were led into a lobby, where
5 they were greeted by a young research assistant who guided them to an elevator that would take them to a laboratory on the fourth floor. As part of the experiment, the assistant had her hands full, carrying a stack of books, a clipboard, and a cup of coffee.
10 While in the elevator, she asked the participant to hold her coffee for a second, so she could write his or her name and other information on her clipboard. This casual request was actually the most important part of the experimental procedure. Half of the
15 participants were handed a hot cup of coffee and the other half an iced coffee. This subtly exposed them to different tactile experiences of temperature. Yet they had no idea that what they were being asked to do was significant.

20 When the participants stepped out of the elevator and into the lab, they were met by another experimenter, who sat them down and asked them to read a description of someone called only Person A, who was characterized as skillful, intelligent,
25 determined, practical, industrious, and cautious. Unbeknownst to the participants, Person A was a fictitious composite character. They were then asked to rate Person A from a list of ten additional traits not included in the written description. Half of
30 the traits were on the “warm-cold” spectrum—traits that we might associate with “warm” or “cold” personalities—and were identified by words such as *generous* or *ungenerous*, *good-natured* or *irritable*, *sociable* or *antisocial*, and *caring* or *selfish*. The
35 remaining traits were unrelated to the warm-cold aspect and included descriptions such as *talkative* or *quiet*, *strong* or *weak*, *honest* or *dishonest*.

Behold the power of a warm cup of coffee. Participants who held the hot cup for a few moments
40 in the elevator rated Person A as significantly more generous, good-natured, and caring than did their iced coffee-holding counterparts. People who held the cold cup were far more likely to see Person A as

ungenerous, irritable, and selfish. Yet they all felt
45 pretty much the same about adjectives unrelated to the warm-cold aspect, no matter which coffee the subjects held before they sat down.

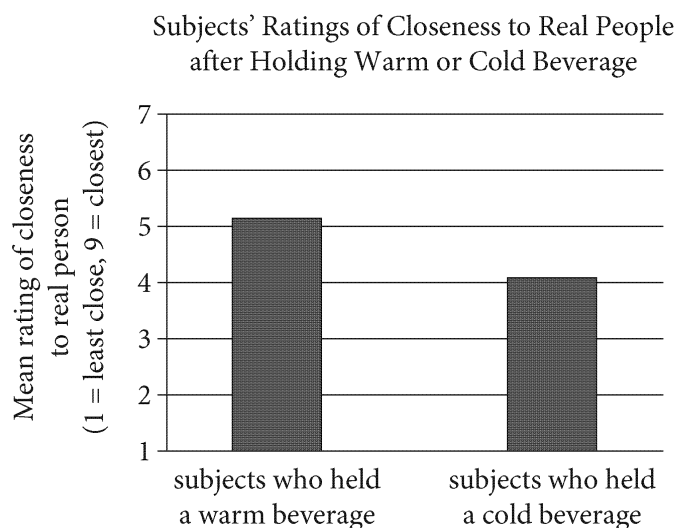
Could the insignificant act of holding a warm cup of coffee in an elevator really make you see the
50 people around you as nicer? What was going on here, psychologically speaking?

This finding that physical warmth promotes interpersonal warmth was so surprising that many scientists raised their eyebrows and asked if it could
55 be true. Yet temperature influences our reactions to real people just as it affected participants’ initial judgments of anonymous people they only read about.

In 2009, two Dutch researchers explored whether
60 temperature could affect how close people thought they were to others. As in the coffee experiment, the researchers had participants hold warm or cold beverages. The experimenter asked each participant to hold a beverage for a few minutes while he was
65 pretending to install a questionnaire on the computer.

The experimenter then took the beverages from the participants and asked them to think of a real person they knew and rate how close they were to
70 that person. Participants who were holding a warm beverage perceived the person in mind as closer emotionally to them than did those who were holding a cold beverage. This is surprising because most of us believe that our most intimate
75 connections are stable on a day-to-day basis—we don’t expect them to be influenced by the temperature of the drink we hold.

Yet our minds do not exist in a vacuum, so our feelings and values can be affected by subtle influences
80 around us. Seemingly irrelevant things that we process through our bodies and our physical senses do affect our states of mind, mostly without our awareness. The core theory of embodied cognition, an emergent field of psychology, states that there is
85 an indissoluble link between our decision making and our sensory-motor experiences, such as touching a warm or cold object, and our behaviors, judgments, and emotions.



Adapted from Hans IJzerman and Gün R. Semin, "The Thermometer of Social Relations: Mapping Social Proximity on Temperature." ©2009 by Association for Psychological Science.

33

Which choice best supports the idea that some experts may be skeptical of the view endorsed by the passage?

- A) Lines 34-37 ("The remaining . . . dishonest")
- B) Lines 42-44 ("People . . . selfish")
- C) Lines 44-47 ("Yet . . . down")
- D) Lines 52-55 ("This . . . true")

34

As used throughout lines 29-35, "traits" most nearly means

- A) virtues.
- B) oddities.
- C) attributes.
- D) patterns.

35

The main purpose of the discussion in the passage of the 2009 experiment by two Dutch researchers is to

- A) reinforce the conclusions of the 2008 experiment.
- B) illustrate a shift in thinking among scientists after the 2008 experiment.
- C) question an idea underlying the 2008 experiment.
- D) note the influence of the design of the 2008 experiment.

36

Which of the following statements, if true, would most clearly serve to weaken the conclusion drawn in the passage from the 2009 study?

- A) Many participants who were holding a warm beverage were thinking of a person they had known for a relatively short time.
- B) Many participants who were holding a cold beverage were thinking of a person they were not particularly close to.
- C) Many participants who were holding a cold beverage did not typically drink cold beverages.
- D) Many participants who were holding a cold beverage had consumed another beverage before the study.

37

By referring to influences as "subtle" (line 79), the author most likely means that they are

- A) unlikely to provoke conscious recognition.
- B) difficult to fully comprehend.
- C) predictive of ambiguous outcomes.
- D) somewhat mysterious in origin.

38

Based on the passage, it can be reasonably inferred that the author regards the experiments she discusses as important partly because they

- A) support a hypothesis from a new area of study about why people think and act as they do.
- B) serve as reminders of scientists' inability to fully anticipate the outcomes of their research.
- C) demonstrate the fundamental unpredictability of how individuals perceive each other.
- D) offer useful examples for discussing and evaluating contemporary research methods.

39

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

- A) Lines 17-19 ("Yet . . . significant")
- B) Lines 29-34 ("Half . . . *selfish*")
- C) Lines 78-80 ("Yet . . . around us")
- D) Lines 83-88 ("The core . . . emotions")

40

Which quotation from the passage best summarizes the data presented in the figure?

- A) Lines 14-17 ("Half . . . temperature")
- B) Line 38 ("Behold . . . coffee")
- C) Lines 70-73 ("Participants . . . beverage")
- D) Lines 80-83 ("Seemingly . . . awareness")

41

According to the figure, the mean rating of closeness by subjects who held a cold beverage differed from that by subjects who held a warm beverage by approximately how many points on the 7-point scale?

- A) 1 point
- B) 3 points
- C) 4 points
- D) 5 points

42

The figure suggests that on average, as compared with subjects who held a cold beverage, subjects who held a warm beverage experienced a stronger sense of which feeling in relation to the people they were rating?

- A) Collegiality
- B) Respect
- C) Tolerance
- D) Intimacy

Questions 43-52 are based on the following passage.

This passage is adapted from Amy Coombs, "Down and Dirty." ©2012 by *The Scientist*.

Plant diversity was the foundation upon which the ancient Mayan civilization was built. Growing beans, maize, and squash together created healthier crops and dark, fertile earth, and enabled successive generations to rotate crops through the same plots without depleting the soil.

"I always wondered about the underlying mechanisms," says Alexandre Jousset, from the Georg August University in Göttingen, Germany. "These agricultural practices weren't used in Europe, and I always wondered about the comparative outcomes."

This is why Jousset was captivated with the Jena Experiment—a series of biodiverse grassland plots in Germany that have been continuously maintained since 2002, allowing researchers to study the impacts of species richness and diversity on soil fertility. Thanks to Jena data, we know that plant diversity increases microbial activity, and that beneficial bacteria like *Pseudomonas fluorescens* fight soil-borne plant diseases.

