Reading Test

65 MINUTES, 52 QUESTIONS

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

DIRECTIONS

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

Questions 1-10 are based on the following passage.

This passage is adapted from Robertson Davies, *What's Bred in the Bone*. ©1985 by Robertson Davies. Frank Cornish is a young boy in Canada during World War I.

Frank's life was not at all dark; he was not clever at school, but he attracted Miss McGladdery's attention by the seriousness with which he applied himself in the weekly half-hour that was given to Art. Miss McGladdery taught Art, as she taught everything, and she instructed all three classes at once in the mysteries of drawing a pyramid and shading one side of it so that it appeared to have a third dimension—or as she put it the shaded side "went back" and the unshaded side "stuck out". A pyramid and a circle which shading made into a ball, and, as the culmination of Art, an apple. Shading was done by scuffling down one side of the object with the flat of the pencil's point. But Frank did not think that was good enough; he had learned a craft at home in which shading was done with tiny parallel lines, achieved with great patience, and even by cross-hatching.

"If you take the time to do all that tick-tack-toe on your apple you won't be finished by four, and you'll have to stay in till it's done," said Miss McGladdery. So he did "stay in" with half a dozen other culprits who had work to finish before they were released for the weekend, and when he showed Miss McGladdery his apple at half past four she admitted reluctantly that it was "all right", for she did not want to encourage the boy to be "fancy" and try to go beyond what the class demanded and what she herself knew. Frank could draw, which was something not required in Art, and Miss McGladdery had come upon a caricature of herself done in the back of his arithmetic workbook. Miss McGladdery, who was a fair-minded woman, except about religion and politics, and had no vanity, admitted to herself that it was good, so she said nothing about it. Frank was an oddity, and, like a true Scot, Miss McGladdery had a place in her approval for "a chiel o' pairts", so long as he did not go too far.

Almost every Saturday Frank could escape into a world of imagination by going to the matinee at the McRory Opera House, where movies were shown. He got in for nothing, because the girl at the ticket office recognized him, and as he pushed his ten-cent piece across the little counter she winked and quietly pushed it back again.

Then inside, and into his favourite seat, which was on the aisle at the back; he did not crowd into the front rows, as did the other children. Riches unfolded. An episode—locally pronounced "esipode"—of a serial, in which, every week, a noble cowboy was brought to the point of a horrible death by remorseless villains who sought to rob him of the equally noble girl he loved. Of course, it all came out right at the end of Esipode Twelve, and then another great adventure was announced for the weeks to follow. After the serial, a hilarious comedy, sometimes about the Keystone Komedy Kops, who were as incapable of dealing with disaster as the girl in the serial.

CONTINUE

Frank had an eye for the movies that took in more than the action; he saw backgrounds, landscapes (many of them painted, if you looked carefully), and angles; he even saw light. It was to his grandfather, the Senator, that he owed this extension of his understanding, for the Senator was an amateur photographer. His techniques were not sophisticated in terms of the Great War period when Frank was so often his companion; he worked with a large box-camera and a tripod. With this load he trudged happily around Blairlogie, taking pictures of the town, and such of its more picturesque citizens as he could persuade to stand or sit still for the necessary number of seconds, and he drove out to the lumber camps from which his growing fortune flowed, and took pictures of the men at work, or standing by giant trees lying on their sides. He took pictures in his mills. He took pictures of young Blairlogie men who were going off to war, with their rifles and kit, and gave copies to their families. The Senator never thought of himself as an artist, but he had an eye for a picture and he was an enthusiastic pursuer of all the many sorts of light the Canadian seasons afford. He talked to Frank about it as if the boy were of his own age. His senatorial and grandpaternal aloofness quite disappeared on these expeditions in search of what he called "sun-pictures".

"It's all a question of the light, Frank," he said repeatedly; "the light does it all." And he explained that all that painstaking shading in Art was related to light—something which certainly had never occurred to Miss McGladdery.

1

Which statement about Frank's attitude toward drawing can most reasonably be inferred from the passage?

A) He believes that his creativity will earn him special recognition from others.

B) He is committed to his work regardless of the diligence it requires.

C) He accepts the fact that while he is talented, he must still strive to improve.

D) He pursues his interest in art because it gives him a rare chance to excel.

2

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

A) Lines 1-4 ("Frank's . . . to Art")

B) Lines 5-10 ("Miss . . . stuck out")

C) Lines 12-14 ("Shading . . . point")

D) Lines 14-18 ("But Frank . . . cross-hatching")

3

Which choice best describes the passage?

A) A lasting effect of a meaningful interaction between two characters is analyzed.

B) The influence of a character's early experiences with art on his later life is examined.

C) A character's early experiences with art at school and outside of school are described.

D) The perspective of a young character is contrasted with those of two adult characters.

4

The passage suggests which similarity between Frank's grandfather and Miss McGladdery?

A) Though they attempt to instruct Frank about art, they sense that Frank is reluctant to heed their advice.

B) Though they conduct themselves modestly, they privately take great pride in their accomplishments.

C) Though they enjoy teaching, they ultimately prefer their own artistic pursuits to helping others.

D) Though they engage in artistic activities, these activities do not define their identities as professionals.

CONTINUE

5

The author's use of the phrase "Riches unfolded" (lines 48-49) has the main effect of

A) emphasizing the complexity of the movies' plot lines and characters.

B) conveying Frank's delight in the movies shown at the theater.

C) contrasting Frank's reaction to the movies with that of the other children.

D) suggesting the care taken by the theater's staff in selecting the movies.

6

As used in line 54, "right" most nearly means

A) favorably.

B) precisely.

C) reasonably.

D) normally.

7

The sentence in lines 60-63 ("Frank . . . light") primarily serves to

A) suggest that the movies shown at the theater are not of high quality.

B) identify a way to distinguish landscapes from other movie backgrounds.

C) convey that Frank applies his understanding of artistic elements to other activities.

D) establish a contrast between Frank's perspective and the narrator's perspective.

8

Based on the passage, a love of photography transforms Frank's grandfather's personality in which way?

A) He becomes less impatient with members of his community.

B) He becomes more enthusiastic about the war effort.

C) He interacts with Frank on a more personal level.

D) He takes a more generous view of Miss McGladdery.

9

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

A) Lines 63-66 ("It was . . . photographer")

B) Lines 66-69 ("His techniques . . . tripod")

C) Lines 77-79 ("He took . . . families")

D) Lines 84-86 ("His senatorial . . . sun-pictures")

10

The last paragraph mainly serves to

A) underscore a contrast between Frank's grandfather and Miss McGladdery.

B) highlight the importance of art to Frank and his grandfather.

C) reveal Frank's grandfather's dissatisfaction with Miss McGladdery's teaching.

D) convey Frank's admiration for his grandfather's expertise.

CONTINUE

Questions 11-20 are based on the following passages.

Passage 1 is adapted from a speech delivered by Paul Robeson, "For Freedom and Peace." ©1978 by Brunner/Mazel, Inc. Originally published in 1949. Passage 2 is adapted from a speech delivered in 1949 by Jackie Robinson, "Testimony before the House Un-American Activities Committee." Robeson, an actor and singer, discusses remarks he made at a peace conference in Paris during a time of high tension between the United States and the communist Soviet Union, also called Russia. Robinson, a prominent athlete, was called before the House of Representatives to respond to Robeson's remarks.

Passage 1

. . . I love [the] Soviet people more than any other nation, because of their suffering and sacrifices for us, the Negro people, the progressive people, the people of the future in this world.

At the Paris Peace Conference I said it was unthinkable that the Negro people of America or elsewhere in the world could be drawn into war with the Soviet Union. I repeat it with hundred-fold emphasis. THEY WILL NOT. . . .

I am born and bred in this America of ours. I want to love it. I love a part of it. But it's up to the rest of America when I shall love it with the same intensity that I love the Negro people from whom I spring,—in the way that I love progressives in the Caribbean, the black and Indian peoples of South and Central America, the peoples of China and Southeast Asia, yes suffering people the world over,—and in the way that I deeply and intensely love the Soviet Union. That burden of proof rests upon America.

Now these peoples of the Soviet Union, of the new Eastern Democracies, of progressive Western Europe, and the representatives of the Chinese people whom I met in Prague and Moscow, were in great part Communists. They were the first to die for our freedom and for the freedom of all mankind. So I'm not afraid of Communists; no, far from that. I will defend them as they defended us, the Negro people. . . .

But to fulfill our responsibilities as Americans, we must unite, especially we Negro people. We must know our strength. We are the decisive force. . . . That's why they fear us. And if we unite in all our might, this world can fast be changed. Let us create that unity now. And this important, historic role of the Negro people our white allies here must fully comprehend. This means increasing understanding of the Negro, his tremendous struggle, his great contributions, his potential for leadership at all levels in the common task of liberation. It means courage to stand by our side whatever the consequences, as we the Negro people fulfill our historic duty in Freedom's struggle.

Passage 2

I've been asked to express my views on Paul Robeson's statement in Paris to the effect that American Negroes would refuse to fight in any war against Russia because we love Russia so much. I haven't any comment to make on that statement except that if Mr. Robeson actually made it, it sounds very silly to me. But he has a right to his personal views, and if he wants to sound silly when he expresses them in public, that's his business and not mine. He's still a famous ex-athlete and a great singer and actor.

I understand that there are some few Negroes who are members of the Communist Party, and in the event of war with Russia they'd probably act just as any other Communist would. So would members of other minority and majority groups. There are some colored pacifists, and they'd act just like pacifists of any color. And most Negroes—and Italians and Irish and Jews and Swedes and Slavs and other Americans—would act just as all these groups did in the last war. They'd do their best to keep their country out of war; if unsuccessful, they'd do their best to help their country win the war—against Russia or any other enemy that threatened us.

This isn't said as any defense of the Negro's loyalty, because any loyalty that needs defense can't amount to much in the long run. And no one has ever questioned my race's loyalty except a few people who don't amount to very much.

What I'm trying to get across is that the American public is off on the wrong foot when it begins to think of radicalism in terms of any special minority group. It is thinking of this sort that gets people scared because one Negro, speaking to a Communist group in Paris, threatens an organized boycott by 15,000,000 members of his race.

CONTINUE

I can't speak for any 15,000,000 people any more than any other one person can, but I know that I've got too much invested for my wife and child and myself in the future of this country, and I and other Americans of many races and faiths have too much invested in our country's welfare, for any of us to throw it away. . . .

But that doesn't mean that we're going to stop fighting race discrimination in this country until we've got it licked. It means that we're going to fight it all the harder because our stake in the future is so big.

11

In Passage 1, the speaker indicates that he loves the Soviet people because they

A) are in the same situation as that of black people.
B) make no distinctions between white people and black people.
C) work to advance the interests of black people.
D) need the assistance of black people.

12

Based on Passage 1, the speaker would most likely agree with which statement about the relationship between a nation and its citizens?

A) A nation depends more on its citizens than its citizens depend on the nation.
B) A nation has the right to require that its citizens fight in its defence.
C) A nation should first and foremost protect its citizens from outside dangers.
D) A nation must earn the devotion of citizens through its treatment of them.

