

The SAT®

IMPORTANT REMINDERS

1

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

2

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

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 Jane Austen, *Mansfield Park*, originally published in 1814. Sir Thomas, a rich man, is telling Fanny, the poor niece he raised from age ten, that their neighbor wishes to speak to her to continue his courtship of her.

“Mr. Crawford, as you have perhaps foreseen, is yet in the house. He is in my room, and hoping to see you there.”

Line There was a look, a start, an exclamation on 5 hearing this, which astonished Sir Thomas; but what was his increase of astonishment on hearing her exclaim—” Oh! no, sir, I cannot, indeed I cannot go down to him. Mr. Crawford ought to know—he must know that—I told him enough yesterday to convince 10 him; he spoke to me on this subject yesterday—and I told him without disguise that it was very disagreeable to me, and quite out of my power to return his good opinion.”

“I do not catch your meaning,” said Sir Thomas, 15 sitting down again. —“Out of your power to return his good opinion! What is all this? I know he spoke to you yesterday, and (as far as I understand), received as much encouragement to proceed as a well-judging young woman could permit herself to give. I was very 20 much pleased with what I collected to have been your behaviour on the occasion; it shewed a discretion highly to be commended. But now, when he has made his overtures so properly, and honourably—what are your scruples now?”

25 “You are mistaken, Sir,” —cried Fanny, forced

by the anxiety of the moment even to tell her uncle that he was wrong—“ You are quite mistaken. How could Mr. Crawford say such a thing? I gave him no encouragement yesterday—On the contrary, I told 30 him—I cannot recollect my exact words—but I am sure I told him that I would not listen to him, that it was very unpleasant to me in every respect, and that I begged him never to talk to me in that manner again. —I am sure I said as much as that and more; 35 and I should have said still more, —if I had been quite certain of his meaning any thing seriously; but I did not like to be—I could not bear to be—imputing more than might be intended. I thought it might all pass for nothing with *him*.”

40 She could say no more; her breath was almost gone.

“Am I to understand,” said Sir Thomas, after a few moments silence, “that you mean to *refuse* Mr. Crawford?”

45 “Yes, Sir.”

“Refuse him?”

“Yes, Sir.”

“Refuse Mr. Crawford! Upon what plea? For what reason?”

50 “I—I cannot like him, Sir, well enough to marry him.”

“This is very strange!” said Sir Thomas, in a voice of calm displeasure. “There is something in this which my comprehension does not reach. Here is a young 55 man wishing to pay his addresses to you, with every thing to recommend him; not merely situation in life, fortune, and character, but with more than common

agreeableness, with address and conversation pleasing to every body. And he is not an
 60 acquaintance of to-day, you have now known him some time. His sister, moreover, is your intimate friend."

"Yes," said Fanny, in a faint voice, and looking down with fresh shame; and she did feel almost
 65 ashamed of herself, after such a picture as her uncle had drawn, for not liking Mr. Crawford.

"You must have been aware," continued Sir Thomas presently, "you must have been some time aware of a particularity in Mr. Crawford's
 70 manners to you. This cannot have taken you by surprise. You must have observed his attentions; and though you always received them very properly, (I have no accusation to make on that head,) I never perceived them to be unpleasant to you. I am half
 75 inclined to think, Fanny, that you do not quite know your own feelings."

"Oh! yes, Sir, indeed I do. His attentions were always—what I did not like."

Sir Thomas looked at her with deeper surprise.
 80 "This is beyond me," said he. "This requires explanation. Young as you are, and having seen scarcely any one, it is hardly possible that your affections—"

He paused and eyed her fixedly. He saw her lips
 85 formed into a no, though the sound was inarticulate, but her face was like scarlet. That, however, in so modest a girl, might be very compatible with innocence; and chusing at least to appear satisfied, he quickly added "No, no, I know *that* is quite out of
 90 the question—quite impossible. Well, there is nothing more to be said."

And for a few minutes he did say nothing. He was deep in thought. His niece was deep in thought likewise, trying to harden and prepare herself against
 95 farther questioning.

1

What is the relationship between Sir Thomas's view and Fanny's view of Mr. Crawford's intentions?

- A) Sir Thomas is approving, while Fanny is displeased.
- B) Sir Thomas is indifferent, while Fanny is interested.
- C) Sir Thomas is shocked, while Fanny is unsurprised.
- D) Sir Thomas is perplexed, while Fanny is assured.

2

The words "look," "start," and "exclamation" (line 4) serve which purpose?

- A) They establish a character's nervous temperament.
- B) They indicate the unexpected nature of a character's decision.
- C) They emphasize the strength of a character's reaction.
- D) They suggest the importance of a character's announcement.