Yet despite these findings, soil cultivation is still more of an art than a science. Research says little about the best mixtures of plants or the abundance of each species needed to nurture beneficial microbes. The problem is that bacteria are elusive; to compare microbes between two sites, samples must be taken to a lab where species are cultured in growth media. Some soil bacteria don't grow well in culture, and because two different species can secrete the same defense chemicals, "screening for bacteria says little about their actual contributions to the soil," says Ellen Latz, who collaborated with Jousset on a study of the Jena plots.

This is why Jousset and Latz turned to genes found in the soil—instead of screening Jena soils for beneficial bacteria, the researchers used genes that produce anti-fungal compounds as biomarkers. Comparing the disease-fighting genes harbored in the soils beneath diverse plant communities reflects the microbial makeup fostered by plant group interactions, and focuses on the bacteria that suppress soil pathogens, say Jousset and Latz.

In the first set of experiments, the team collected dirt from 78 Jena plots containing different ratios of legumes, herbs, and grasses. They extracted DNA

from the soil samples and used probes to identify two *P. fluorescens* genes—*phlD* and *prnD*, which code for enzymes that regulate the production of the antifungal compounds 2,4-diacetylphloroglucinol (DAPG) and pyrrolnitrin (PRN), respectively.

The results were a surprise: a soil's genetic profile depended on the relative abundance of herbs, grasses, and other plant groups, and this, in turn, impacted the rate of plant disease. A diverse mix of plants increased the abundance of bacteria producing the antifungal compound DAPG. A blend of herbs and grasses, however, increased the abundance of the PRN gene and presumably its producers. Despite their ability to fix nitrogen, soil-friendly legumes diminished the prevalence of both antifungal genes, a somewhat counterintuitive finding that suggests a "best mixture" of plants for promoting soil health. "This could be crucial for establishing environmentally friendly plant-protection strategies," says Latz.

Next, the researchers grew sugar beets from seeds in containers of dirt collected from the Jena grasslands. They first inoculated the soil with the fungal pathogen *Rhizoctonia solani*, which plagues a long list of crops, including tomatoes, eggplants, and peppers. After seedlings became established, the scientists compared the rate of disease between containers, which featured differing ratios of the two different disease-fighting genes.

It turns out that a cocktail of both DAPG and PRN provided the best defense against *R. solani*, although it appears the ratio of the two genes was particularly important to plant health. The disease rate was lowest when the genes for both these compounds were present in similarly high amounts. When the DAPG-producing gene was more abundant, plants became sick. When one gene was only slightly more abundant than the other, disease-fighting benefits were reduced but some improvement in plant health was seen.

"Should the mechanism described here prove generally true, there could be more reasons to invest in developing polyculture and diverse planting mixtures in agricultural systems," says Indiana University soil biologist Jim Bever, who was not involved with the study.

While monoculture has been shown to decrease the relative number of beneficial soil microbes over time, Jousset's study suggests that some forms of diversity are better than others.

43

In the context of the passage, lines 22-23 (“Yet . . . science”) primarily serve to

- A) emphasize a problem that Jousset and Latz’s research attempted to address.
- B) expose a design flaw in the experiments Jousset and Latz conducted.
- C) introduce a discussion of how soil cultivation methods have changed over time.
- D) explain how Jena data could be applied to improve soil cultivation.

44

The second paragraph (lines 7-12) mainly serves to

- A) identify key differences between two agricultural approaches explored in the passage.
- B) point to the scientific considerations motivating the research discussed in the passage.
- C) provide biographical details about a researcher discussed in the passage.
- D) qualify a historical claim about agriculture presented earlier in the passage.

45

As used in line 15, “maintained” most nearly means

- A) assisted.
- B) protected.
- C) tended.
- D) repaired.

46

When the author describes soil bacteria as “elusive” (line 26), she most nearly means that they are

- A) absent from certain soil types.
- B) less well studied than are other microbes.
- C) more short-lived than are other bacteria.
- D) difficult for scientists to identify.

47

The passage credits Jousset and Latz for which innovation in their study of soil bacteria?

- A) They were able to identify a new type of bacteria that affects soil health.
- B) They devised a way to discern a specific type of bacterial activity.
- C) They focused on soil pathogens rather than on beneficial bacteria.
- D) They developed a new test to differentiate between harmful and beneficial bacteria.

48

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

- A) Lines 26-28 (“The problem . . . media”)
- B) Lines 29-34 (“Some . . . plots”)
- C) Lines 39-43 (“Comparing . . . Latz”)
- D) Lines 44-46 (“In the . . . grasses”)

49

According to the passage, the Jena Experiment was useful to Jousset and Latz in executing their study because it provided

- A) a variety of soil samples with different microbial makeups.
- B) historical data about the composition of ancient soils.
- C) laboratory facilities for cultivating bacteria.
- D) tools for extracting DNA from soil samples.

50

What evidence considered by Jousset and Latz allowed them to draw conclusions about the best way to prevent soil pathogens from damaging crops?

- A) One experiment showed that grasses produce DAPG and PRN in high amounts, and another experiment confirmed that grasses produce an ideal ratio of DAPG to PRN.
- B) One experiment confirmed a relationship between soil health and legumes, and another experiment demonstrated that sugar beets can counteract legumes' effects on the soil.
- C) One experiment showed that certain plant combinations yield different amounts of DAPG and PRN, and another experiment provided more specific information regarding the optimal balance of DAPG and PRN.
- D) One experiment showed that PRN is crucial to soil health, and another experiment demonstrated that DAPG is more harmful to plants than previous tests had indicated.

51

Which choice best supports the idea that Jousset and Latz's results challenged certain reasonable assumptions about soil health?

- A) Lines 55-57 ("A diverse . . . DAPG")
- B) Lines 57-59 ("A blend . . . producers")
- C) Lines 59-63 ("Despite . . . health")
- D) Lines 64-66 ("This . . . Latz")

52

Lines 87-92 ("Should . . . study") mainly serve to

- A) introduce another biologist's critique of the methods used by Jousset and Latz.
- B) summarize the similarities between the research discussed in the passage and another study.
- C) raise an additional question that a researcher at another institution is considering investigating.
- D) point to the potential practical applications of the research 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.

The Legacy of the Dark Room Collective

Founded in 1988 by Harvard students and aspiring poets Sharan Strange and Thomas Sayers Ellis, the Dark Room Collective (DRC) was an organization that built and nurtured a community of African American artists in the Boston area. The DRC established itself as a space for both emerging and established writers, visual artists, and musicians to engage with and support one another.

The idea for the DRC came to Strange and Ellis on December 8, **1** 1987. This was the day that they and their friends attended the funeral of acclaimed writer James Baldwin. As Strange recalled, “The funeral was a

1

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

- A) 1987; on the date just mentioned,
- B) 1987, and
- C) 1987, when
- D) 1987, because of the fact that

literary event. . . . All our literary icons were there [and] our sorrow was suffused with a kind of energy, a desire to make something positive out of loss.” Rather than simply admiring their idols from afar, the group’s founders resolved to reach out to them, acknowledge their influence, and **2** learning from them.

3 The DRC would eventually sponsor workshops and readings in several East Coast cities. Strange and Ellis held public events on Sunday afternoons at their house, featuring art shows, discussions, readings, and performances. The events became so **4** popular, which attendees could not all fit into the living room, and many had to listen from the front porch. Informally, the DRC also provided a space for its members to experiment in their creative pursuits and to inspire and critique each other. **5** Participants have provided varying accounts of the process of gaining membership in the DRC. Poet Patrick Sylvain recalls how Yusef Komunyakaa (who would later win a Pulitzer Prize for poetry) sat with him to review drafts of his poems, advising him to cut unnecessary words.

2

- A) NO CHANGE
- B) learn
- C) to learn
- D) they learned

3

Which choice best introduces the information that follows in the paragraph?

- A) NO CHANGE
- B) Those who attended Baldwin’s funeral recovered in the long run from their profound loss.
- C) The DRC’s mission was to provide a community for local writers and artists.
- D) The founders of the DRC realized how crucial it was for them to reach out to the writers they admired the most.