13

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

A) Lines 1-4 ("I love . . . world")
B) Lines 5-9 ("At the . . . NOT")
C) Lines 10-14 ("I am . . . spring")
D) Lines 30-32 ("But to . . . strength")

14

The speaker of Passage 1 uses the phrases "historic role" (line 35) and "historic duty" (line 42) most likely to

A) highlight the accomplishments of earlier generations of black leaders.
B) suggest that black people play a unique part in advancing a cause for all humanity.
C) underscore how long black people have been struggling for equality.
D) emphasize the previous demonstrations of the Soviet Union's commitment to ending the oppression of black people anywhere it occurs.

15

Which choice best supports the idea that the speaker of Passage 2 would agree that a person's political opinions do not necessarily detract from that person's accomplishments?

A) Lines 44-47 ("I've been . . . much")
B) Lines 47-50 ("I haven't . . . to me")
C) Lines 53-54 ("He's still . . . actor")
D) Lines 55-58 ("I understand . . . would")

CONTINUE

16

In lines 82 and 85, the speaker's use of the word "invested" mainly serves to

A) convey the speaker's sense that he and other Americans have a personal interest in seeing the United States flourish.

B) emphasize the speaker's point that his responsibilities to his family supersede his responsibilities to his country.

C) foreshadow the speaker's claim that racial discrimination is incompatible with essential American values.

D) reveal the speaker's concern about the potential for communist activity to negatively affect the American economy.

17

The speaker of Passage 1 would most likely regard black people in the United States who acted in the way described in lines 64-67, Passage 2 ("They'd . . . us") as having

A) failed to understand the great contributions that black people in the United States have made to political progress.

B) misrepresented their willingness to suffer negative consequences for their political beliefs.

C) exploited their historic role in humanity's liberation for personal gain.

D) betrayed people who defended them in favor of a country that oppresses them.

18

Based on the passages, the two speakers would most likely agree with which point about the United States?

A) Its future depends in part on the elimination of racial discrimination.

B) Its attitude toward racial discrimination has gradually been changing.

C) Its history of racial discrimination has no parallel in other nations.

D) Its rejection of communism is a product of its legacy of racial discrimination.

19

One way in which the speaker of Passage 2 responds to the claim made by the speaker of Passage 1 regarding the attitude of black people in the United States toward war with the Soviet Union is by

A) citing several examples of black people in the United States who hold views contrary to those of the speaker of Passage 1.

B) arguing that the speaker of Passage 1 has exaggerated the views of black people in the United States for rhetorical effect.

C) implying that the speaker of Passage 1 cannot know or represent the views of black people in the United States in general.

D) suggesting that black people in the United States have already demonstrated their attitude toward the Soviet Union in ways ignored by the speaker of Passage 1.

CONTINUE

20

An important difference in how the speakers of the two passages present themselves is that the speaker of Passage 1

A) expresses his deep affinity for the Soviet Union, while the speaker of Passage 2 primarily defines himself in opposition to the ideology of the Soviet Union.

B) aligns himself with a worldwide community of people with similar aims, while the speaker of Passage 2 emphasizes his commitment to the United States.

C) identifies himself as a patriot who hopes to see his country correct its faults, while the speaker of Passage 2 presents himself as defending his country against any criticism.

D) suggests that he speaks for all oppressed peoples, while the speaker of Passage 2 describes himself as speaking only for black people in the United States.

Questions 21-30 are based on the following passage.

This passage is adapted from Elizabeth Pennisi, "How Birds Got Their Beaks." ©2015 by American Association for the Advancement of Science.

Agile beaks of all shapes and sizes, from the gulping gape of a pelican to the needle nose of a hummingbird, have enabled the 10,000 avian species to thrive from the Arctic to the tropics, build intricate nests, and eat many different foods.

Now, researchers may have identified genes that transformed an ancestral snout into a bird's bill. By manipulating the genes' proteins, they have seemingly turned back the evolutionary clock, producing snouts in developing chicken embryos that resemble those of alligators today. "We're trying to explain evolution through developmental studies," says Harvard University evolutionary biologist Arhat Abzhanov, who, with his colleagues, describes the work in *Evolution*.

Their conclusions are at odds with an earlier study. But even those who disagree with the result say Abzhanov and Bhart-Anjan Bhullar, now a post-doctoral fellow at the University of Chicago, have demonstrated a powerful approach: pinning down how anatomy changes using fossils, then trying to recapitulate the changes in the lab by tinkering with genetic signals. "The value of this paper is their ability to blend paleontology with evolutionary developmental biology," says Richard Schneider at the University of California, San Francisco (UCSF), who has linked beak evolution to different genes.

In ancestral reptiles, a pair of small bones makes up the tip of the snout. In today's birds, those premaxillary bones are long, narrow, and fused, producing the upper bill. The ancient bird *Archaeopteryx* reveals an intermediate step. Its premaxillary bones were not very expanded, but in later avian species the bones are progressively more fused. Other work had also implicated the premaxillary bones in beak evolution.

So Bhullar searched for earlier studies of genetic pathways that control development of these bones. Work in mice and chickens had implicated two sets of signals. A gene called Fibroblast growth factor 8 (*Fgf8*) becomes active in the front part of the face as it takes shape in 3-day-old chick embryos; later, just before bones form, a gene called *WNT* helps drive the proliferation of cells in the middle of the face,

CONTINUE

where it may prompt expansion of the premaxillary bones. In mammals, lizards, turtles, and alligators, in contrast, activity of the *WNT* gene is highest on the sides of the embryonic face.

To explore these genes' role, Bhullar and Abzhanov treated bird embryos with inhibitors of the WNT and Fgf8 proteins. When the two signals were curbed, the premaxillary bones became round and never fused, as in birds' dinosaur relatives, instead of growing long and pointy.

To the pair's surprise, a palatal bone, which makes up the roof of the mouth, also changed dramatically. In many vertebrates, this bone is flat and fused to surrounding bones. But in birds, it's reduced and disconnected, which frees the top part of the bill to move upward, expanding birds' gape. In the treated chick embryos, the palate looked more like it does in other vertebrates: flat and seemingly reconnected to jaw bones. The studies suggest that *Fgf8* and *WNT* signaling changes allowed skulls of ancient birds "to evolve in a whole new direction" and form a beak, Abzhanov says.

Not everyone agrees. In 2014, UCSF's Nathan Young and Ralph Marcucio, working with Schneider, carried out extensive skull measurements on a variety of embryonic vertebrates and determined the point during development at which the bird face begins to diverge from those of other vertebrates. The work and later experiments supported a 2009 idea proposed by Marcucio that the activity of another gene, *SHH* (for sonic hedgehog), was critical for forming the beak. Unlike *Fgf8*, he says, it's active in the right place and right time in bird embryos.

Marcucio, a developmental biologist, also worries that the changes in facial structure observed by the Harvard team may stem from unintended cell death caused by the inhibitors they used. "Adding the fossil record to this work is really an important step, but I think they are just looking at the wrong pathway," he says. Abzhanov and Bhullar counter that *Fgf8* and *SHH* are often coexpressed and may work together.

21

The primary purpose of the passage is to

A) present research that validates earlier studies about the evolution of beaks in a particular species of bird.

B) suggest that alligators were the ancestor of several species of birds.

C) discuss a study that provides an explanation of how a bird's beak has evolved from an ancestral snout.

D) critique the approach a research team used to study the development of beak formation in chicken embryos.

22

According to the passage, the ancient bird *Archaeopteryx* is significant to the evolution of beaks in birds because, based on the fossil record, the facial structure of *Archaeopteryx*

A) provides evidence of the existence of an evolutionary step between a snout and a beak.

B) possesses physical characteristics directly linking them to present-day alligators.

C) identifies them as one of the oldest birds to have had a beak.

D) reveals them to be one of the earliest birds to have fused facial bones.

23

What evidence in the passage best supports the hypothesis that the presence of WNT and Fgf8 proteins during embryonic development is necessary for the formation of beaks?

A) Lines 37-38 ("So Bhullar . . . these bones")

B) Lines 46-48 ("In mammals . . . face")

C) Lines 49-51 ("To explore . . . proteins")

D) Lines 51-54 ("When . . . pointy")

CONTINUE

24

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

A) evaded.
B) suppressed.
C) anchored.
D) contained.

25

As used in lines 32, "step" most nearly means

A) stage.
B) procedure.
C) distance.
D) movement.

26

According to the passage, the earlier studies that Bhullar consulted were important primarily because they

A) confirmed when beak formation in an embryonic bird typically begins.
B) identified particular genes that could initiate beak formation in birds.
C) proved that beak formation in birds was a response to external conditions.
D) pinpointed the primary gene that activates the development of a bird's beak.

27

The passage shifts focus in the eighth paragraph (lines 67-77) from a consideration of Bhullar and Abzhanov's research to a

A) sketch of an experiment to confirm that research.
B) discussion of a possible challenge to that research.
C) defense of the ultimate usefulness of that research.
D) summary of a study disproving that research.

28

Based on the passage, Marcucio's response to which of the following questions would most likely differ from Abzhanov's?

A) Is there evidence that birds are related to alligators?
B) How are bird beaks different from alligator snouts?
C) What triggered the anatomical change from snouts to beaks?
D) When did the evolution of contemporary bird beaks begin?

29

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

A) Line 67 ("Not . . . agrees")
B) Lines 67-72 ("In 2014 . . . other vertebrates")
C) Lines 72-76 ("The work . . . beak")
D) Lines 78-81 ("Marcucio . . . used")

30

The last paragraph mainly functions to

A) offer an alternative interpretation of Abzhanov and Bhullar's evidence as described in the passage.
B) preview upcoming research that may support the findings in the study analyzed in the passage.
C) imply that the sponsors of the study analyzed in the passage might have influenced its results.
D) challenge the underlying intentions of the researchers described in the passage.

CONTINUE

Questions 31-41 are based on the following passage and supplementary material.

This passage is adapted from Robert Cialdini, *Pre-Suasion: A Revolutionary Way to Influence and Persuade*. ©2016 by Robert Cialdini.

Suppose you've started an online furniture store that specializes in various types of sofas. Some are attractive to customers because of their comfort and others because of their price. Is there anything you can think to do that would incline visitors to your website to focus on the feature of comfort and, consequently, to prefer to make a sofa purchase that prioritized it over cost?

You've no need to labor long for an answer, because two marketing professors, Naomi Mandel and Eric Johnson, have provided one in a set of studies using just such an online furniture site. When I interviewed Mandel regarding why she decided on this particular set of issues to explore, she said her choice had to do with two big, unresolved matters within the field of marketing—one relatively recent and one long-standing. The new topic at the time was e-commerce. When she began the research project in the late 1990s, the impact of virtual stores such as Amazon and eBay was only beginning to be seen. But how to optimize success within this form of exchange had not been addressed systematically. So she and Johnson opted for a virtual store site as the context for their study.

The other matter that had piqued Mandel's interest is one that has vexed merchandisers forever: how to avoid losing business to a poorer-quality rival whose only competitive advantage is lower cost. That is why Mandel chose to pit higher-quality furniture lines against less expensive, inferior ones in her study. "It's a traditional problem that the business-savvy students in our marketing courses raise all the time," she said. "We always instruct them not to get caught up in a price war against an inferior product, because they'll lose. We tell them to make quality the battleground instead, because that's a fight they'll most likely win.