3

In the passage, Mr. Crawford's feelings for Fanny are best described as

- A) passionate.
- B) unreturned.
- C) possessive.
- D) fickle.

4

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

- A) Lines 9-13 ("I told . . . opinion")
- B) Lines 16-19 ("I know . . . give")
- C) Lines 53-54 ("There . . . reach")
- D) Lines 70-71 ("This . . . surprise")

5

As used in line 14, the word “catch” most nearly means

- A) stick.
- B) confuse.
- C) fasten.
- D) comprehend.

6

Based on the passage, which of the following inferences can most plausibly be drawn about the interactions between Fanny and Mr. Crawford?

- A) Fanny did not express her wishes to Mr. Crawford as clearly as she thought.
- B) Fanny was unsure of the nature of her feelings for Mr. Crawford.
- C) Mr. Crawford did not make his intentions sufficiently clear to Fanny.
- D) Mr. Crawford changed his mind after hearing Fanny’s reaction.

7

The series of interruptions to Fanny’s speech in lines 28-39 (“I gave...him”) serve to

- A) imply that she is not telling the truth.
- B) suggest that she is highly agitated.
- C) show that she is not yet sure of what she wants.
- D) indicate that Sir Thomas will not let her finish.

8

Based on the passage, which of the following is indisputably true about Mr. Crawford?

- A) He is unattractive.
- B) He is dishonest.
- C) He is stubborn.
- D) He is wealthy.

9

In line 89, “that” most likely refers to the idea that Fanny

- A) is too innocent to understand Mr. Crawford’s meaning.
- B) is impossible to persuade.
- C) may have formed an attachment to someone else.
- D) may be too young to accept Mr. Crawford’s proposal.

10

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

- A) Lines 77-78 (“Oh . . . like”)
- B) Lines 81-83 (“Young . . . affections”)
- C) Lines 86-88 (“That . . . innocence”)
- D) Lines 93-95 (“His niece . . . questioning”)

Questions 11-20 are based on the following passage and supplementary material.

This passage is adapted from Eric Jaffe, "Digital Cameras Are Messing With Your Memory." ©2013 by Mansueto Ventures LLC.

Socrates once feared that technology would corrupt human memory. Quaint as it sounds today, he was worried about a form of communication *Line* called writing. The more easily people could access 5 something in a document, he reasoned, the less inclined they'd be to remember it.

The great philosopher's point rings as true in the digital age as it did in ancient Greece. Recent tests have found that people who think a computer will 10 save their information recall much less of it than those led to believe the machine will delete it. A difficult trivia question is as likely to bring Google to mind as it is the answer.

Fairfield University psychologist Linda Henkel 15 believes something similar may be happening with digital photography. The more easily people can take and access pictures, she says, the less inclined they may be to remember the moment itself. "You're just kind of mentally discounting it—thinking, 'Well, the 20 camera's got it,'" Henkel says.

Henkel draws that conclusion from a study she recently conducted at the Bellarmine Museum of Art on Fairfield's campus. In one of her experiments, she gave test participants a digital camera and an 25 itinerary of museum objects to view. Some of the objects were simply observed. Some were photographed whole with the digital camera. Some were photographed with explicit instructions to zoom in on a detail.

30 The following day, Henkel gathered the participants and tested their memories about the museum experience. She showed them the names (or pictures) of all the objects they'd seen, as well as 10 they hadn't, and asked them whether or not they'd 35 gone up to the item, and if so whether they'd simply observed it or photographed it. For each item they said they saw, she also questioned them about a detail.

Socrates would have enjoyed the results. Test 40 participants recognized fewer objects they'd photographed whole than those they'd observed on their museum tour (from both the list of names and the roster of pictures). They were also much

less accurate in recalling visual details of museum 45 objects they'd photographed whole, compared with those they'd only observed. Simply put, they took the picture and missed the moment.

Henkel calls her finding the "photo-taking-impairment effect." When people know a camera 50 will document an object or event, they may well dismiss it from their own mind. Digital cameras seem particularly conducive to the effect since it's far easier (and cheaper) to take and store digital pictures than it is to develop film or compile photo albums.

55 In other words, the facility of digital photography may well come at the cost of cognitive engagement. "I think it's about the mindlessness with which people approach the task," says Henkel. "If you treat acquiring the photograph as if it's just something to 60 get off your checklist—been there, done that, check—that's what's going to create this dismiss-this-from-memory thing."