4

- A) NO CHANGE
- B) popular, whose
- C) popular that
- D) popular in which

5

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

- A) NO CHANGE
- B) Visiting writers would lead workshops and mentor younger writers.
- C) Even prize-winning authors mentioned the DRC in their writings.
- D) Aspiring writers—no matter how talented—often received little to no financial compensation for their work.

Many joined the DRC as students to experience what

6 would it be like to pursue writing professionally.

Members desired the **7** chance connecting with like-minded individuals (including journalists, editors, and academics) rather than reading and writing in isolation. Strange remembers that many emerging artists did not know one another, since their work was not yet widely available in bookstores or featured at many events.

“We wanted them to know that their work was appreciated, was inspiring, was changing lives,” Strange said. Even before it began organizing events, the group had started to amass a library of works by African American writers; **8** the DRC thus became a place to exchange out-of-print books and to acquire works by newer writers.

6

- A) No CHANGE
- B) would it be like to pursue writing professionally?
- C) it would be like to pursue writing professionally.
- D) it would be like to pursue writing professionally?

7

- A) NO CHANGE
- B) chance to connect
- C) connection chance
- D) chance for the connection

8

Which choice follows most logically from the first part of the sentence?

- A) NO CHANGE
- B) the Library of Congress in Washington, DC, meanwhile, has long served as the nation library of the United States.
- C) it is therefore not surprising that the DRC has been described as a “haven for [its] early members” in a *Harvard Magazine* article about the organization.
- D) in fact, generous donations from patrons such as the Lannan Foundation helped writers cover the cost of their travel to the Boston area.

Although the DRC officially **9** disbanded after only a decade (once its core members had moved away), it had hosted over one hundred award-winning artists and inspired many more who passed through **10** these doors. Most importantly, the DRC brought attention to the work of African American literary **11** forebears, and the organization's alumni have won many awards.

9

- A) NO CHANGE
- B) disbanded after only a ten-year decade
- C) disbanded, consequently losing its core members, after a duration of only one decade
- D) broke up and disbanded after only a ten-year period

10

- A) NO CHANGE
- B) their
- C) its
- D) whose

11

Which choice provides the best conclusion to the passage?

- A) NO CHANGE
- B) forebears as well as a new generation of poets, writers, and performers.
- C) forebears so that great writers like James Baldwin would never be forgotten.
- D) forebears, though the audience for literary writing, especially poetry, remains small throughout the United States.

Questions 12-22 are based on the following passage.

Revolutionizing Archaeology through Radiocarbon Dating

Radiocarbon dating, a powerful technique that allows archaeologists to determine the age of artifacts, was originally developed in the 1940s by the chemist Willard Libby. Libby **12** has determined that organic (carbon-containing) material could be dated based on the ratio of the radioactive carbon isotope carbon-14 to ordinary, nonradioactive carbon-12. He found that carbon-14 atoms slowly decay into nonradioactive nitrogen-14 atoms at a predictable rate. Using this finding, he developed methods to extract carbon from an object and measure the ratio of carbon-14 to carbon-12 to accurately determine the object's age. Unfortunately, these methods required large amounts of the sample to be cleansed with acids and bases to remove impurities and then combusted, making the technique useless for dating small, precious artifacts.

12

- A) NO CHANGE
- B) determines
- C) will determine
- D) determined

In 1992, **13** chemist-archaeologist Marvin Rowe wished to **14** theorize the age of fragile cave art in southwestern Texas. Believing that organic binders such as animal fat may have been used in the **15** paintings and eager to test this hypothesis regarding organic materials, Rowe and his team attempted to develop a nondestructive dating technique. They scraped samples of pigments from the cave **16** wall. Next, they placed them in a small glass chamber; then, they passed a thin layer of electrically charged oxygen gas over them. The gas gently oxidized the surface of the samples, extracting carbon to form carbon dioxide. The team could then analyze the carbon dioxide to determine the ratio of carbon-14 to carbon-12.

13

- A) NO CHANGE
- B) chemist-archaeologist, Marvin Rowe,
- C) chemist-archaeologist Marvin Rowe,
- D) chemist-archaeologist, Marvin Rowe

14

- A) NO CHANGE
- B) comprehend
- C) fathom
- D) ascertain

15

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

- A) NO CHANGE
- B) paintings, which show ancient artisans' skill in working with natural rock surfaces,
- C) paintings but concerned that the traditional radiocarbon-dating process would damage these materials,
- D) paintings, which depict hunting scenes and other representations of ancient tribal life,

16

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

- A) wall, placed them in a small glass chamber, and
- B) wall, and then did the following: first, they placed them in a small glass chamber; second, they
- C) wall: then, while placing them in a small glass chamber, they
- D) wall; the samples were then placed in a small glass chamber, and Rowe and his team

[1] After this initial success, Rowe’s team continued to refine the new technique. [2] To date items at a sacred burial **17** site, the team constructed a larger testing chamber consisting of a glass tube outfitted with electrodes. [3] Whole artifacts could be placed inside this chamber, eliminating the need to damage artifacts by cutting off samples for testing. [4] The team later developed a solvent capable of removing oils and soil-based **18** contaminants, both of which skew the results of radiocarbon dating—without harming delicate specimens. **19**

17

- A) NO CHANGE
- B) sight,
- C) cite,
- D) citation,

18

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

19

To improve the cohesion and flow of this paragraph the writer wants to add the following sentence.

This innovation allowed the team to test a wide variety of materials, including wood, leather, hair, and bone, that could not withstand a more abrasive cleansing method.

The sentence would most logically be placed

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

Advancements in nondestructive radiocarbon

20 dating yield results that match those the conventional radiocarbon dating technique. Artifacts such as the Venus of Brassempouy, a tiny Stone Age figurine that features one of the earliest known depictions of a human face, had not been dated for fear that they might be damaged. **21** Regardless of their fears, researchers will learn more about the artifacts **22** themselves. And about the societies that created them.

20

Which choice most effectively sets up the example in the paragraph's next sentence?

- A) NO CHANGE
- B) dating promise to transform the study of unique and significant objects.
- C) dating build on the discoveries of Willard Libby in the mid-twentieth century.
- D) dating, like the conventional method, can determine the age of objects as far back as 50,000 years.

21

Which choice provides the most effective transition from the previous sentence to the remainder of the paragraph?

- A) NO CHANGE
- B) Using a multidisciplinary approach,
- C) Now that these artifacts can be tested,
- D) To the delight of art enthusiasts,

22

- A) NO CHANGE
- B) themselves; not to mention
- C) themselves, they will also learn about
- D) themselves and

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

MacGyvers of the Deep

For Mandy Buchmeier, it was the daily challenge of on-the-fly problem solving that attracted her to commercial diving. “It’s like being an underwater MacGyver,” she once said, referring to the famously resourceful TV show character known for solving complex conundrums **23** with the use of the common materials of everyday life. In her career as a commercial diver, Buchmeier has seemingly done it all—from hazmat to inspection work to salvage to construction. Now she instructs the next generation of divers and encourages others to consider careers in this dynamic and in-demand field. Commercial diving offers job seekers a career path in a variety of industries, with options for both inland and deep-sea environments.

Within the broad field of commercial diving, jobs fall into two main **24** categories: onshore and offshore. Onshore divers, such as Buchmeier, work in inland bodies of **25** water, which they may, for example, salvage sunken objects from rivers and lakes or perform repairs on harbor piers and bridges. Offshore divers, **26** regardless, work on ships and maritime structures in oceans across the world. On these projects, divers may be at sea for weeks or months at a time, welding underwater pipelines or repairing oil rigs.

23

- A) NO CHANGE
- B) by utilizing commonplace, ordinary materials.
- C) and problems with materials.
- D) with commonplace materials.

24

- A) NO CHANGE
- B) categories; onshore
- C) categories onshore—
- D) categories onshore

25

- A) NO CHANGE
- B) water that
- C) water, there,
- D) water where

26

- A) NO CHANGE
- B) similarly,
- C) on the other hand,
- D) as a result,

To gain employment, a **27** perspective commercial diver must first obtain the proper certification through an accredited commercial diving **28** school a military dive school, or a college offering an associate's degree in commercial diving technology. **29** In fact, the offshore commercial diving industry is facing a shortage of skilled professionals. Because of the often-unpredictable nature of a day on the job, divers must be prepared to tackle any number of different tasks.