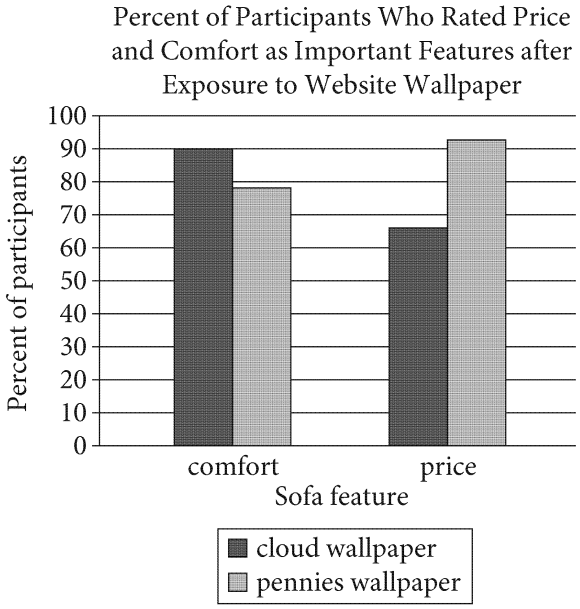
"Fortunately for me," she continued, "the best of the students in those classes have never been satisfied with that general advice. They'd say, 'Yeah, but how?' and I never really had a good answer for them, which gave me a great question to pursue for my research project."

Fortunately for *us*, after analyzing their results, Mandel and Johnson were in a position to deliver a stunningly simple answer to the "Yeah, but how?" question. In an article, they described how they were able to draw website visitors' attention to the goal of comfort merely by placing *fluffy clouds* on the background wallpaper of the site's landing page. That maneuver led those visitors to assign elevated levels of importance to comfort when asked what they were looking for in a sofa. Those same visitors also became more likely to search the site for information about the comfort features of the sofas in stock and, most notably, to choose a more comfortable (and more costly) sofa as their preferred purchase.

To make sure their results were due to the landing page wallpaper and not to some general human preference for comfort, Mandel and Johnson reversed their procedure for other visitors, who saw wallpaper that pulled their attention to the goal of economy by depicting pennies instead of clouds. These visitors assigned greater levels of importance to price, searched the site primarily for cost information, and preferred an inexpensive sofa. Remarkably, despite having their importance ratings, search behavior, and buying preferences all altered by the landing page wallpaper, when questioned afterward, most participants refused to believe that the depicted clouds or pennies had affected them in any way.

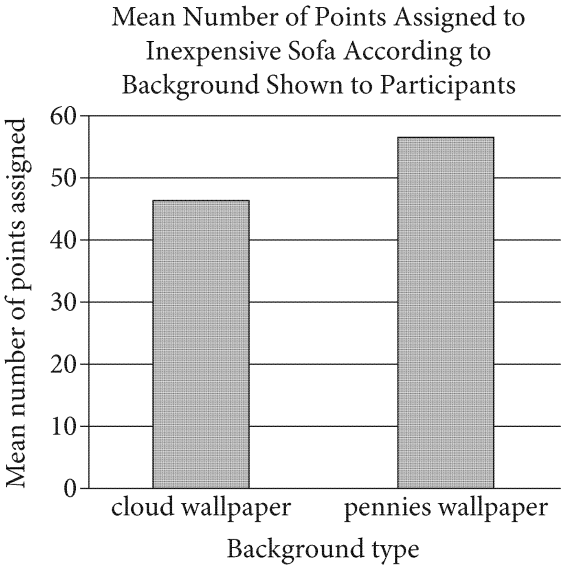
CONTINUE

Figure 1



Participants were able to rate both price and comfort as important features.

Figure 2



Source: Data from Naomi Mandel and Eric J. Johnson, "When Web Pages Influence Choice: Effects of Visual Primes on Experts and Novices." ©2002 by Journal of Consumer Research, Inc.

Participants had to assign a total of 100 points between the inexpensive sofa and a comfortable, more expensive sofa. The difference in the amounts allocated to the sofas indicates the extent to which participants preferred one over the other.

31

The main purpose of the first paragraph is to

A) offer cultural background that explains the need for further studies of online customer behavior.

B) present a hypothetical situation that frames a discussion of research into a particular marketing problem.

C) suggest the practical application of a scientific discovery that has been overlooked by many business managers.

D) detail the factors that make the challenges faced by online marketers distinct from those presented in traditional marketing.

CONTINUE

32

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

A) broach.
B) nurture.
C) elevate.
D) construct.

33

What is the main function of the fourth paragraph (lines 38-43)?

A) It provides a solution to the problem raised in the previous paragraph.
B) It challenges the validity of the conclusion presented in the previous paragraph.
C) It explains the inspiration for the study outlined in the following paragraphs.
D) It undermines the credibility of the results related in the following paragraphs.

34

The main effect of the phrase "stunningly simple" (line 46) is to

A) indicate the author's disapproval of the experiment's lack of complexity.
B) express the author's confusion about the researchers' initial inability to answer the students' questions.
C) convey the author's admiration of the experiment's straightforward results.
D) illustrate the author's appreciation of the students' insights.

35

It can reasonably be inferred from the passage that Mandel and Johnson strengthened their conclusions by

A) anticipating a potential criticism of their experimental design.
B) recruiting subjects from a variety of economic backgrounds.
C) incorporating the input of business students in the interpretation of the results.
D) demonstrating the results' applicability outside the context of online marketing.

36

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

A) Lines 17-21 ("The new . . . seen")
B) Lines 31-33 ("It's . . . said")
C) Lines 50-53 ("That . . . sofa")
D) Lines 58-63 ("To make . . . clouds")

37

The passage best supports the idea that customers likely make decisions about purchases based on

A) messages that are communicated below the level of conscious perception.
B) careful research into the overall quality of a particular product.
C) economic factors that influence individual spending budgets.
D) marketing campaigns that call attention to the best features of new merchandise.

CONTINUE

38

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

A) Lines 44-47 ("Fortunately . . . questions")
B) Lines 47-50 ("In an . . . page")
C) Lines 53-57 ("Those . . . purchase")
D) Lines 67-72 ("Remarkably . . . way")

39

Which choice offers data reflecting the statement made in lines 64-66 ("These . . . sofa")?

A) The bar representing pennies wallpaper in the comfort category in figure 1
B) The bar representing cloud wallpaper in the price category in figure 1
C) The bar representing cloud wallpaper in figure 2
D) The bar representing pennies wallpaper in figure 2

40

According to figure 1, price was rated as important to those exposed to pennies wallpaper by approximately

A) 66% of participants.
B) 78% of participants.
C) 85% of participants.
D) 94% of participants.

41

Which choice best summarizes the information presented in the two figures?

A) Figure 1 focuses on how exposure to different wallpapers affects perception of comfort and price, whereas figure 2 focuses on how exposure to different wallpapers affects the assessment of a particular product.
B) Figure 1 focuses on how exposure to different wallpapers changed the participants' understanding of comfort and price over time, whereas figure 2 focuses exclusively on the participants' understanding during a particular time.
C) Figure 1 focuses on a comparison between the importance of comfort and price, whereas figure 2 focuses exclusively on the growing importance of price to consumers.
D) Figure 1 focuses on the reactions of a large number of participants to the exposure to different wallpapers, whereas figure 2 focuses on the reactions of a small number of participants to the exposure to the same wallpaper.

CONTINUE

Questions 42-52 are based on the following passage and supplementary material.

This passage is adapted from Chris D. Thomas, *Inheritors of the Earth: How Nature Is Thriving in an Age of Extinction*. ©2017 by Chris D. Thomas.

California enjoys a Mediterranean-style climate, with cool and relatively moist winters and dry, hot summers, so it is not surprising that the European yellow star-thistle *Centaurea solstitialis* and its relative the sulphur star-thistle *Centaurea sulphurea* established wild populations there. The yellow star-thistle, in particular, has become so successful that it is regarded as a noxious weed—despite the fact that its spiky golden-yellow flowers supply nectar to butterflies and bees and it mainly grows on disturbed ground where native wildflowers are rare. In any event, there is no getting rid of it now.

Long established in California, there have been plenty of generations available for the two plants to evolve in isolation from their Spanish ancestors—the sulphur star-thistle was introduced to California around 1923, allowing the Spanish and Californian populations to develop in isolation for up to eighty-six generations. But could they actually have become that different after such a short period of time? No one would really have expected this to be the case, and University of Montana researchers Daniel Montesinos, Gilberto Santiago and Ray Callaway were no exceptions—ecologists and evolutionary biologists have been brought up on the 'knowledge' that it takes a very long time for new species to form. In fact, they were not thinking about it at all. The main goal of their experiment was to obtain 'pure' seeds of each population and species to use in the rest of their research. However, just to amuse himself, Montesinos, who is now at the Universidade de Coimbra in Portugal, in his own words *'playfully decided'* to transfer pollen from Spanish to Californian plants *'just to see what happened'*.

The results were very surprising. Californian sulphur star-thistles produced 44 per cent fewer seeds per flower when they were fertilized using Spanish pollen than when they were supplied with Californian pollen. Over the period since the plants were introduced to California, the compatibility of the Spanish with the Californian sulphur star-thistle has declined. Isolation in the yellow star-thistle is even greater, at around 52 per cent reduction in fertility. However, this is over a larger number of generations. The yellow star-thistle was first found growing in California in 1824, but its journey was an indirect one, via Chile, so the chances are that the Spanish and Californian yellow star-thistles last interbred 350 or so generations ago. Nonetheless, this is still exceptionally fast. The Californian and Spanish star-thistles seem to be losing the ability to mate with one another. They are on the path towards becoming separate species.

Because closely related species can sometimes mate with one another and produce hybrid offspring, the benchmark for Californian plants to be regarded as different species is not a full 100 per cent reduction in fertility. Knowing this, Montesinos and his colleagues decided to find out what the fertility might be when you cross different wild star-thistle species with one another. They tried to fertilize yellow star-thistles with the pollen of sulphur star-thistles, and also with the pollen of yet another related species. The answer was a 65–88 per cent reduction in the number of seeds produced when crosses were made using pollen from different species. This suggests that the Californian plants, at 44 per cent and 52 per cent reduction in fertility, are probably not yet fully-fledged species, but are well on the way towards it, a mere 86 to 350 years after they separated from their Spanish ancestors. If they continue to diverge at the same rate, then they might well be quite distinct 'human-created' species within a few more centuries.