The experiment also revealed an important limitation of the photo-taking-impairment effect. 65 When test participants zoomed in on an object, they remembered it as vividly as those objects they had observed (and, of course, far better than the ones they'd photographed whole). What's more, participants even remembered details about the 70 object that they *hadn't* zoomed in on.

Henkel suspects that zooming triggered a completely different cognitive process. While the rote act of photographing a whole object led a person to dismiss it from memory, the slight uptick in focus 75 required to zoom in on a detail caused the same person to absorb the scene as if there were no camera present at all. The brief mental climb from *click* to *zoom-click* was enough to overcome the impairment effect.

80 Of course, an impaired memory for photographs doesn't have to be a bad thing at all. Looking at photographs later on does help recover memories of the moments in question, just as a quick web search helps recover information. In that sense, the transfer 85 system is working as expected. Socrates might have frowned on shifting knowledge into documents, but no less a mind than Einstein once advised people not to memorize what they could easily look up in books.

Percent of Questions Answered Correctly about
Objects' Visual Details and Locations as a
Function of Photographing or Observing the Objects

Experiment and measure	Photographed museum object		Observed museum object
	Whole object	Zoomed in on part	
Experiment 1: Recalling visual detail of object	55%	-	64%
Experiment 2: Recalling visual detail of object	38%	46%	44%
Recalling location of object in the museum	67%	45%	74%

Adapted from Linda A. Henkel, "Point-and-Shoot Memories: The Influence of Taking Photos on Memory for a Museum Tour."
©2013 by Linda A. Henkel.

11

Which choice best supports the idea that modern technology has reduced people's reliance on memory?

- A) Lines 1-2 ("Socrates . . . memory")
- B) Lines 4-6 ("The more . . . remember it")
- C) Lines 8-11 ("Recent . . . delete it")
- D) Lines 21-23 ("Henkel . . . campus")

12

Henkel's study supported which claim about photographing an art object in its entirety?

- A) Photographing a whole art object diminishes one's awareness of it.
- B) Photographing a whole art object enhances visual recall.
- C) Photographing a whole art object permits one to study its composition in detail.
- D) Photographing a whole art object has no impact on memory.

13

As used in line 55, "facility" most nearly means

- A) effortlessness.
- B) competence.
- C) aptitude.
- D) equipment.

14

The main purpose of the author’s use of italics for the word “hadn’t” in line 70 is to

- A) call an interpretation into question.
- B) imply that a claim is not to be taken literally.
- C) underscore the unexpectedness of a result.
- D) draw attention to a key omission.

15

In the course of its discussion of how photographing an object affects one’s recollection of it, the passage implies that

- A) an understanding of a work of art becomes clearer the more time a person spends taking pictures of the work.
- B) increasing one’s concentration minimally can result in recall as good as that associated with direct observation.
- C) photographing something up close can distort a person’s impression of the photograph’s subject.
- D) zooming in on an object restricts one’s focus and therefore makes one less likely to remember the object as a whole.

16

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

- A) Lines 55-56 (“In other . . . engagement”)
- B) Lines 63-64 (“The experiment . . . effect”)
- C) Lines 71-72 (“Henkel . . . process”)
- D) Lines 74-77 (“the slight . . . all”)

17

The main purpose of the last paragraph is to

- A) indicate that a phenomenon may not be entirely troublesome
- B) suggest that an established way of thinking has undergone a radical transformation.
- C) imply that certain historical figures misunderstood the function of human memory.
- D) argue against a series of concerns about the impact of new technologies.

18

According to the table, what percent of participants in experiment 2 were able to recall visual details of objects they photographed in part?

- A) 74%
- B) 55%
- C) 46%
- D) 38%

19

The table indicates that participants were LEAST likely to recall the location of an object when they

- A) looked at it without taking a picture of it.
- B) zoomed in on it with the camera.
- C) photographed it in its entirety.
- D) captured images of other nearby objects.

20

Based on information provided in the table, which statement is true of both experiments?

- A) Photographing a whole object leads to a less accurate recollection than does observing it.
- B) Photographing a whole object leads to the most accurate recollection of its location.
- C) Photographing part of an object leads to a more accurate recollection of detail than does observing it.
- D) Photographing part of an object leads to greater accuracy in recalling the object's location than does merely observing it.

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

This passage is adapted from Mlot, "MiniMoose Evolve on Isle Royale." ©2011 by American Institute of Biological Sciences.

Rows of moose skulls, moose antlers, and club-size moose metatarsal bones fill a clearing behind the weathered wooden cottage where biologist Rolf Line Peterson has spent the last 40 summers, on Isle 5 Royale, Michigan. Hauled each year from the spruce bogs and fir forests on the Lake Superior island, the display is part of the world's largest collection of moose bones.