27

- A) NO CHANGE
- B) prospective
- C) prescriptive
- D) proscriptive

28

- A) NO CHANGE
- B) school:
- C) school,
- D) school—

29

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

- A) NO CHANGE
- B) A typical training program covers a wide range of subjects, including diving physics and procedures, operations planning, and mechanical skills.
- C) The work commercial divers perform is not always glamorous; some tasks, for example, involve working with sewer pipes.
- D) Recreational scuba divers also undergo rigorous training so they can gain confidence with the underwater environment and the equipment they use.

A high demand for certified commercial divers coupled with a projected 37 percent job growth rate for 2014 through 2024 translates to a correspondingly rosy employment picture. According to the US Bureau of Labor Statistics, in 2016 divers who worked in construction made an average yearly salary of

30 \$32,150; those who worked in support activities for water transportation averaged \$64,850 annually; and

31 each diver in scientific research and development services earned the only annual salary outside of the \$50,000–\$60,000 range in the diving field.

Average Annual Salaries
of Divers by Industry

Industry	Average annual salary
Engineering services	\$71,660
Support activities for water transportation	\$64,850
Administrative, support, waste management, and remediation services	\$53,490
Construction	\$52,820
Manufacturing	\$49,460
Scientific research and development services	\$36,400
Arts, entertainment, and recreation	\$32,150

Adapted from US Bureau of Labor Statistics. Published in 2016.

30

Which choice offers accurate information from the table?

- A) NO CHANGE
- B) \$49,460;
- C) \$52,820;
- D) \$53,490;

31

Which choice offers an accurate interpretation of the data in the table?

- A) NO CHANGE
- B) divers who worked in manufacturing earned an average yearly income of \$36,400, just above the lowest average compensation
- C) each diver in arts, entertainment, and recreation also earned \$52,820, an average annual salary higher than that earned by manufacturing workers
- D) divers in engineering services earned an average yearly income of \$71,660, the highest average compensation

Commercial diving is no easy job, though. Long hours spent submerged in sometimes inky black water can **32** be physically and mentally taxing, but as diver Marco Polo Manubes says, “You never get bored doing same thing daily.” Whether far out at sea or in a reservoir close to home, commercial diving offers rewarding and engaging career options to job seekers who are up for a challenge and willing to get **33** their feet wet.

32

- A) NO CHANGE
- B) knock a person out both physically and mentally,
- C) exact an onerous toll on a human’s physical and mental well-being,
- D) totally do in both the mind and the body,

33

- A) NO CHANGE
- B) one’s
- C) his or her
- D) your

Questions 34-44 are based on the following passage.

The Limits of Quantifying the Self

I recently purchased an activity tracker—a small, pellet-shaped device, clipped to my pocket, that counts my footsteps, measures my altitude, and tracks my location. More sophisticated **34** devices, strapped to one’s wrist, can do even more, including monitoring the wearer’s heart rate and sleep cycles. Marketers offer many reasons that consumers would want to buy one of these devices, but most of the reasons involve the empowering nature of the data collected: the more informed about our bodies **35** you become, the more control we will gain over our physical well-being.

34

- A) NO CHANGE
- B) devices strapped
- C) devices—strapped
- D) devices strapped,

35

- A) NO CHANGE
- B) he or she becomes,
- C) I become,
- D) we become,

This is the aspirational view, one that is also promulgated by members of the global movement known as the Quantified Self. The movement’s mission—and the mission’s optimism—is nicely **36** summarized and encapsulated by the slogan of the movement’s main organization, Quantified Self Labs: “self knowledge through numbers.” However, while data about oneself might ideally yield useful insight, the reality is somewhat less encouraging.

36

- A) NO CHANGE
- B) and summarily encapsulated
- C) encapsulated in sum
- D) encapsulated

One problem with consumer data-gathering devices like my activity tracker **37** are that in many countries they are exempt from formal **38** oversight. It would help ensure the accuracy of the data they collect. In the United Kingdom, for example, the Medicines and Healthcare Products Regulatory Agency does regulate certain devices, but only those that claim to diagnose or prevent disease and injury (a claim that most companies selling consumer activity-tracking devices do not make). In the United States, the Food and Drug Administration has taken a similar approach. As a result, most devices available on store shelves in these countries **39** are not subsidized by medical insurance providers, and while some metrics (such as number of steps) are represented fairly accurately across different **40** manufacturers' devices, the lack of oversight allows for other metrics (such as heart rate) to be reported with significant error.

37

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

38

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

- A) oversight that
- B) oversight, because it
- C) oversight and also
- D) oversight, as it

39

Which choice most clearly reinforces the main focus of the paragraph?

- A) NO CHANGE
- B) cannot prevent physical injury,
- C) carry no official assurances,
- D) must be evaluated independently by journalists and consumers,

40

- A) NO CHANGE
- B) manufacturer's devices,
- C) manufacturer's device's,
- D) manufacturers' devices',

And then the question arises: **41** How useful can any data-collection device be if most users stop wearing such devices regularly once the novelty has worn off?

Journalist David Pierce echoes this question in his review of one of many wearable devices that **42** have flooded the market in recent years. Learning from the device that he rarely gets a full cycle of REM sleep, **43** Pierce’s observation is as follows: “That’s great—the more you know and all that—but I have no idea why. . . . So far the only thing I can figure out is that I should go to bed earlier.”

41

Which question provides the best transition from the previous paragraph to this one?

- A) NO CHANGE
- B) Because some activity-tracking devices provide little (if any) visible feedback to users, how can users be sure that the devices are functioning properly and continuously over the course of a day?
- C) Can makers of activity-tracking devices be trusted to safeguard the data that their devices collect?
- D) Even if the data were guaranteed to be highly accurate, what exactly does one do with it?

42

Which choice best introduces the specific information about the device provided in the next sentence?

- A) NO CHANGE
- B) could easily be mistaken for each other based on their uniformly utilitarian designs.
- C) track nonwaking activities as well as waking ones.
- D) are meant to help users achieve their fitness goals.

43

- A) NO CHANGE
- B) Pierce observes:
- C) this observation is made by Pierce:
- D) the device elicits this observation from Pierce:

44 Some data collected by activity-tracking devices does have obvious applications for improving physical well-being, but much of the data currently lacks purpose. This issue as well as that of the data's reliability will need to be addressed if the ambitious vision of the Quantified Self is truly to be achieved.

44

At this point, the writer is considering deleting the underlined portion, adjusting the capitalization as needed. Should the underlined portion be kept or deleted?

- A) Kept, because it acknowledges an important exception to the writer's argument.
- B) Kept, because it contributes to the writer's analysis of why activity-tracking devices are so popular.
- C) Deleted, because it undermines the previous paragraph's main idea.
- D) Deleted, because it presents information that is irrelevant to the passage's discussion of the usefulness of the data.

STOP

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

No Test Material On This Page



Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

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

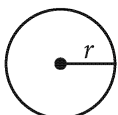
DIRECTIONS

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

NOTES

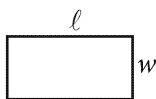
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated,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

REFERENCE

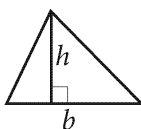


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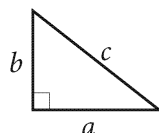
$$C = 2\pi r$$



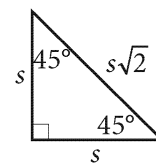
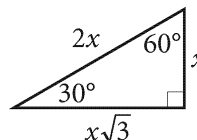
$$A = \ell w$$



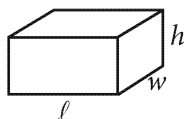
$$A = \frac{1}{2}bh$$



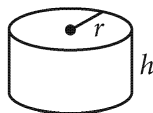
$$c^2 = a^2 + b^2$$



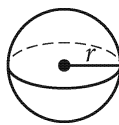
Special Right Triangles



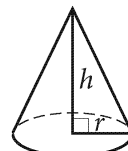
$$V = \ell wh$$



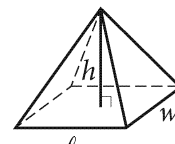
$$V = \pi r^2 h$$



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



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



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

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

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

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



1

$$(x + 15) - (x + 4)$$

What is the value of the given expression?