CONTINUE

Figure 1

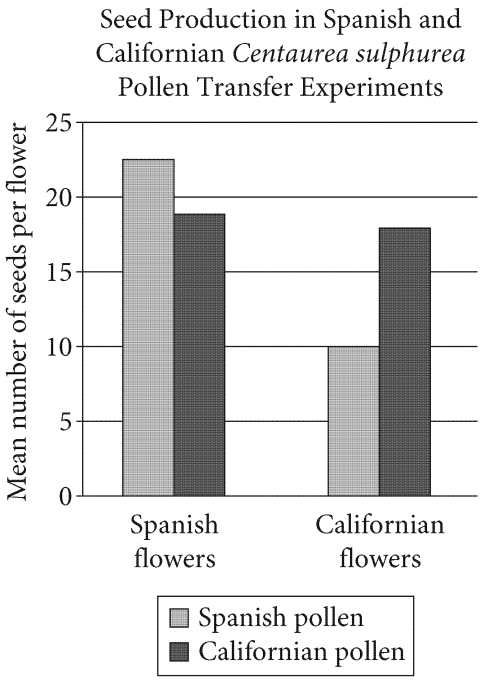
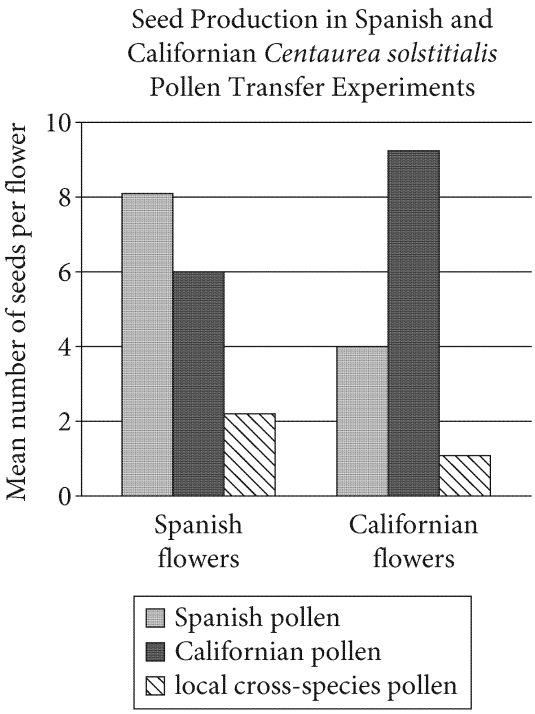


Figure 2



Figures adapted from Daniel Montesinos, Gilberto Santiago, and Ragan M. Callaway, "Neo-Allopatry and Rapid Reproductive Isolation." ©2012 by The University of Chicago.

42

It can reasonably be inferred from the passage that the experiment was ultimately prompted by

A) professional competitiveness along with a particular fascination with star thistles.

B) personal curiosity about star thistles in addition to a clear scientific objective.

C) a desire to corroborate an earlier study on star thistles rather than to gain new insights.

D) an interest in studying other plants related to star thistles rather than an interest in star thistles themselves.

CONTINUE

43

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

A) Lines 21-24 ("No one . . . exceptions")
B) Lines 27-35 ("In fact . . . *happened*")
C) Lines 36-40 ("The results . . . pollen")
D) Lines 43-50 ("Isolation . . . ago")

44

Which choice best supports the conclusion that attitudes toward nonnative star thistle may overlook the plant's positive effects on the environment?

A) Lines 1-6 ("California . . . there")
B) Lines 6-11 ("The yellow . . . rare")
C) Lines 51-53 ("The Californian . . . another")
D) Lines 59-65 ("Knowing . . . species")

45

In placing the word "knowledge" (line 26) in quotation marks, the author most likely suggests that

A) scientific concepts are often more specialized than are concepts in other disciplines.
B) what constitutes valid evidence varies widely across scientific fields.
C) scientific theories are easily misunderstood by nonscientists.
D) an idea assumed by scientists to be true may not be applicable in some contexts.

46

As used in line 48, "indirect" most nearly means

A) misleading.
B) roundabout.
C) restrained.
D) implicit.

47

The sentence in lines 50-51 ("Nonetheless . . . fast") mainly serves to

A) summarize the data provided in the paragraph.
B) interpret the findings of the experiment described in the paragraph.
C) contextualize information presented in the preceding sentence.
D) illustrate the idea developed in the preceding sentence.

48

According to the passage, what is the relationship between the Spanish and the Californian populations of yellow star thistles?

A) They are now recognized as different but closely related species.
B) They are currently of the same species but appear to be diverging into distinct species.
C) The Californian population is a hybrid offspring of the Spanish yellow star thistle and is native to California.
D) The Spanish population has low fertility rates compared to the Californian population of the yellow star thistle.

49

Based on the passage, if hypothetical fertility data on two cross-pollinated plants that seem to be of the same species show an 80% reduction in seed production, which choice is a reasonable conclusion?

A) The plants may no longer be of the same species.
B) The plants are probably of the same species but inhabit different local regions.
C) The offspring of the plants will have 100% reduction in fertility.
D) The offspring of the plants are hybrid.

CONTINUE

50

Which statement is best supported by the data in figure 1?

A) Spanish pollen produced approximately the same number of seeds in Californian flowers as it did in Spanish flowers.

B) Californian pollen produced fewer seeds in both Spanish and Californian flowers than did Spanish pollen.

C) Spanish pollen produced more seeds in Californian flowers than did Californian pollen.

D) Californian pollen produced a slightly higher number of seeds in Spanish flowers than it did in Californian flowers.

51

According to figure 1, the greatest mean number of seeds per flower was produced with which combination of pollen and flowers?

A) Spanish pollen and Californian flowers

B) Californian pollen and Spanish flowers

C) Spanish pollen and Spanish flowers

D) Californian pollen and Californian flowers

52

According to figure 2, in which combination was the mean number of seeds per flower lowest for both Spanish and Californian flowers?

A) Spanish pollen in Spanish flowers and Californian pollen in Californian flowers

B) Californian pollen in Spanish flowers and local cross-species pollen in Californian flowers

C) Californian pollen in both Spanish and Californian flowers

D) Local cross-species pollen in both Spanish and Californian flowers

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

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.

Wish Upon a Tree

Strolling down a stone path surrounded by Japanese dogwood trees, visitors to the Smithsonian Institution's Hirshhorn Museum and Sculpture Garden might notice hundreds of paper tags 1 gently swaying from the Japanese dogwood trees' branches. These pieces of

1

A) NO CHANGE
B) gently blowing and swaying from the branches of the trees.
C) swaying gently from the tree branches.
D) or pieces of paper that sway gently from the tree branches.

CONTINUE

2 paper—a favorite installation with Hirshhorn patrons—decorate the trees every year from July 1 through Labor Day. Entitled *Wish Tree for Washington, DC*, this exhibit was the brainchild of Yoko Ono, an artist and musician who has spent decades creating interactive art—art designed to encourage and incorporate the participation of its viewers—as a platform for peace.

For her *Wish Trees* series, 3 which is perhaps her best-known interactive project; Ono was inspired by the temple courtyards she visited as a child in Japan, where people could write wishes on small paper tags and then tie them to trees. Ono once compared the stunning visual result to "white flowers blossoming from afar." 4 Often using everyday items to create her art, she created *Wish Trees*, an ongoing project that showcases trees and invites visitors to write and attach their own wishes to the branches. By encouraging people to reflect on their aspirations and to 5 attribute to a large, collective project, Ono believes *Wish Trees* will promote global harmony.

2

Which choice most effectively establishes one of the main ideas of the passage?

A) NO CHANGE
B) paper are secured to the trees with strong cotton string to prevent them from blowing away.
C) paper are exposed to the elements, but they are still for the most part intact and legible.
D) paper, though light, bear something truly weighty—the hopes and dreams of museum patrons.

3

A) NO CHANGE
B) perhaps her best-known interactive project,
C) it was perhaps her best-known interactive project,
D) perhaps her best-known interactive project and

4

Which choice provides the best transition from the first two sentences of the paragraph?

A) NO CHANGE
B) Having left Japan after the Second World War,
C) To bring this experience to more people,
D) In between her many other artistic endeavors,

5

A) NO CHANGE
B) attribute by
C) contribute by
D) contribute to

CONTINUE

[1] Ono's trees have been shown in museums around the world, with each exhibit featuring tree species—typically indigenous ones—selected to complement the venue. [2] The exhibits have proved very 6 popular, in fact more than a million wishes have been written over the past ten years. [3] Visitors have filled tags with diverse hopes, ranging from goals for 7 its families to desires for "equality, respect and fair opportunity for all." [4] In addition to museum installations, Ono has provided instructions for schools, 8 workplaces, and communities that are interested in creating their own wish trees, further expanding the interactivity of the project. 9

6

A) NO CHANGE
B) popular—in fact—
C) popular; in fact,
D) popular in fact,

7

A) NO CHANGE
B) one's
C) their
D) his

8

A) NO CHANGE
B) working, and in communities
C) at work, and people in communities
D) workplaces, and to be a community

9

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

> A *Wish Tree* exhibit at the Museum of Contemporary Art in Sydney, Australia, for instance, used six lemon-scented eucalyptus trees, which are native to the continent.

The best placement for the sentence is

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

CONTINUE

Once an exhibit ends or a tree becomes full, the wish tags are collected and then deposited in capsules at the base of the *Imagine Peace Tower* on Viðey Island, near Reykjavík, Iceland. 10 The tower was also designed by Ono. Ono's tower is a beam of light that shines each winter from a base carved of stone into the aurora-graced Icelandic night. Radiating symbolically from a well of wishes, the tower is a reminder of 11 Ono's international reputation: "A dream you dream alone is only a dream. A dream you dream together is reality."

10

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

A) The tower was also an Ono design; additionally, it
B) Although also an Ono design, the tower
C) Ono also designed the tower, and the tower
D) The tower, which Ono also designed,

11

Which choice most effectively sets up the quotation at the end of the sentence?

A) NO CHANGE
B) Ono's own wish for world peace:
C) Iceland's commitment to green energy:
D) *Wish Trees*' popularity in museums:

CONTINUE

Questions 12-22 are based on the following passage.

The Hubble Deep Field

The Hubble Space Telescope (HST) was launched in 1990 to provide researchers with views of the universe undiminished by interference from Earth's atmosphere. After a misshapen mirror was fixed, the HST began returning clear, breathtaking images that greatly advanced scientific understanding of the known universe. However, the director of the Space Telescope Science Institute, Bob Williams, suspected that the HST 12 needed a boost in public opinion: he thought it might be used to study the farthest reaches of space and answer fundamental questions about the history of the universe.

At the time, no one knew exactly how far the HST could see into space. Williams wanted to test the 13 telescopes' capabilities' by directing it at a part of the sky with no known objects and recording images over an extended period. Successfully detecting far-off galaxies, those billions of light-years away, would allow scientists to see these objects as they were billions of years ago. 14 However, with ongoing observation scientists could also determine how galaxies changed as time passed.

12

Which choice most effectively sets up the information that follows in the sentence?

A) NO CHANGE
B) would operate successfully for years:
C) lacked sufficient funding:
D) could do more:

13

A) NO CHANGE
B) telescope's capability's
C) telescope's capabilities
D) telescopes capabilities

14

A) NO CHANGE
B) Nonetheless,
C) Furthermore,
D) Regardless,

CONTINUE

Some of Williams's colleagues thought that it was unwise to spend so many hours trying to look into seemingly empty space. They argued that Williams should use his observation time for other projects. These scientists were concerned that the study **15** will show only the telescope's limitations—that is, what it could not do. **16** "I had 10 percent of the telescope time," Williams said later as he recalled the experience. He vowed that he would resign from his position if the effort proved **17** as an embarrassment.

15

A) NO CHANGE
B) had shown
C) showed
D) would show

16

Which quotation from Williams provides the most effective support for the point the writer is making in this paragraph?

A) NO CHANGE
B) "Scientific discovery requires risk,"
C) "It turned out to be a neat image,"
D) "You do the same thing if you're trying to understand the geology of the Earth,"

17

A) NO CHANGE
B) being
C) to be
D) as being

CONTINUE

Williams assembled a small team of researchers and conducted his study for 10 days in December 1995. Under his supervision, the HST focused on a small patch of sky for a 18 total of 100 hours and captured hundreds of images. The researchers then processed and combined the images into a composite 19 picture. They called the composite picture the Hubble Deep Field (HDF). As it turned out, the HDF significantly reshaped scientific understanding of the universe. It showed an area filled with galaxies—more than 3,000—and it prompted scientists to change their estimate of the number of galaxies in the universe from 10 billion to 50 billion. Some of the galaxies were as much as 12 billion years old. 20 There colors, shapes, and other attributes provided scientists with insights into what galaxies were like at a much earlier stage in the history of the universe.