The bones tell many tales—of periodontal disease 10 and arthritis, of lean years and flush years, of two bulls that crossed antlers in a duel and died that way, racks locked. Most famously, they tell a long-running tale of predator and prey, of how wolf numbers have affected moose numbers, and vice versa. Now Peterson, John 15 Vucetich, and their colleagues have extracted a new evolutionary tale from the bones: Living on the island downsized the moose.

The phenomenon has been found elsewhere: Mini 20 hippos and elephants once resided on Mediterranean islands, and a hobbit-like human ancestor lived on an island in what is now Indonesia. Limited resources can account for this *island rule*, and that seems to have been the case for Isle Royale's moose, says Peterson, at least for the first half of their history.

That history dates back to the early 1900s, when a few Canadian moose probably swam 20 miles of Lake Superior to the 210-square-mile island of predator-free boreal forest. They displaced the caribou, gorged on bog plants in summer and balsam fir in winter, and 30 exploded in number, reaching several thousand in the 1920s. Their free rein ended in 1949, when a curious pair of Canadian wolves managed the same journey across a frozen lake and claimed the new territory. Ten years later, when Allen of Purdue University began 35 studying the predator-prey interaction, the wolves were up to 20 and the moosedown to 538. The two population numbers have seesawed ever since.

Peterson, who joined the project as a graduate student in 1970 and later moved to Michigan 40 Technological University in Houghton, was teaching dissection using some moose metatarsal bones that he had collected from mainland Michigan. (The

metatarsus in a moose makes up the hind leg and serves as a proxy for body size.) Peterson noticed that their size was “consistently above the average for Isle Royale moose. Then when researchers in Minnesota started collaring moose and making collections from dead animals, I saw an opportunity to collect enough moose bones to do a respectable comparison.”

Researchers measured the length of more than 1000 metatarsal bones collected on Isle Royale and found that the mean was significantly shorter than that of bones collected from nearby mainland moose, by about 9 millimeters for females and double that for males. The difference with moose bones collected from mainland Sweden and Alaska was even greater; Isle Royale moose, it seems, may be among the smallest in the world.

Shripad Tuljapurkar, a Stanford University evolutionary biologist who has worked on the evolution of phenotypic traits, calls the paper “an insightful historical analysis that provides valuable detail about evolution in a large mammalian species and marches with the general island rule.” The detail, he notes, should help in creating analytical models of size change for species with island and mainland populations.

Although the island’s limited resources have downsized the moose, ongoing research suggests that another evolutionary process has been countering that force: Wolf predation seems to be selecting for larger moose. Smaller moose are more likely to end up as wolf fare, and that preference shows up in the bone collection: The longer the metatarsus was, the older the moose was, which makes it more likely that the moose had had more offspring. And since most of the metatarsus develops *in utero* and is fully grown by the time the moose is one to two years old, “the pattern of increasing bone length with increasing age can’t have a physiological explanation,” says Vucetich.

That leaves the role of the wolves, which creates another evolutionary tale. “Darwin was keen that predators shape the lives of their prey,” says Vucetich. What is distinctive, he notes, is the wolves’ effect on the body size of a large, long-lived vertebrate and during a relatively short period. “Even though it’s 50 years, it’s very brief in evolutionary time.”

Figure 1

Metatarsal Length in Male
Isle Royale and Mainland Moose

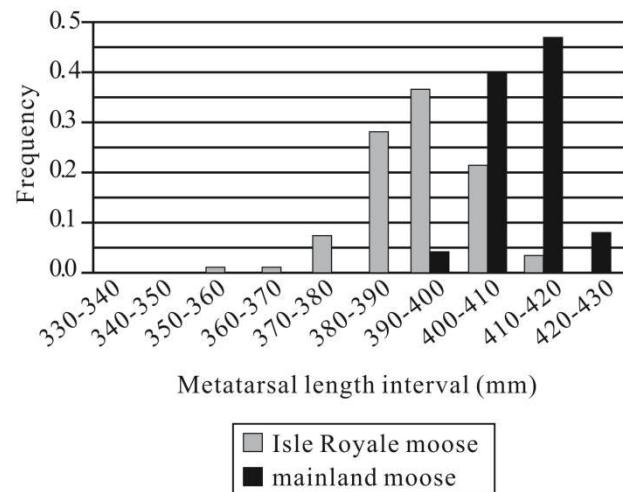
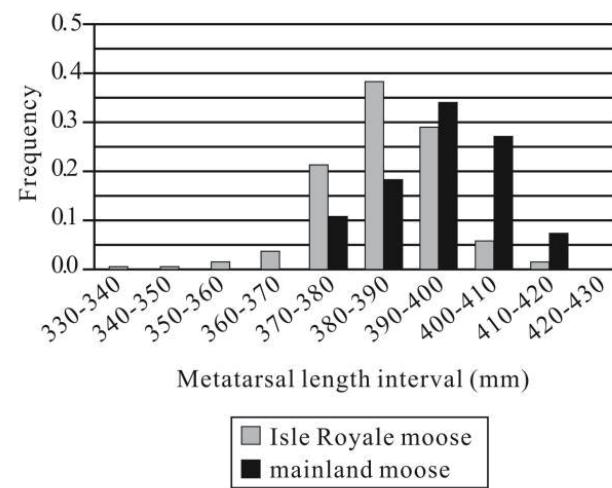