- A) 11
- B) 19
- C) $2x + 11$
- D) $2x + 19$

2

Line p in the xy -plane contains the points $(5, 0)$ and $(5, 5)$. Which of the following is the equation of line p ?

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

3

$$\text{Equation A: } y = 3x$$

$$\text{Equation B: } y = -2x + 5$$

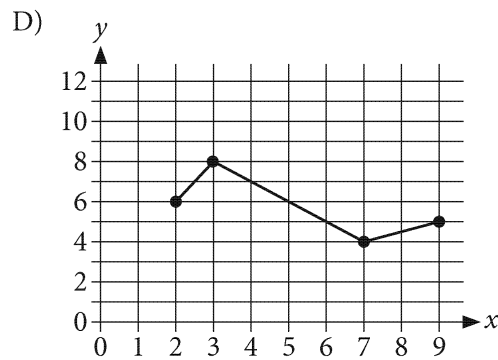
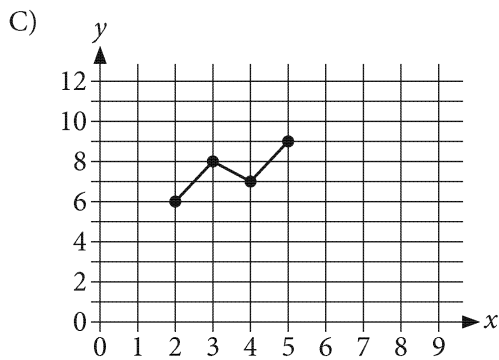
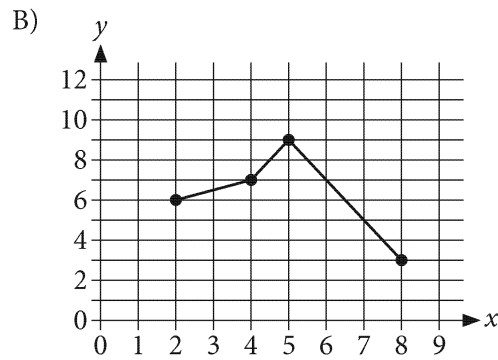
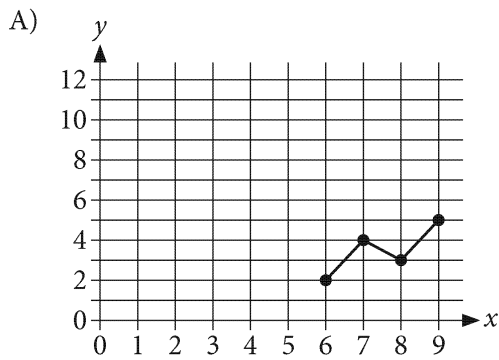
When the given system of equations is graphed in the xy -plane, which of the following statements is true about the point $(1, 3)$?

- A) The point $(1, 3)$ satisfies only equation A.
- B) The point $(1, 3)$ satisfies only equation B.
- C) The point $(1, 3)$ satisfies both equations in the system.
- D) The point $(1, 3)$ satisfies neither equation in the system.



x	$f(x)$
2	6
3	8
4	7
5	9

The table shown gives several values of x and their corresponding values of $f(x)$ for the function f . Which of the following could be the graph of $y = f(x)$ in the xy -plane?





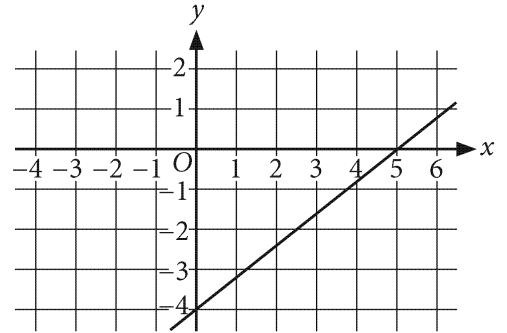
5

$$T(h) = 15h$$

The function T , defined by the equation shown, gives the total amount of money, in dollars, Ellie makes per day at her job, where h is the number of hours Ellie works that day. Which of the following is the best interpretation of 15 in this context?

- A) The amount, in dollars, Ellie makes per hour
- B) The amount, in dollars, Ellie makes per day
- C) The number of hours Ellie works per day
- D) The number of days Ellie works per pay period

6



The graph of the equation $8x - 10y = C$, where C is a constant, is shown. What is the value of C ?

- A) -40
- B) -18
- C) 18
- D) 40



7

$$D = \frac{V - S}{N}$$

The given equation relates the variables D , N , S , and V . Which of the following equations gives S in terms of D , N , and V ?

- A) $S = \frac{DN}{V}$
- B) $S = \frac{D - N}{V}$
- C) $S = DN - V$
- D) $S = V - DN$

8

The kinetic energy K , in joules, of an object is given by the formula $K = \frac{1}{2}mv^2$, where m is the mass of the object, in kilograms, and v is the velocity of the object, in meters per second. If the kinetic energy of a specific object can be found by using the formula

$$K = 10v^2, \text{ what is the mass of the object, in}$$

kilograms?

- A) 5
- B) 10
- C) 20
- D) 100

9

$$5x - 2 = qx - (x + 2)$$

In the equation shown, q is a constant. If the equation has infinitely many solutions, what is the value of q ?

- A) 7
- B) 6
- C) 5
- D) 4



10

$$\frac{6}{x-2} + 4 = \frac{1}{x-2}$$

What is the solution to the given equation?

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

11

$$(x+5)^2 + (y+12)^2 = 49$$

The given equation represents a circle in the xy -plane. If the circle is translated up 2 units, which of the following is an equation of the resulting circle?

- A) $(x+3)^2 + (y+12)^2 = 49$
- B) $(x+5)^2 + (y+10)^2 = 49$
- C) $(x+5)^2 + (y+14)^2 = 49$
- D) $(x+7)^2 + (y+12)^2 = 49$

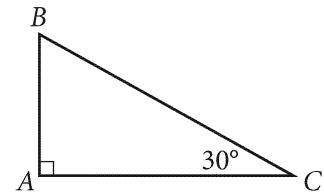
12

$$x^{\frac{a}{6}} = \sqrt[3]{x^3}$$

In the equation above, $x > 1$. What is the value of ac ?

- A) 2
- B) 3
- C) 9
- D) 18

13



In the right triangle above, the length of segment AC is 5. What is the length of segment AB ?

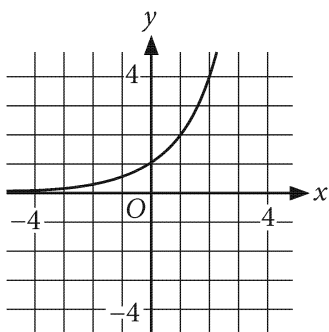
- A) $\frac{5}{\sqrt{3}}$
- B) $\frac{5}{\sqrt{2}}$
- C) $5\sqrt{2}$
- D) $5\sqrt{3}$



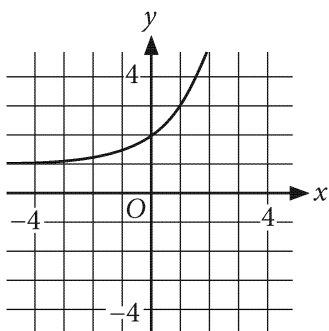
14

Which of the following is the graph of $y = 2^x - 1$ in the xy -plane?

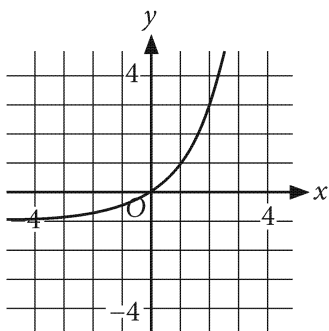
A)



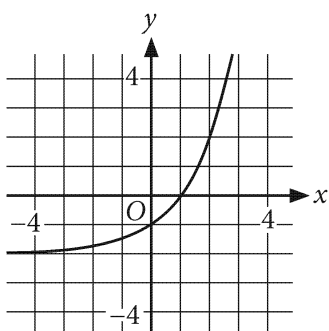
B)



C)



D)



15

$$f(x) = 4^{-(2+x)}$$

Which of the following equivalent forms of the given function displays the y -coordinate of the y -intercept of its graph in the xy -plane as a constant?