18

A) NO CHANGE
B) sum total equaling
C) total that equaled
D) sum, or total, of

19

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

A) picture that they called
B) picture, but they called it
C) picture; thus, they called it
D) picture, and they then called it

20

A) NO CHANGE
B) Their
C) They're
D) Its

CONTINUE

The HDF was a major breakthrough in astronomy, illuminating the early history of the universe and helping astronomers construct a more complete picture of how 21 do galaxies evolve over time? Williams's gamble had paid off, and 22 the whole community of scientists who study space, even those who were initially skeptical, shared in the reward.

21

A) NO CHANGE
B) do galaxies evolve over time.
C) galaxies evolve over time.
D) galaxies evolve over time?

22

The writer wants a conclusion that links the success of Williams's work back to a discussion earlier in the passage. Which choice best accomplishes this goal?

A) NO CHANGE
B) he still left many more mysteries of space for his colleagues to discover.
C) the HST's successor, the James Webb Space Telescope, will carry on the HST's mission.
D) Williams went on to facilitate a groundbreaking study of the universe's expansion—which earned the participating teams the 2011 Nobel Prize in physics.

CONTINUE

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

Identity Marketing

One proven way for marketers to appeal to a target audience is through identity marketing: advertisements that demonstrate the fit between a product and the audience's sense of 23 identity, traditional wisdom holds that the more directly an advertisement connects a product to a particular identity, the more effective that advertisement will be with consumers who share that identity. However, recent evidence suggests that direct identity marketing may no longer be as effective as it once was.

A team of researchers led by marketing professor Amit Bhattacharjee conducted a study of different types of identity-marketing messages. The study included both "green" 24 consumers, people whose purchases are especially influenced by the perceived environmental friendliness of a product, and neutral consumers. The researchers divided the participants into three 25 groups. The researchers also showed each of the three groups a different advertising message for a cleaning product, Charlie's Soap. One message proclaimed that

23

A) NO CHANGE
B) identity. Traditional
C) identity, so traditional
D) identity and traditional

24

A) NO CHANGE
B) consumers: people whose purchases are especially influenced by the perceived environmental friendliness of a product,
C) consumers, people whose purchases are especially influenced by the perceived environmental friendliness of a product;
D) consumers people whose purchases are especially influenced by the perceived environmental friendliness of a product,

25

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

A) groups, with the researchers showing each of these three groups
B) groups and showed each group
C) groups; each group would also be shown
D) groups, and the researchers showed each of the groups

CONTINUE

the product was necessary for those who think of 26 ourselves as green ("Charlie's: The only good choice for green consumers!"), while another message indicated that the product was an attractive option for that group ("Charlie's: A good choice for green consumers"). A control message was also used ("Charlie's: A good choice for consumers"). The researchers then 27 asked, the participants to rate, on a scale of 1 to 7 their likelihood of purchasing the product, with 1 indicating that they were "not at all likely" and 7 that they were "very likely" to do so. At the same time, 28 a group of marketing executives was simultaneously asked which message would be most effective with the target group.

26

A) NO CHANGE
B) themselves
C) himself or herself
D) oneself

27

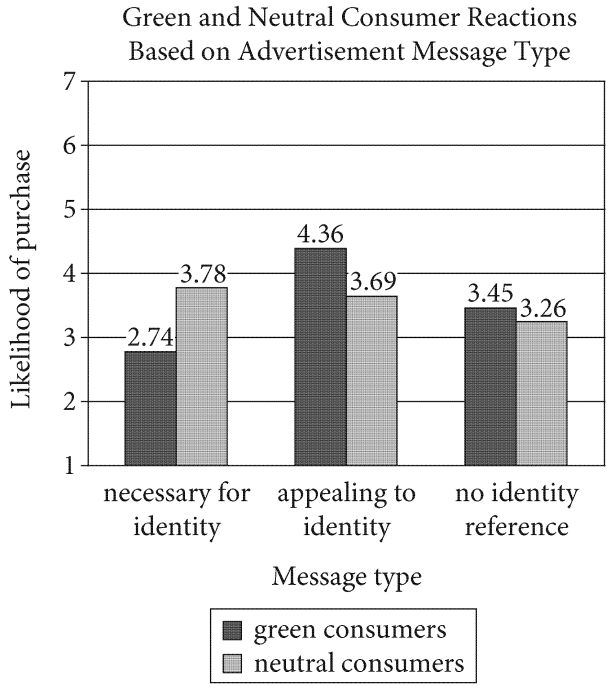
A) NO CHANGE
B) asked the participants to rate on a scale of 1 to 7,
C) asked the participants: to rate on a scale of 1 to 7
D) asked the participants to rate on a scale of 1 to 7

28

A) NO CHANGE
B) while the target group was asked the same thing, a group of marketing executives was asked
C) a group of marketing executives was collectively all asked together
D) a group of marketing executives was asked

CONTINUE

The results of the study **29** suggest that the marketing executives **30** have discovered an effective new strategy. The message **31** least effective with neutral-identity consumers, with an average likelihood rating of 4.36, was the one that appealed to their identity without insisting that the product was necessary for them: "Charlie's: A good choice for green consumers." **32** As a result, the lowest average rating in the study, 2.74, was assigned by green-identity consumers to the message that the marketing executives had rated the highest: "Charlie's: The only good choice for green consumers!"



Adapted from Amit Bhattacharjee et al., "When Identity Marketing Backfires: Consumer Agency in Identity Expression." ©2014 by Journal of Consumer Research, Inc.

29

A) NO CHANGE
B) is suggesting
C) suggests
D) has suggested

30

Which choice provides the best interpretation of the data in the study?

A) NO CHANGE
B) are following an outdated paradigm.
C) have been highly successful with identity marketing.
D) are creating an efficient model for market testing.

31

Which choice provides accurate information from the graph?

A) NO CHANGE
B) most effective with neutral-identity
C) least effective with green-identity
D) most effective with green-identity

32

A) NO CHANGE
B) Similarly,
C) In contrast,
D) Nevertheless,

CONTINUE

In conclusion, while consumers do seem to favor products that claim to fit with their identity, messages that boast of a product's superior link to a group identity seem to turn off the very group to which they were designed to appeal. To continue being successful, marketers will need to take these findings into consideration and 33 aim for more direct appeals to consumer tastes.

33

Which choice provides the most effective conclusion to the passage?

A) NO CHANGE
B) target specific consumer identities for their advertisements.
C) experiment with more nuanced appeals to consumer identity.
D) direct various types of advertisements at neutral consumers.

CONTINUE

Questions 34-44 are based on the following passage.

The Sky Is the Limit

Until the 1960s, buildings of more than thirty stories were 34 mainly found in North America. The thick interior columns and walls necessary to fortify these buildings against forces such as powerful winds and earthquakes reduced the amount of rentable floor space. Moreover, taller 35 buildings requiring additional concrete and steel to resist increased lateral (side-to-side) forces, and the high cost of these materials often deterred development. To address these challenges, Bangladeshi American engineer and 36 architect, Fazlur Rahman Khan developed novel forms of structural tubing, 37 which were later used in the Willis Tower in Chicago.

34

Which choice most effectively introduces the paragraph?

A) NO CHANGE
B) constructed of concrete and steel.
C) inefficient for developers to build.
D) used for residential and business purposes.

35

A) NO CHANGE
B) buildings required
C) buildings, which required
D) buildings that were requiring

36

A) NO CHANGE
B) architect—Fazlur Rahman Khan
C) architect Fazlur Rahman Khan,
D) architect Fazlur Rahman Khan

37

Which choice most effectively sets up the main idea of the passage?

A) NO CHANGE
B) gaining admiration at the Chicago firm that hired him.
C) giving rise to a new era in urban architecture.
D) eventually becoming a groundbreaker in computer-aided design as well.

CONTINUE

Metropolitan population growth in the 1950s encouraged the construction of tall structures to house people and support growing businesses. Khan realized that if a building's exterior walls could be made to bear more weight and withstand lateral forces more effectively than they traditionally had, the result would be a taller, safer, and more cost-effective building. Khan applied this idea to his 1961 design for Chicago's Brunswick Building, which contains a shear-wall core and an exterior frame of closely spaced columns. With support at both the center and perimeter, 38 this "tube-within-a-tube" layout could resist strong winds and reduce the need for space-consuming columns to be placed throughout the floor plan.

Realizing the advantages of the tube structure, Khan developed the "bundled tube" system. Chicago's Willis Tower, designed by Khan, 39 was originally intended to be only seventy stories tall. Instead of being a single rectangular tower, the building is composed of nine square tubes of varying 40 heights and resulting in a multileveled structure with the two tallest tubes surrounded by progressively shorter ones. The tubes are structurally sound on their 41 own. However, those tubes get added stability from the bundled structure that connects the tubes in the lower fifty stories. This design allows the building to retain its lateral strength and to use steel more economically; in fact, the Willis Tower contains about as much steel as do shorter structures built at that time. Opening in 1973 at 110 stories, it was the world's tallest building for more than two decades.

38

A) NO CHANGE
B) strong winds could be resisted by this "tube-within-a-tube" layout, reducing
C) resistance to strong winds could result from this "tube-within-a-tube" layout, thereby reducing
D) there could be resistance to strong winds by this "tube-within-a-tube" layout and a reduction in

39

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

A) NO CHANGE
B) is one of the most renowned landmarks to feature this system.
C) took three years and over $175 million dollars to build.
D) is an iconic structure that many still refer to as the Sears Tower.

40

A) NO CHANGE
B) heights, while it results
C) heights, which it results
D) heights, resulting

41

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

A) own, but the bundled structure creates added stability by connecting the tubes
B) own; added stability is created through the bundled structure, which connects those tubes
C) own, with the bundled structure creating added stability due to the connection of the tubes
D) own; however, stability is added because the structure is bundled, which involves the tubes being connected

CONTINUE

[1] Once buildings had demonstrated the effectiveness of tubular designs, engineers and architects were free to imagine even loftier projects. [2] The result was 42 an inflation of extremely tall buildings. [3] Structures such as the 163-floor skyscraper Burj Khalifa, completed in 2010 by the engineering firm with which Khan worked, 43 continues to pay homage to the person who heralded the modern age of the skyscraper. [4] The fact that this record did not endure is a testament to the success of Khan's design. 44

42

A) NO CHANGE
B) an amplification
C) a proliferation
D) a dissemination

43

A) NO CHANGE
B) has continued
C) is continuing
D) continue

44

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

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

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.

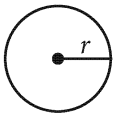
DIRECTIONS

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.