Figure 2

Metatarsal Length in Female
Isle Royale and Mainland Moose



Figures adapted from Rolf O. Peterson et al., “Phenotypic Variation in Moose: The Island Rule and the Moose of Isle Royale” ©2011 by Rolf O. Peterson et al.

21

- The primary purpose of the passage is to
- A) discuss research about the effects of environmental factors on the body size of Isle Royale moose.
 - B) describe a study of the relationship between wolf population size and moose population size on Isle Royale.
 - C) explain the ecological changes that have endangered the Isle Royale moose.
 - D) resolve a controversy about the evolution of a new species of small moose on Isle Royale.

22

The main purpose of the author’s description of Peterson’s collection of moose bones in the first paragraph is to

- A) suggest that the bones of the Isle Royale moose show traits absent in other moose populations.
- B) identify the central question addressed by scientists studying Isle Royale moose.
- C) show the extent of evidence a researcher has gathered.
- D) characterize the relationship between Isle Royale moose and their habitat.

23

The passage most strongly suggests that moose rapidly increased in number after arriving on Isle Royale in part because they

- A) adapted quickly to unfamiliar food resources.
- B) were not preyed on by any other animals.
- C) needed less food than did the caribou.
- D) already had evolved a smaller average body size.

24

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

- A) Lines 14-17 (“Now . . . moose”)
- B) Lines 21-24 (“Limited . . . history”)
- C) Lines 25-28 (“That . . . forest”)
- D) Lines 28-31 (“They . . . 1920s”)

25

As used in line 44, “makes up” most nearly means

- A) reconciles.
- B) arranges.
- C) forms.
- D) balances.

26

In saying that Peterson’s analysis “marches with the general island rule” (line 66), Tuljapurkar most likely means that Peterson’s analysis

- A) is consistent with the island rule.
- B) displays a familiarity with the island rule.
- C) serves as proof of the island rule.
- D) is comparable to the island rule.

27

What evidence in the passage supports the claim that wolf predation may be leading to larger body size in Isle Royale moose?

- A) A comparison of the metatarsal lengths in mainland and Isle Royale moose before and after the arrival of wolves on Isle Royale
- B) A correlation between moose metatarsal length and age that is not attributable to normal growth patterns
- C) Data pointing to a rise in the wolf population and a corresponding decrease in the moose population
- D) The demonstrated tendency for large mammalian species to follow the island rule in the face of limited resources

28

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

- A) Lines 34-37 (“Ten . . . 538”)
- B) Lines 70-74 (“Although . . . larger moose”)
- C) Lines 78-83 (“And . . . Vucetich”)
- D) Lines 87-89 (“What . . . period”)

29

According to figure 1, the metatarsal length interval with the highest frequency in male Isle Royale moose is

- A) 370-380 mm.
- B) 380-390 mm.
- C) 390-400 mm.
- D) 410-420 mm.

30

Which statement about the metatarsal length in female moose is best supported by figure 2?

- A) Metatarsal lengths below 380 mm have not been observed in mainland moose.
- B) The metatarsal length interval with the highest frequency in Isle Royale moose is 390–400 mm.
- C) Metatarsals of 400–410 mm in length occur with a frequency greater than 0.1 in Isle Royale moose.
- D) Some Isle Royale and mainland moose have metatarsals at least 410 mm long.

31

Data presented in the figures most directly support which statement about metatarsal lengths in mainland moose?

- A) The metatarsal length interval with the highest frequency in females includes greater lengths than the metatarsal length interval with the highest frequency in males.
- B) More female metatarsals have been recovered than male metatarsals.
- C) In males frequency increases as metatarsal length increases, whereas in females frequency decreases as metatarsal length increases.
- D) Female metatarsal lengths span a greater number of length intervals than do male metatarsal lengths.