A) $f(x) = \frac{1}{16} \left(\frac{1}{4} \right)^x$

B) $f(x) = \left(\frac{1}{4} \right)^{(2+x)}$

C) $f(x) = 2^{-2(2+x)}$

D) $f(x) = 4^{(-2-x)}$



DIRECTIONS

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

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.

5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If

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

 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:

Write answer in boxes. →

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

← Fraction line

Grid in result.

Answer: 2.5

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

← Decimal point

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

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

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

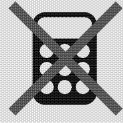
.	6	6	7
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	<input checked="" type="radio"/>	<input checked="" type="radio"/>	6
7	7	7	<input checked="" type="radio"/>
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

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

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

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



16

$$y = 3x - 1$$

$$y = 2x + 3$$

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

17

If $y = 2x + 10$, what is the value of y when $x = 5$?

18

$$10x + 3 - 5x + 7 = 35$$

What value of x satisfies the equation above?

19

The volume of rectangular solid X is 200 cubic units. The length, the width, and the height of rectangular solid Y are 2 times the corresponding dimensions of rectangular solid X. What is the volume, in cubic units, of rectangular solid Y?

20

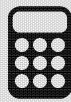
$$2x^2 + 3x - 4 = 0$$

If one of the solutions of the given equation is $\frac{-3 + \sqrt{c}}{4}$, where c is a constant, what is the value of c ?

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.

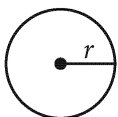
DIRECTIONS

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 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

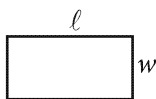
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated,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

REFERENCE

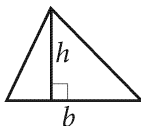


$$A = \pi r^2$$

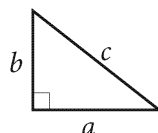
$$C = 2\pi r$$



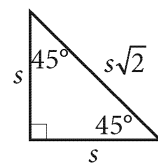
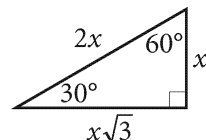
$$A = \ell w$$



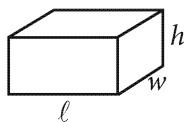
$$A = \frac{1}{2}bh$$



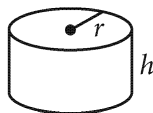
$$c^2 = a^2 + b^2$$



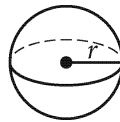
Special Right Triangles



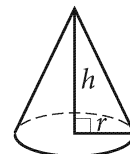
$$V = \ell wh$$



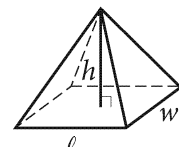
$$V = \pi r^2 h$$



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



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



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

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.



1

Energy is being used at a rate of 75 joules per second. At this rate, how long will it take for 30,000 joules of energy to be used?

- A) 0.0025 second
- B) 400 seconds
- C) 29,925 seconds
- D) 2,250,000 seconds

2

$$5x + 22y = 40$$

Lycopene is a chemical that occurs naturally in some fruits and vegetables. Shreya combined x cups of carrot juice and y cups of tomato juice to make a mixture that contained 40 milligrams of lycopene, which is represented by the given equation. Based on the equation, if the mixture consisted of 2.5 cups of carrot juice, how many cups of tomato juice did Shreya use to make the mixture?

- A) 3.00
- B) 1.50
- C) 1.25
- D) 0.75

3

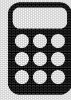
The air pressure in Charlize's scuba tank is 3,442 pounds per square inch. The area of the base of the tank is approximately 40 square inches. Which of the following is closest to the force, in pounds, exerted by the air on the base of the tank? (force = pressure \times area)

- A) 85
- B) 1,700
- C) 69,000
- D) 140,000

4

What is 50% of 20 ?

- A) 2
- B) 3
- C) 10
- D) 30

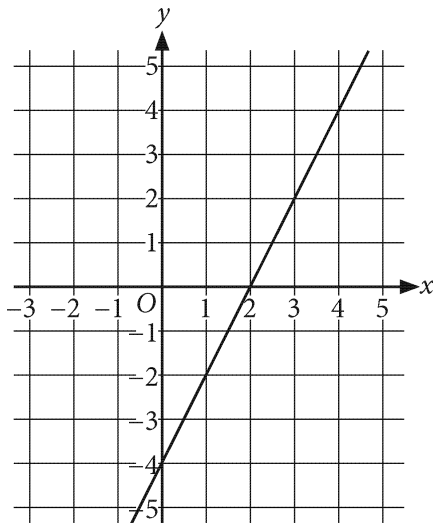


5

If $2x + 4 = 10$, which of the following is equal to 5?

- A) $x + 2$
- B) $x + 4$
- C) $2x + 2$
- D) $4x + 8$

6



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

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

Questions 7 and 8 refer to the following information.

Colony A growth model: $d_A = 0.038t + 3.1$

Colony B growth model: $d_B = 0.076t + 4.3$

In a lab, two colonies of a certain bacteria are growing on a nutrient medium in two different petri dishes. A biologist measures the sizes of the colonies as they grow. The size of a colony is defined as the diameter d , in millimeters (mm), of the colony. The given equations model the colony size, in mm, for colony A and colony B t hours after the colonies were first measured. The equations model the sizes of colonies for $t \leq 24$.

7

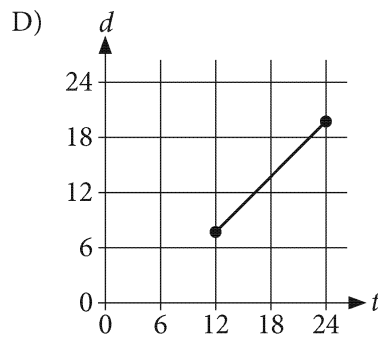
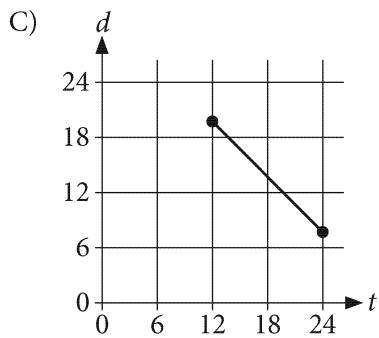
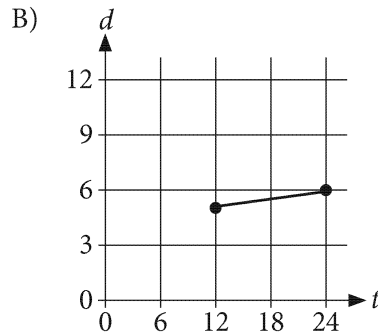
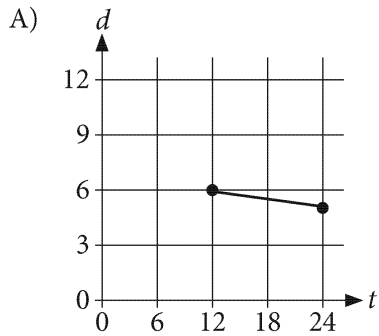
Based on the colony A growth model, what is the size of colony A, to the nearest tenth of a millimeter, when $t = 20$ hours?

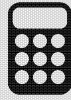
- A) 3.9
- B) 5.1
- C) 6.2
- D) 62.0



8

Which of the following is the graph, in the td -plane, of the colony B growth model for $12 \leq t \leq 24$?





9

Pyramid location	Height		
	Less than 50 meters	50–60 meters	Greater than 60 meters
Belize	1	0	0
Mexico	2	1	2
Guatemala	1	1	2

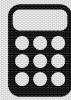
The table shows the distribution of the heights and locations of 10 Mesoamerican pyramids. If one of the pyramids located in Mexico is selected at random, what is the probability it has a height greater than 60 meters?

- A) $\frac{2}{3}$
- B) $\frac{2}{4}$
- C) $\frac{2}{5}$
- D) $\frac{2}{10}$

10

The number of pens in an office supply cabinet decreases by 2 each day. Which of the following types of functions best models the number of pens in the office supply cabinet as a function of time?