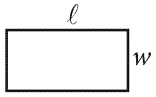
NOTES

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

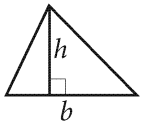
REFERENCE



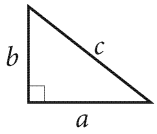
$A = \pi r^2$
$C = 2\pi r$



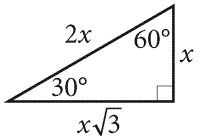
$A = \ell w$

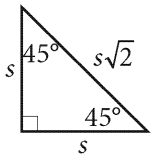


$A = \frac{1}{2}bh$

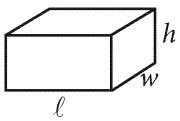


$c^2 = a^2 + b^2$

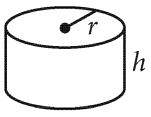




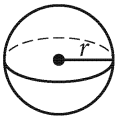
Special Right Triangles



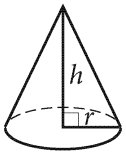
$V = \ell wh$



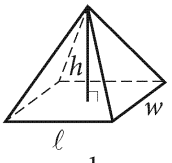
$V = \pi r^2 h$



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



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



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

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

CONTINUE

1

A college mathematics department plans to spend \$1,800 buying computers and books. Each computer costs \$300 and each book costs \$90. Which equation represents this situation, where x is the number of computers and y is the number of books that the department can buy?

A) $300x + 90y = 1{,}800$

B) $90x + 300y = 1{,}800$

C) $390(x + y) = 1{,}800$

D) $1{,}800(x + y) = 390$

2

What is the x-intercept of the graph of $8x + 6y = 24$ in the xy-plane?

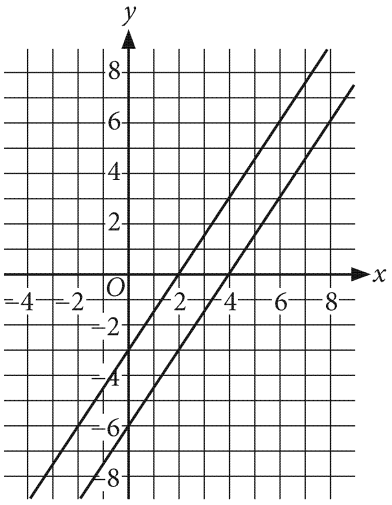
A) $(3, 0)$

B) $(4, 0)$

C) $(6, 0)$

D) $(8, 0)$

3



What system of linear equations is represented by the lines shown?

A) $3x - 2y = 6$
$3x - 2y = 12$

B) $3x - 2y = 6$
$3x + 2y = 12$

C) $2x + 3y = 6$
$2x - 3y = 12$

D) $-2x - 3y = 6$
$-2x + 3y = 12$

CONTINUE

4

$$ka + nb = 10$$

The given equation relates the positive numbers a, b, k, and n. Which of the following correctly expresses a in terms of b, k, and n ?

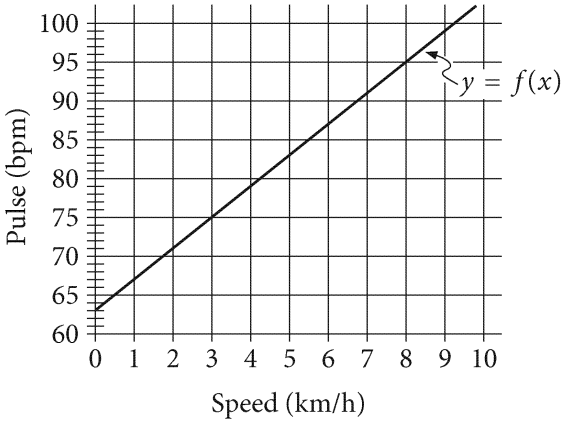
A) $a = 10 - \dfrac{k}{nb}$

B) $a = 10 - \dfrac{nb}{k}$

C) $a = \dfrac{10 - k}{nb}$

D) $a = \dfrac{10 - nb}{k}$

5



The function f models Jack's pulse, in beats per minute (bpm), as a function of his speed, in kilometers per hour (km/h), on a stationary bicycle. Based on the model, what was Jack's pulse, in bpm, when his speed was 0 km/h?

A) 4

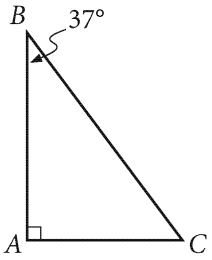
B) 15

C) 63

D) 123

CONTINUE

6



Triangle DEF (not shown) is similar to triangle ABC above, where side DE corresponds to side AB, side DF corresponds to side AC, and $DE = 2AB$. What is the measure of angle DFE ?

A) 37°

B) 53°

C) 74°

D) 106°

7

Which expression is equivalent to $x^4 - 18x^2 + 81$?

A) $(x - 3)^4$

B) $(x - 3)(x + 3)^3$

C) $(x - 3)^3(x + 3)$

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

8

Which expression is equivalent to $g^{\frac{4}{5}}h^{\frac{2}{5}}$, where g and h are positive?

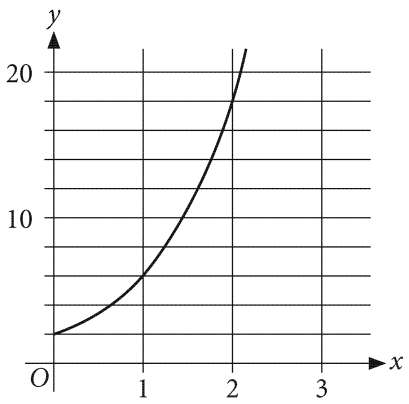
A) $\sqrt[4]{g^5h^{10}}$

B) $\sqrt[5]{g^4h^2}$

C) $\dfrac{1}{\sqrt[4]{g^5h^{10}}}$

D) $\dfrac{1}{\sqrt[5]{g^4h^2}}$

9



What is an equation of the graph shown?

A) $y = 3^x$

B) $y = 2(3)^x$

C) $y = 2^x$

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

CONTINUE

10

$$|x + 2| = |x - 8|$$

What is the solution to the given equation?

A) -6

B) -3

C) 3

D) 6

11

$$y = (x + 5)^2 - 8$$

The equation above can be represented by a parabola in the xy-plane. The parabola is then translated so that the vertex is at $(0, 0)$. Which of the following best describes the translation?

A) 5 units in the negative x direction and 8 units in the negative y direction

B) 5 units in the negative x direction and 8 units in the positive y direction

C) 5 units in the positive x direction and 8 units in the negative y direction

D) 5 units in the positive x direction and 8 units in the positive y direction

12

$$5x - 2 + 3x = 3(x + 4) + 5x - 10$$

Which of the following statements is true about the equation above?

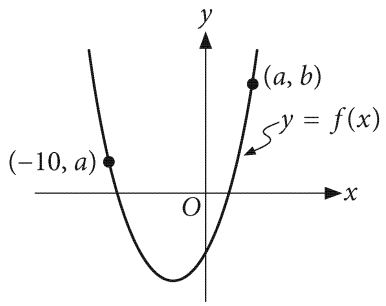
A) The equation has one solution because a single value of x makes this equation true.

B) The equation has one solution because the equation is true for all values of x.

C) The equation has an infinite number of solutions because the equation is true for all values of x.

D) The equation has no solution because the equation is not true for any value of x.

13



The graph of the function f defined by $f(x) = \frac{1}{4}(x + 4)^2 - 5$ is shown. The graph passes through the points $(-10, a)$ and (a, b), where a and b are constants. What is the value of b ?

A) 4

B) 9

C) 11

D) 16

CONTINUE

14

$$x^2 - 12x + 23 = 0$$

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

A) $-12 + \sqrt{11}$

B) $12 + \sqrt{11}$

C) $-6 + \sqrt{13}$

D) $6 + \sqrt{13}$

15

In the xy-plane, the points $(-3, 10)$ and $(3, 10)$ are endpoints of the diameter of a circle. Which equation represents this circle?

A) $x^2 + (y - 10)^2 = 9$

B) $(x + 3)^2 + y^2 = 36$

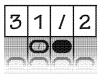
C) $(x + 3)^2 + (y - 10)^2 = 9$

D) $(x + 3)^2 + (y - 10)^2 = 36$

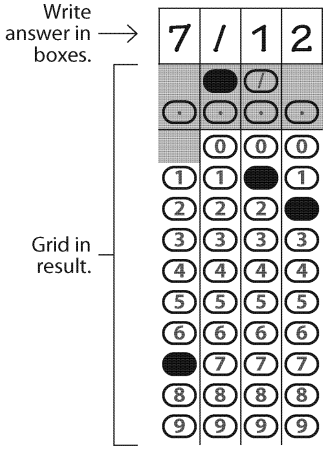
CONTINUE

DIRECTIONS

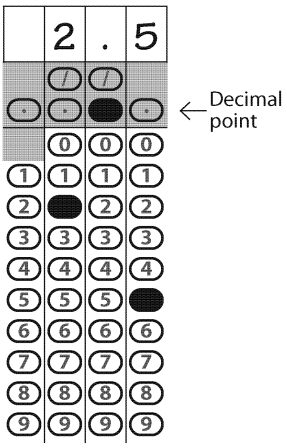
For questions 16-20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

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

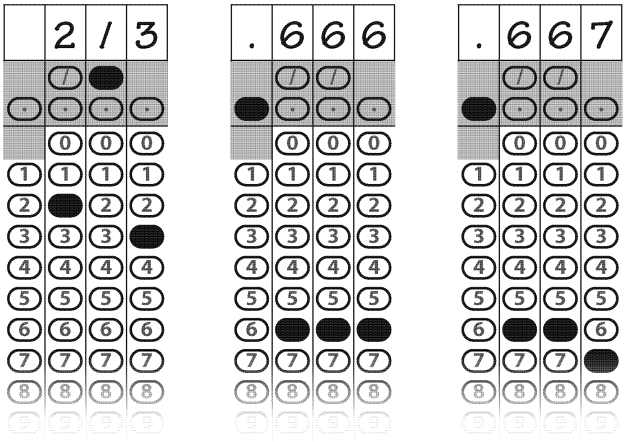
Answer: $\frac{7}{12}$ are:



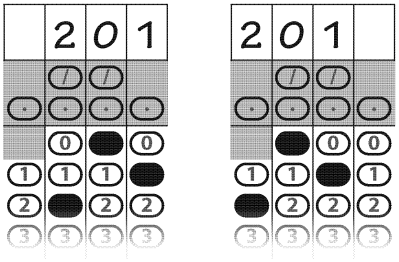
Answer: 2.5



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



Answer: 201 – either position is correct



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

CONTINUE

16

$$2x + 3y = 2$$
$$x - 2y = 8$$

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

17

$$9n + 3 = 15n$$

What value of n satisfies the given equation?

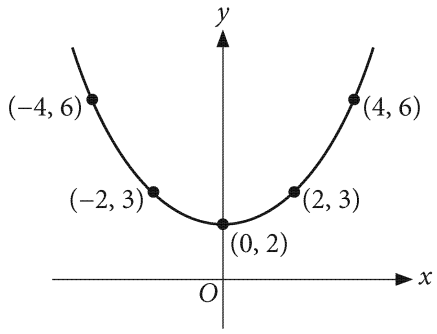
18

The function f is defined by $f(x) = \frac{2}{5}x + 10$. For what value of x does $f(x) = 30$?

19

An office building has a room with a square-shaped floor. The actual length of the floor is 90 times the length of the floor on a blueprint drawn to scale. The actual area of the floor is p times the area of the floor on the blueprint. What is the value of p ?

20



The graph of $y = ax^2 + c$, where a and c are constants, is shown. 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.

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

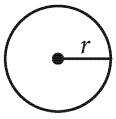
DIRECTIONS

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.

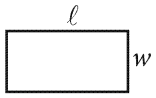
NOTES

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.