Questions 32–42 are based on the following passages.

Passage 1 is adapted from Betty Friedan, *The Feminine Mystique*. 1963 by Betty Friedan. Passage 2 is adapted from the Statement of Purpose and the Bill of Rights of the National Organization for Women (NOW), adopted at NOW's first national conference in 1966.

Passage 1

The problem lay buried, unspoken, for many years in the minds of American women. It was a strange stirring, a sense of dissatisfaction, a yearning *Line* that women suffered in the middle of the twentieth century in the United States. Each suburban wife struggled with it alone. As she made the beds, shopped for groceries, matched slipcover material, ate peanut butter sandwiches with her children, chauffeured Cub Scouts and Brownies, lay beside her husband at night—she was afraid to ask even of herself the silent question—“Is this all?”

For over fifteen years there was no word of this yearning in the millions of words written about women, for women, in all the columns, books and articles by experts telling women their role was to seek fulfillment as wives and mothers. Over and over women heard in voices of tradition and of Freudian sophistication that they could desire no greater destiny than to glory in their own femininity.

Experts told them how to catch a man and keep him... how to cope with sibling rivalry and adolescent rebellion; how to buy a dishwasher, bake bread, cook gourmet snails, and build a swimming pool with their own hands; how to dress, look, and act more feminine and make marriage more exciting; how to keep their husbands from dying young and their sons from growing into delinquents. They were taught to pity the neurotic, unfeminine, unhappy women who wanted to be poets or physicists or presidents.

They learned that truly feminine women do not want careers, higher education, political rights—the independence and the opportunities that the old-fashioned feminists fought for. Some women, in their forties and fifties, still remembered painfully giving up those dreams, but most of the younger women no longer even thought about them. A thousand expert voices applauded their femininity, their adjustment, their new maturity. All they had to do was devote their lives from earliest girlhood to finding a husband and bearing children.

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Passage 2*Statement of Purpose*

We, men and women who hereby constitute ourselves as the National Organization for Women, believe that the time has come for a new movement toward true equality for all women in America, and 45 toward a fully equal partnership of the sexes, as part of the world-wide revolution of human rights now taking place within and beyond our national borders....

We reject the current assumptions that a man must 50 carry the sole burden of supporting himself, his wife, and family, and that a woman is automatically entitled to lifelong support by a man upon her marriage, or that marriage, home and family are primarily woman's world and responsibility — hers, to dominate — 55 his, to support. We believe that a true partnership between the sexes demands a different concept of marriage, an equitable sharing of the responsibilities of home and children and of the economic burdens of their support....

60 In the interests of the human dignity of women, we will protest, and endeavor to change, the false image of women now prevalent in the mass media, and in the texts, ceremonies, laws, and practices of our major social institutions. Such images perpetuate 65 contempt for women by society and by women for themselves....

We believe that women will do most to create a new image of women by acting now, and by speaking out in behalf of their own equality, freedom, and 70 human dignity—not in pleas for special privilege, nor in enmity toward men, who are also victims of the current, half-equality between the sexes—but in an active, self-respecting partnership with men.

We Demand:

75 That the U.S. Congress immediately pass the Equal Rights Amendment to the Constitution to provide that "Equality of rights under the law shall not be denied or abridged by the United States or by any State on account of sex" and that such then be 80 immediately ratified by the several states.

32

The main effect of the references in lines 2-3 to "a strange stirring," "a sense of dissatisfaction," and "a yearning" is to

- A) draw attention to a subtle historical change.
- B) acknowledge a feeling of repressed discontent.
- C) reveal a dilemma's underlying cause.
- D) express contempt for a series of activities.

33

Which of the following does Passage 1 suggest about publications for and about women in the mid-twentieth-century United States?

- A) They contained numerous advertisements for household products.
- B) They were filled with advice columns devoted to working women's careers.
- C) They were almost all written and published by men.
- D) They neglected to challenge the mainstream view of suburban women's circumstances.

34

The author of Passage 1 mentions "voices of tradition and of Freudian sophistication" (lines 17-18) most likely in order to

- A) allude to literary works frequently read by women.
- B) show that scientific findings about women's needs often differed from received wisdom.
- C) suggest that women received the same advice from a range of sources.
- D) characterize the tone of most writing addressed to women.

35

Based on Passage 1, in the United States in the mid-twentieth century, women who valued career success were generally

- A) envy.
- B) ridicule.
- C) outrage.
- D) condescension.