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



11

A researcher asked study participants to report the number of jumps they observed in a video of a person jumping rope. The frequency table summarizes the number of jumps that each of the 30 participants reported.

Number of jumps reported	Frequency
0	1
1 to 10	0
11 to 20	2
21 to 30	17
31 to 40	10

Due to a conflict of interest, the participant who reported 0 jumps was removed from the study. When the participant who reported 0 jumps was removed from the study, what was the effect on the mean number of jumps reported?

- A) The mean decreased.
- B) The mean increased.
- C) The mean remained the same.
- D) The effect on the mean cannot be determined.

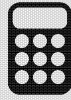
12

The closing price, in dollars, per barrel of crude oil is listed in the table for 5 days in May 2016.

Date	Closing price per barrel (dollars)
May 2, 2016	47.69
May 3, 2016	46.99
May 4, 2016	46.90
May 5, 2016	47.25
May 6, 2016	47.78

What is the median closing price, in dollars, per barrel of crude oil during this 5-day period?

- A) \$46.90
- B) \$47.25
- C) \$47.32
- D) \$47.69



Questions 13 and 14 refer to the following information.

A credit card company offers two credit cards with different cash-back rewards programs.

For Credit Card A, the equation $R(x) = 0.03(x - 100)$ gives the relationship between the reward amount earned, $R(x)$, in dollars, and the amount charged on the card, x , in dollars, where x is greater than 100.

Credit Card B earns a 1% reward for every dollar that is charged on that card.

13

If $y = R(x)$ is graphed in the xy -plane, what is the slope of the line?

- A) 0.03
- B) 0.01
- C) -100
- D) -300

14

Which of the following inequalities represents the amount x , in dollars, charged on Credit Card A that will result in earning at least \$30 in rewards?

- A) $x \leq 1,000$
- B) $x \geq 1,000$
- C) $x \leq 1,100$
- D) $x \geq 1,100$

15

According to Hooke's law, the force needed to compress a spring by a distance is proportional to that distance. For a certain spring, a force of F causes the spring to compress by a distance of x . If a force of $4F$ is applied to the spring, by what distance will the spring compress in terms of x ?

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



16

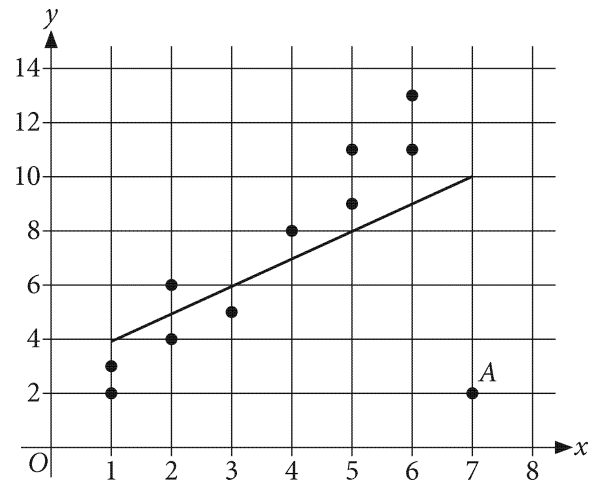
$$y = -3x + 1$$

$$y = 3x - 5$$

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

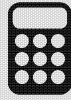
- A) -4
- B) -2
- C) 1
- D) 3

17

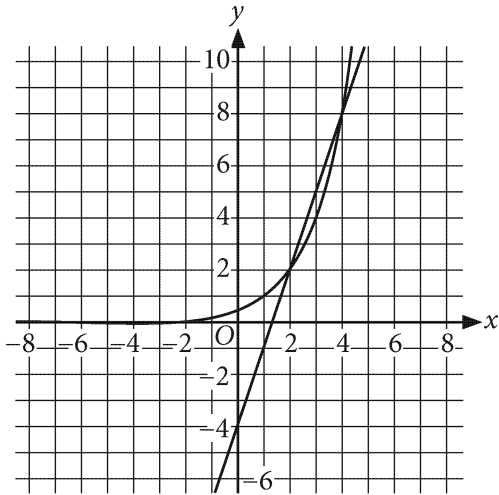


The scatterplot for a set of data is shown in the xy -plane above. A line of best fit for the data is also shown. If point A is removed from the data and a new line of best fit is found for the remaining 10 points, which of the following expresses the relationship between u , the slope of the new line of best fit, and t , the slope of the original line of best fit?

- A) $u = t$
- B) $u > t$
- C) $u < t$
- D) A comparison of u and t cannot be made based on the information given.



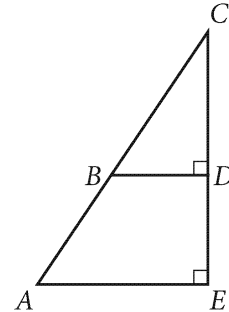
18



The graphs of the linear function $y = 3x - 4$ and the exponential function $y = \frac{1}{2}(2)^x$ are shown in the xy -plane. For which of the following intervals is $3x - 4 > \frac{1}{2}(2)^x$?

- A) $x < -4$
- B) $-4 < x < 2$
- C) $2 < x < 4$
- D) $x > 4$

19



If $\cos(A) = 0.57$, what is the value of $\sin(C)$?

- A) 0.19
- B) 0.43
- C) 0.57
- D) 0.81

20

A carpenter is hired to build a rectangular storage box. The customer wants the box to have a width of 2 feet and a capacity of 42 cubic feet. The carpenter plans to make the length of the box 4 feet greater than the height of the box. If the carpenter's plans and the customer's specifications are met, what will be the height, in feet, of the box?

- A) 3
- B) 5.25
- C) 7
- D) 10.5



21

$$|3x - 2| = -5$$

How many solutions does the given equation above have?

- A) Zero
- B) One
- C) Two
- D) Infinitely many

22

$$8x + a = 4(bx + c)$$

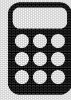
In the given equation, a , b , and c are constants. If the equation has an infinite number of solutions, which of the following must be true?

- A) $b = 2$ and $c = 4a$
- B) $b = 2$ and $c = \frac{a}{4}$
- C) $b = a$ and $c = \frac{a}{4}$
- D) $b = a$ and $c = 2$

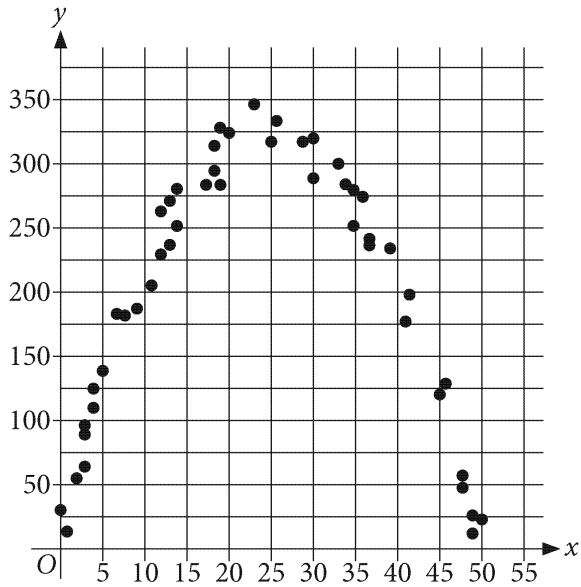
23

The function f has the property that for each increase of 1 in the value of x , the value of $f(x)$ is halved. If $f(0) = 2$, which of the following defines $f(x)$?

- A) $f(x) = -x + 2$
- B) $f(x) = -\frac{1}{x-2}$
- C) $f(x) = \frac{1}{2}\sqrt{2-x}$
- D) $f(x) = 2\left(\frac{1}{2}\right)^x$



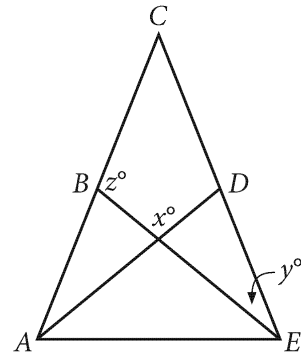
24



The points in a data set are shown in the scatterplot. Which of the following quadratic equations best models the data?