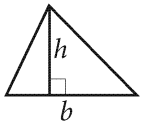
REFERENCE



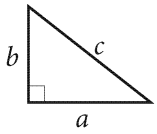
$A = \pi r^2$
$C = 2\pi r$



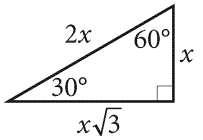
$A = \ell w$

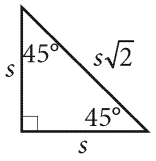


$A = \frac{1}{2}bh$

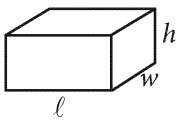


$c^2 = a^2 + b^2$

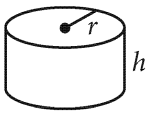




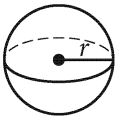
Special Right Triangles



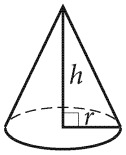
$V = \ell wh$



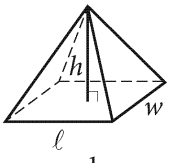
$V = \pi r^2 h$



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



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

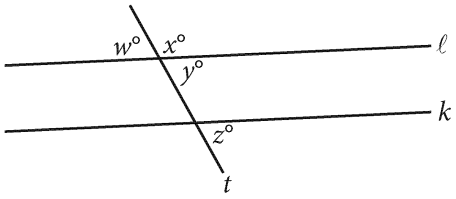


$V = \frac{1}{3}\ell wh$

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.

CONTINUE

1



Note: Figure not drawn to scale.

In the figure shown, line t intersects lines ℓ and k. Which additional piece of information is sufficient to prove that lines ℓ and k are parallel?

A) $x > 90$

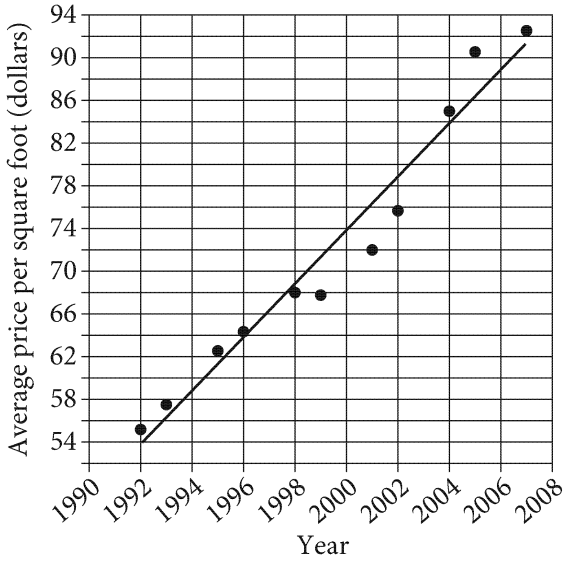
B) $w < 90$

C) $w = y$

D) $y = z$

2

The scatterplot shows the average price per square foot of a house in the United States each year for several years. A line of best fit for the data is also shown.



The line of best fit predicted that the average price per square foot in 2001 would be $76. What is the difference between the predicted value and the actual average price per square foot in 2001?

A) $0

B) $2

C) $4

D) $6

CONTINUE

3

$$(x - 8)^3 = 0$$

What is the solution to the given equation?

A) −8

B) −2

C) 2

D) 8

Questions 4 and 5 refer to the following information.

Costs of some steps to publish a manuscript can vary, as shown in the table.

Publishing step	Minimum cost per manuscript	Maximum cost per manuscript	Mean cost per manuscript
Acquiring an ISBN	$125	$125	$125
Professional review	$250	$650	$395
Marketing	$35 per hour	$75 per hour	$50 per hour

4

Ewan writes 30 manuscripts and wants to get them published. What is the minimum cost, in dollars, for professional review of Ewan's manuscripts?

A) $7,500

B) $11,850

C) $13,125

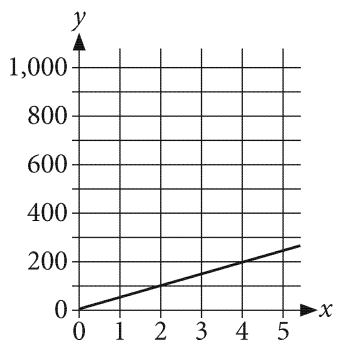
D) $18,750

CONTINUE

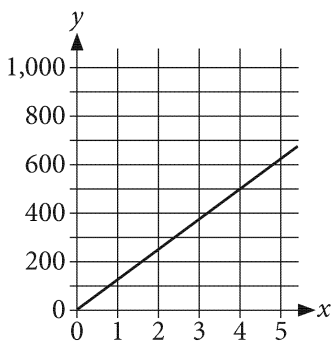
5

Which of the following graphs could represent the relationship between the number of manuscripts, x, and the cost, y, of acquiring ISBNs for the manuscripts?

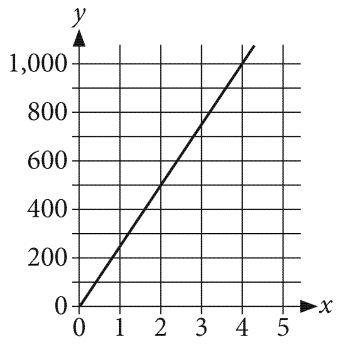
A)



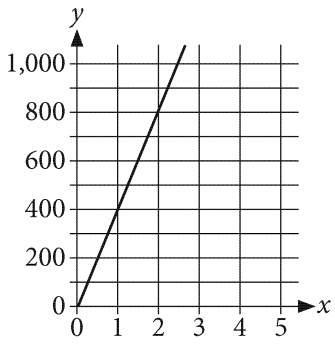
B)



C)



D)



CONTINUE

6

Water quality managers estimate that a population of algae initially covered x square miles of water in a nearby river. After a period of time, the algae grew to cover 375% of its original area. Which of the following expressions represents the area of water, in square miles, that the algae covered after this period of time?

A) $0.375x$

B) $3.75x$

C) $37.5x$

D) $375x$

Questions 7 and 8 refer to the following information.

The nutrition information for a chicken noodle soup recipe is shown in the table. One batch of soup consists of 6 servings. (1 serving = 1 cup)

Nutrition Information, Amount/Serving
Total calories: 203 calories
Percent of total calories from fat: 30%
Fat: 7 grams
Protein: 25 grams
Carbohydrate: 9 grams
Fiber: 1 gram

7

Approximately how many calories from fat are in one serving of the soup?

A) 61

B) 75

C) 144

D) 609

8

The total cost to make one batch of soup is $20. What is the approximate cost per calorie, in cents?

A) 1.6

B) 9.9

C) 33.8

D) 59.1

CONTINUE

9

$$(x + 1) = 2(x + 1)$$

What value of x satisfies the given equation?

A) -1

B) 0

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

D) 1

10

In the xy-plane, what is the y-intercept of the line with equation $y = -2x + 4$?

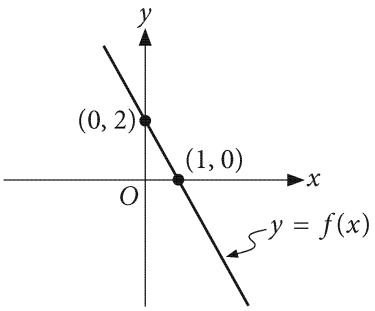
A) $(4, 0)$

B) $(2, 0)$

C) $(0, 2)$

D) $(0, 4)$

11



The graph of the linear function f is shown. Which equation defines f ?

A) $f(x) = -\frac{1}{2}x + 2$

B) $f(x) = -\frac{1}{2}x - 2$

C) $f(x) = -2x + 2$

D) $f(x) = -2x - 2$

12

A speed of 60 meters per second is equivalent to z meters per minute. What is the value of z ?

A) 1

B) 600

C) 1,200

D) 3,600

CONTINUE

13

$$E = 18{,}000 - 2{,}000t$$

$$V = 18{,}000(0.85)^t$$

The given equations are two different models that can be used to find the value, in dollars, of a particular car t years after it was purchased. Which of the following statements correctly compares the values of E and V for $0 < t < 9$?

A) E is always less than V.

B) E is always greater than V.

C) E is initially greater than V but eventually becomes less than V.

D) E is initially less than V but eventually becomes greater than V.

14

	Type A	Type B	Type C	Total
Category 1	10	8	14	32
Category 2	12	7	15	34
Category 3	10	5	19	34
Total	32	20	48	100

The table shown summarizes 100 items by type and category. One type C item will be selected at random. What is the probability that the selected item will be in category 3 ?

A) $\frac{19}{100}$

B) $\frac{19}{48}$

C) $\frac{19}{34}$

D) $\frac{34}{48}$

15

Henri buys 2 boxes of blue pens and some boxes of black pens, Each box contains 10 pens, and Henri buys a total of 50 pens. The equation $10(x + 2) = 50$ represents this situation. Which of the following is the best interpretation of the expression $x + 2$ in this context?

A) The number of blue pens that Henri buys

B) The number of boxes of pens that Henri buys

C) The number of boxes of blue pens that Henri buys

D) The number of boxes of black pens that Henri buys

CONTINUE

16

For the linear function f, $f(6) = 4$, and the graph of $y = f(x)$ in the xy-plane has a slope of $\frac{1}{2}$. Which equation defines f?

A) $f(x) = \frac{1}{2}x + 1$

B) $f(x) = \frac{1}{2}x + 2$

C) $f(x) = \frac{1}{2}x + 4$

D) $f(x) = \frac{1}{2}x + 10$

17

Crawford County, Iowa, is shaped like a rectangle. The length of the county is 6 miles longer than the width of the county. If $A(x)$ is the area of the county, in square miles, and x is the width, in miles, which equation best models the area of the county?

A) $A(x) = x(6x)$

B) $A(x) = x(6 - x)$

C) $A(x) = x(x - 6)$

D) $A(x) = x(x + 6)$

18

$$|x + 3| = 0$$

Exactly how many solutions does the given equation have?

A) Zero

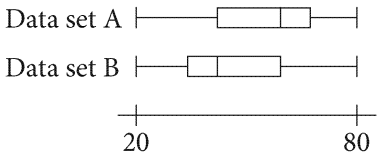
B) One

C) Two

D) Three

CONTINUE

19



The box plots above show the distributions of two data sets. Which of the following statements must be true?

A) The minimum value of numbers in data set A is greater than the minimum value of numbers in data set B.

B) The range of data set A is greater than the range of data set B.

C) Data set A has more data values than data set B has.

D) The median of data set A is greater than the median of data set B.

20

In a tournament for 64 teams, each game is played between two teams. Each team plays one game in the first round. For all rounds, the winning team of each game advances to play a game in the next round, and the losing team is eliminated from the tournament. How many teams remain to play in the fourth round of the tournament?

A) 4

B) 8

C) 16

D) 32

21

For a certain type of aircraft, the ratio of thrust, in newtons, to weight, in newtons, is 27 to 100. If an aircraft has a weight of 3,730,000 newtons, which of the following is closest to the thrust, in newtons, of the aircraft?

A) 1,010,000

B) 13,800,000

C) 101,000,000

D) 373,000,000

22

The graph of the line $y = -\frac{1}{2}x + 3$ in the xy-plane is translated 2 units to the right. What is the y-intercept of the translated line?