36

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

- A) Lines 1-2 (“The . . . women”)
- B) Lines 27-29 (“They . . . presidents”)
- C) Lines 33-36 (“Some . . . them”)
- D) Lines 38-40 (“All . . . children”)

37

Passage 2 is written from the point of view of a

- A) citizen asking for answers.
- B) historian providing details.
- C) journalist relating facts.
- D) group demanding change.

38

Which choice provides the best evidence for the idea that members of the National Organization for Women were inspired by global events?

- A) Lines 41-48 (“We, men . . . borders”)
- B) Lines 49-55 (“We reject . . . support”)
- C) Lines 55-59 (“We believe . . . support”)
- D) Lines 60-64 (“In the . . . institutions”)

39

As used in line 55, “true” most nearly means

- A) loyal.
- B) genuine.
- C) acceptable.
- D) consistent.

40

The people viewed as “expert voices”(lines 36-37) in Passage 1 would most likely consider the “new movement” (line 43) discussed in Passage 2 to be

- A) cynical, since men are clearly its main proponents.
- B) overdue, since women have already begun to seek new responsibilities.
- C) desirable, because certain tasks have disproportionately fallen to men.
- D) unnecessary, because the current state of affairs satisfies women.

41

Unlike Passage 1, Passage 2 strongly suggests that

- A) men are unfairly burdened by financial responsibilities.
- B) the media attempt to present accurate images of women.
- C) women in the mid-twentieth-century United States were unhappy.
- D) experts have been giving women misinformation.

42

In contrast to Passage 1, Passage 2 makes use of

- A) an ironic tone for humorous effect.
- B) examples of gender-based roles.
- C) calls for specific action.
- D) references to specific individuals.

Question 43-52 are based on the following passage.

This passage is adapted from Fenella Saunders, "Copper, Heal Thyself." 2010 by Sigma Xi, The Scientific Research Society.

A single particle, such as an atom or a neutron, when fired into a piece of copper, causes a fountainlike cascade of disturbance, knocking countless copper atoms out of their positions in the metal's crystalline structure. A few trillionths of a second later, most of the atoms settle back into the crystal's lineup, but a handful are permanently displaced, misaligned and unable to fit back in anywhere. If that material is in an environment with radiation, such as part of a nuclear reactor, over time those wayward atoms migrate and build up on the part's surface, leaving behind voids that can make the material brittle. "After irradiation the size can increase up to 10 percent because of the atoms moving to the surface," says Blas Uberuaga, a materials scientist at Los Alamos National Laboratory. "And that's bad because if you make parts that all fit together, and then they swell, nothing fits together like it's designed to."

With the development of new fusion and fission reactors, researchers are looking for more radiation-resistant construction materials. It's known that materials with a nanocrystalline structure often resist radiation damage better than regular, "bulk" versions of the same compounds. In the former, the material is made up of tiny grains, each one of which is a single crystal. When the grains are agglomerated, their crystal lattices [geometric structures] don't line up, so there are boundaries between the grains. Such *grain boundaries* are undesirable in some applications, such as in electronics, where they impede electron flow, but they are known to make substances stronger as well as more resistant to radiation damage. However, until recently the complete mechanism behind this radiation resiliency was not well understood on the atomic scale.

As Uberuaga, Xian-Ming Bai and their colleagues reported recently, the group performed computer simulations of nanocrystalline copper undergoing radiation damage to figure out what happens inside the metal. The loose atoms, a type of defect known as interstitials, are attracted to the grain boundaries because there's a little more room there than in

the rest of the crystal. "Conventionally it has been assumed that once a defect gets to a boundary it just disappears, it gets very quickly to the surface or something like that," says Uberuaga. However, their simulations found something new, as Bai explains: "We found that some of the absorbed interstitials at the grain boundary can come out to annihilate vacancies. So this is a new mechanism behind the self-healing phenomenon."

Rather than just acting as a transport route to the surface, the grain boundaries seem to be a temporary sink for the loose atoms. The vacancies diffuse through the material much more slowly than the interstitials. But in a nanocrystal material, the chances are good that a grain boundary is relatively nearby, which can hold the atom until it finds a vacancy. "If the interstitials just got swept away somewhere else, that healing would not be able to occur. So that local trapping is crucial," says Uberuaga.

In addition, the large number of grain boundaries in nanocrystalline materials gives the vacancies a shorter finish line for their catch-up race. "The vacancies don't have to diffuse all the way to the boundary. There's this extra zone in our simulation of about a nanometer or so where the interstitials can come out and directly zap the vacancies," says Uberuaga.