- A) $y = -0.5x^2 + 25x + 15$
- B) $y = -0.5x^2 - 25x + 15$
- C) $y = 0.5x^2 - 25x + 15$
- D) $y = 0.5x^2 + 25x + 15$

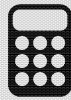
25



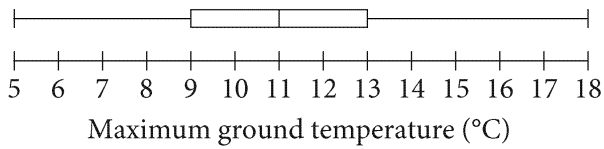
Note: Figure not drawn to scale.

In the figure, points B and D are the midpoints of \overline{AC} and \overline{CE} , and $AC = CE$. If $x = 100$ and $y = 25$, what is the value of z ?

- A) 75
- B) 100
- C) 105
- D) 125



26



The box plot shows the maximum ground temperature, in degrees Celsius ($^{\circ}\text{C}$), each day for 40 solar days on Mars. Which of the following could be the number of solar days for which the maximum ground temperature on Mars was at least 9°C ?

- A) 10
- B) 20
- C) 25
- D) 30

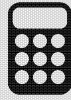
27

If the graphs in the xy -plane of $y = \frac{2}{15 - 6x}$ and $y = \frac{-6}{h(x)}$ are identical for all values of x for which

the equations are defined, which of the following

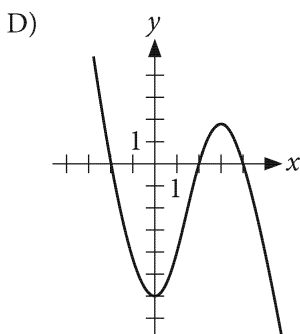
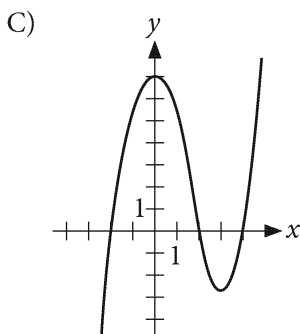
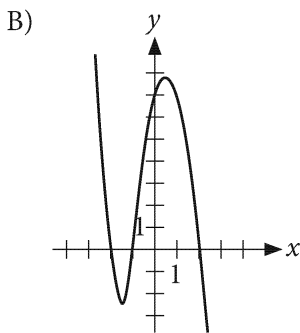
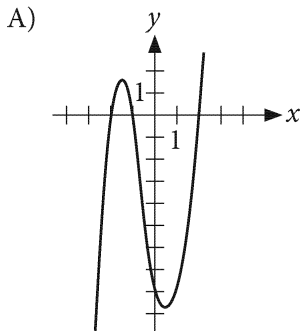
represents $h(x)$?

- A) $2x - 5$
- B) $6x - 15$
- C) $-18x + 45$
- D) $18x - 45$

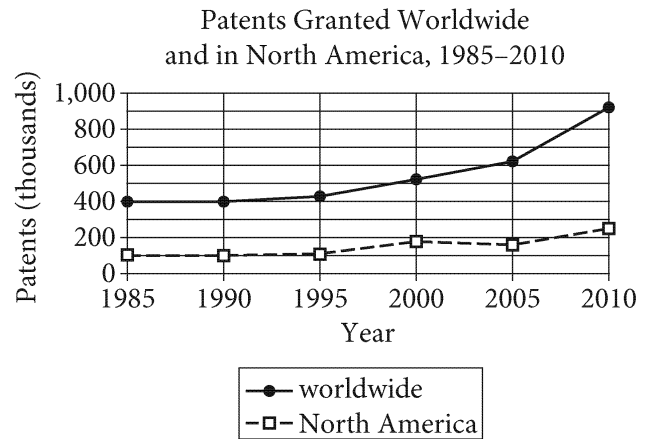
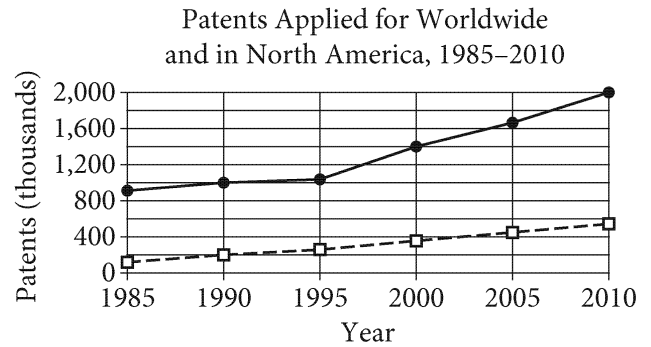


$$f(x) = (x - a)(x + b)(x + c)$$

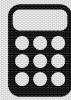
The function f is defined above where a , b , and c are positive constants. Which of the following could be the graph of f in the xy -plane?



Questions 29 and 30 refer to the following information.



The graphs above show, for every fifth year from 1985 through 2010, the number of patents applied for and the number of patents granted worldwide and in North America.



29

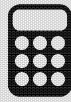
Of the following, which best approximates the number of patents applied for from outside of North America in the year 1990?

- A) 300,000
- B) 400,000
- C) 800,000
- D) 900,000

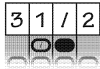
30

Which of the following is closest to the percent increase in the number of patents granted worldwide from 2000 to 2010?

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


DIRECTIONS

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

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

Write answer in boxes. →

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

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

← Fraction line

Grid in result.

Answer: 2.5

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

← Decimal point

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

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

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

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

Answer: 201 – either position is correct

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

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

NOTE:

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



31

The average weight of adult male giraffes is 3,009 pounds. If that weight is 31 pounds less than 20 times the birth weight of a baby giraffe born at the Virginia Zoo, what is the weight, in pounds, of the baby giraffe?

32

If 250% of a positive number n can be represented as kn , what is the value of k ?

33

In the equation $x^2 + kx + 1 = 0$, k is a positive constant. If the equation has exactly one solution, what is the value of k ?

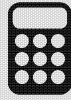
34

Activity level	Number of people
High	7
Moderate	10
Low	22
Inactive	11
Total	50

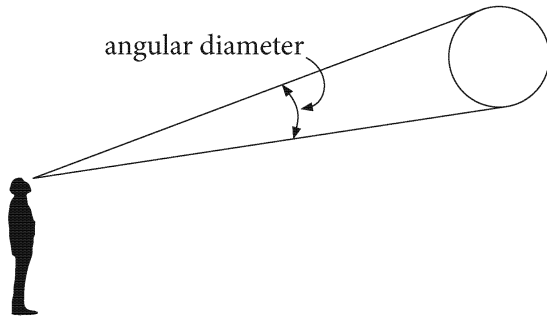
The table above shows the activity levels that were recorded for a group of 50 people by fitness trackers over a one-hour period. If one of the 50 people is selected at random, what is the probability that the person selected has a recorded activity level of high? (Express your answer as a decimal or fraction, not as a percent.)

35

A bus company collected a total of \$1080 from passengers one morning. Each passenger paid either a \$3.00 regular fare or a \$1.50 reduced fare. If 7 of every 8 passengers paid the regular fare, what is the total amount of money, in dollars, that the bus company collected from passengers paying the regular fare? (Disregard the \$ sign when gridding your answer.)



Questions 36 and 37 refer to the following information.



Note: Figure not drawn to scale.

Celestial object	Angular diameter (degrees)
Sun	0.53000
Mercury	0.00305
Venus	0.01658
Moon	0.52000
Mars	0.00695
Jupiter	0.01385
Saturn	0.00574
Uranus	0.00113
Neptune	0.00066

Astronomers use angular diameter to describe the apparent size of objects in space. The table shows the angular diameters, in degrees, for several celestial objects as reported by an astronomer from a specific location on Earth on a certain date. Note: A planet's ring system is included in the measurement of the angular diameter.

36

Of the celestial objects listed in the table, how many have an angular diameter that is greater than the mean angular diameter?



37

What is the angular diameter of the Moon in arcminutes? (1 degree is equal to 60 arcminutes.)



38

Point R lies on a unit circle at coordinates $(1, 0)$ and point O is at the center at coordinates $(0, 0)$. Point P also lies on the unit circle where $m\angle POR = \frac{\pi}{2}$. If the coordinates of point P are (a, b) , where a and b are constants, what is the value of a ?

STOP

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