A) (0, 1)

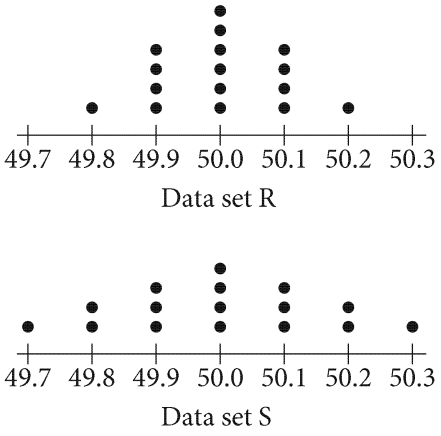
B) (0, 2)

C) (0, 3)

D) (0, 4)

CONTINUE

23



Data set R and data set S are represented in the dot plots shown. The mean for each data set is 50.0. Which of the following best describes the relationship between the standard deviation of data set R and the standard deviation of data set S?

A) Both data sets have the same standard deviation.

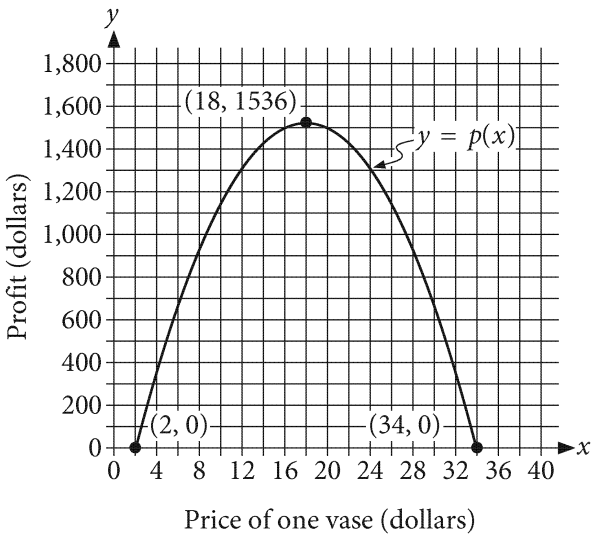
B) The standard deviation of data set R is greater than the standard deviation of data set S.

C) The standard deviation of data set R is less than the standard deviation of data set S.

D) The sum of the standard deviations of the two data sets is 100.

24

A potter is selling vases. The function p gives the total profit $p(x)$, in dollars, the potter will receive if the vases are sold at a price of x dollars each. The graph of $y = p(x)$ is shown.



What equation represents the relationship between the price of one vase and the profit?

A) $p(x) = -6(x - 18)^2 + 34$

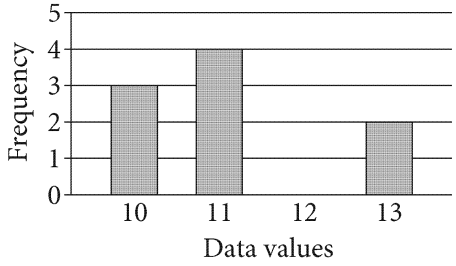
B) $p(x) = -6(x - 18)^2 + 1536$

C) $p(x) = -6(x - 34)^2 + 18$

D) $p(x) = -6(x - 34)^2 + 1536$

CONTINUE

25



The bar graph shows the frequency of each data value in a certain data set. What is the minimum data value in the data set?

A) 10

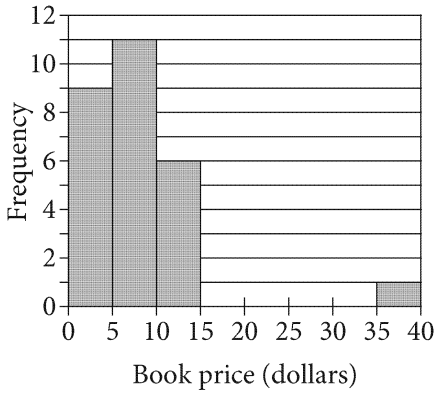
B) 11

C) 12

D) 13

26

The histogram shows the distribution of book prices, in dollars, for the 27 books for sale at a store.



The first bar represents books with prices of less than \$5. The second bar represents books with prices of at least \$5 but less than \$10, and so on. In which interval will the median price of books for sale be included when the book that costs at least \$35 but less than \$40 is sold?

A) At least \$0 but less than \$5

B) At least \$5 but less than \$10

C) At least \$10 but less than \$15

D) At least \$35 but less than \$40

CONTINUE

27

$$y = \frac{1}{2}x + 5$$

One of the two equations in a linear system is given. The system has no solution. Which equation could be the second equation in this system?

A) $y = 2x + 5$

B) $y = \frac{1}{2}x + 5$

C) $y = \frac{1}{2}x - 4$

D) $y = -2x + 5$

28

$$S(t) = 10(0.5)^{\frac{t}{29}}$$

A sample of strontium-90 will radioactively decay to half the original quantity in approximately 29 years. The function S above models the amount of strontium-90, in grams, that remains t years after a 10-gram sample starts to decay. Which of the following is the best interpretation of the number 0.5 in the function?

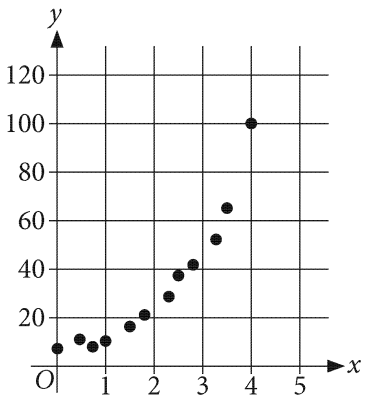
A) The approximate number of years it would take for 5 grams of strontium-90 to remain in the sample

B) The proportion of strontium-90 that remains after approximately 29 years

C) The number of grams of strontium-90 in the sample that will decay approximately every 29 years

D) The number of grams of strontium-90 by which the sample will be reduced each year over approximately 29 years

29



Which equation is the most appropriate exponential model for the data shown in the scatterplot?

A) $y = \frac{1}{100}(10)^x$

B) $y = 2(5)^x$

C) $y = 6(2)^x$

D) $y = 100(2)^{-x}$

30

$$(x + 3)^2 + (y - 7)^2 = 100$$

In the xy-plane, the graph of the given equation is a circle. Which point (x, y) lies on the circle?

A) (3, –4)

B) (3, –1)

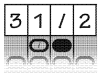
C) (3, 1)

D) (3, 4)

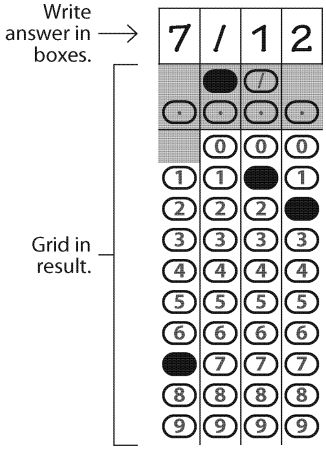
CONTINUE

DIRECTIONS

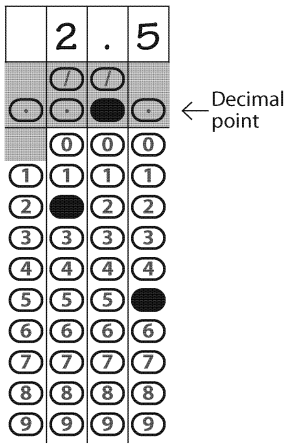
For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

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

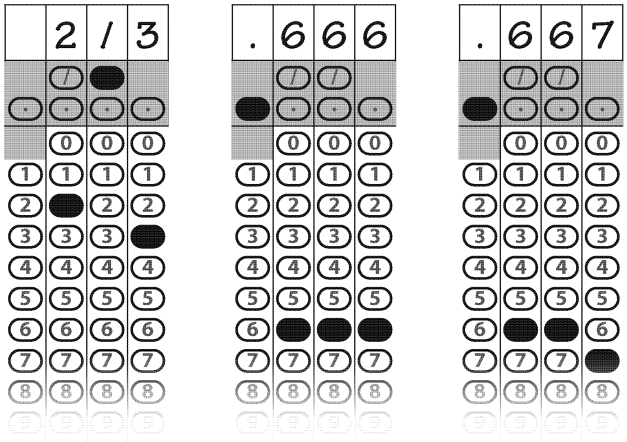
Answer: $\frac{7}{12}$ are:



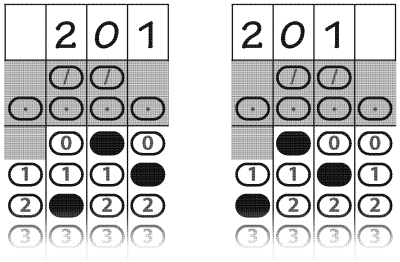
Answer: 2.5



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



Answer: 201 – either position is correct



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

CONTINUE

31

Rectangle A has an area of 64 square meters. The length and width of rectangle B are 3 times the corresponding length and width of rectangle A. What is the area, in square meters, of rectangle B?

32

A one-digit positive integer will be chosen at random. What is the probability that the chosen integer will be greater than 7 ? (Express your answer as a fraction or decimal, not as a percent.)

33

$$5x + 3y = 31$$
$$5x - 4y = 17$$

If (x, y) is the solution to the given system of equations, what is the value of $10x - y$?

34

The expression $3xy(2y + 3)$ is equivalent to $bxy^2 + 9xy$, where b is a constant. What is the value of b ?

Questions 35 and 36 refer to the following information.

As of 2016, there were 118 known elements. These elements can be described with 10 classifications as summarized in the given table.

Classification	Number of elements
Metalloids	7
Other nonmetals	7
Halogens	6
Noble gases	7
Alkali metals	6
Alkaline earth metals	6
Lanthanides	15
Actinides	15
Transition metals	38
Posttransition metals	11

35

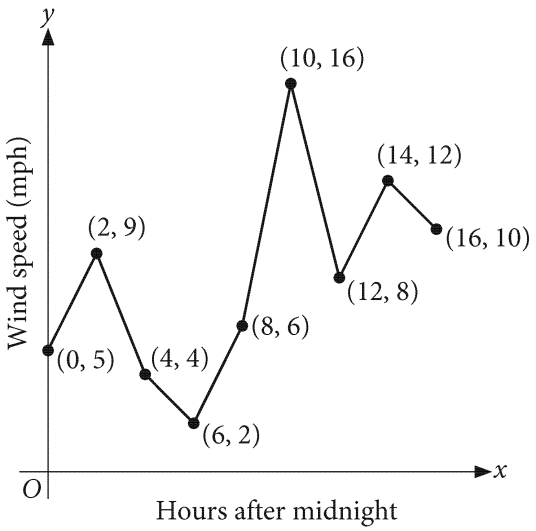
The percentage of the 10 classifications that have 11 or more elements is p%. What is the value of p ?

36

An element is a nonmetal if it is classified as a halogen, noble gas, or other nonmetal. The ratio of all nonmetals to all elements is 10 to k. What is the value of k ?

CONTINUE

37



The line graph shows the wind speed recorded every 2 hours in a town, where x is the number of hours after midnight and y is the wind speed, in miles per hour (mph). What is the greatest average change in wind speed, in miles per hour per hour, between two readings shown in the graph?

38

In the xy-plane, line k with equation $y = mx + b$, where m and b are constants, passes through the point $(-3, 1)$. If line k is perpendicular to the line with equation $y = -2x + 3$, what is the value of b ?

STOP

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