Bai and Uberuaga suspect that the self-healing mechanism they've found will work with certain other metals and ceramics, and could reopen the consideration of whole classes of structural materials thought not to be sufficiently radiation resistant for use in reactors. Radiation does tend to make the crystal grain size grow over time in some metals such as copper, but using an alloy of two materials that don't mix, and therefore can't create larger crystals, could solve that problem. A bigger roadblock may be that nanocrystalline materials are not yet mass-produced. "There are a number of challenges like that before any kind of reactor material is really designed from the nanoscale," says Uberuaga. "But these results give some insight into what kind of interfaces you might need to get some benefit in nuclear environments, both for fission and fusion reactors."

43

The main goal of the research discussed in the passage was to investigate why

- A) some material exists only in nanocrystalline form and some exists only in bulk form.
- B) radiation causes the grains of nanocrystalline material to change size.
- C) nanocrystalline material is especially resistant to radiation damage.
- D) irradiated bulk and nanocrystalline materials become brittle over time.

44

In the first paragraph, the comments from Uberuaga primarily serve to

- A) explain an impediment to testing a theory.
- B) describe the origin of a newly discovered compound.
- C) offer a speculation about the cause of a transformation.
- D) elaborate on the implications of a phenomenon.

45

The passage indicates that interstitials move toward grain boundaries because

- A) interstitials are attracted to magnetic features of grain boundaries.
- B) there is less open space in other areas of crystals than in grain boundaries.
- C) the diffusion of vacancies pushes interstitials toward grain boundaries.
- D) electrons in interstitials can only flow properly through grain boundaries.

46

When Bai says that some interstitials can “annihilate vacancies” (lines 50-51), he means that those interstitials can

- A) block the grain boundaries in nanocrystalline structures.
- B) close the voids caused by the migration of irradiated atoms.
- C) destroy the crystal lattices of tiny grains.
- D) eliminate the displaced atoms in irradiated copper.

47

Based on the passage, which statement provides the best explanation for why materials with nanocrystalline structures differ from bulk versions of the same materials in the damage they display following irradiation?

- A) Grain boundaries prevent interstitials from diffusing through materials with nanocrystalline structures, which means that vacancies cannot form in such materials.
- B) In bulk materials, exposure to radiation knocks some atoms loose, whereas in materials with nanocrystalline structures, atoms are fixed in place in crystal lattices.
- C) When loose atoms build up on the surfaces of bulk materials, those materials change size, whereas atoms can build up on the surfaces of materials with nanocrystalline structures without those materials changing size.
- D) Unless interstitials are temporarily held by the grain boundaries that exist in materials with nanocrystalline structures, they move to the surface too quickly to fill the voids caused by radiation exposure.

48

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

- A) Lines 9-16 (“If that . . . Laboratory”)
- B) Lines 22-27 (“It’s known . . . crystal”)
- C) Lines 37-44 (“As Uberuaga . . . crystal”)
- D) Lines 55-60 (“The vacancies . . . vacancy”)

49

The author uses the phrase “a shorter finish line for their catch-up race” (line 66) most likely to

- A) posit a causal connection between a rare phenomenon and a common phenomenon.
- B) provide a technical explanation for the speed with which a phenomenon unfolds.
- C) describe a phenomenon unfamiliar to nonspecialists in accessible terms.
- D) emphasize the frequency with which a phenomenon occurs.

50

The main function of the last paragraph is to

- A) summarize Bai and Uberuaga's findings and discuss some efforts that are underway to apply those findings to the construction of new reactor parts.
- B) explain how Bai and Uberuaga plan on expanding their study and concede that other nanocrystalline materials may behave differently than copper does when exposed to radiation.
- C) underscore the significance of Bai and Uberuaga's research and acknowledge obstacles to using nanocrystalline materials in nuclear reactor parts.
- D) discuss a technical problem that Bai and Uberuaga faced when testing their hypothesis and show how they adapted their work to overcome that problem.

51

A researcher suggests that brass, which is created by blending copper with zinc, should be used in parts for nuclear reactors since it is harder than copper. Based on the passage, which question would need to be answered to determine whether the researcher's suggestion is viable?

- A) Is nanocrystalline zinc harder than nanocrystalline copper?
- B) Does nanocrystalline brass change from a solid to a liquid at a higher temperature than does nanocrystalline copper?
- C) Does nanocrystalline zinc behave differently in a fission reactor than it does in a fusion reactor?
- D) Do nanocrystalline copper and zinc combine in such a way that the size of the resulting crystal is stable?

52

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

- A) Lines 72-77 ("Bai . . . reactors")
- B) Lines 77-81 ("Radiation . . . problem")
- C) Lines 81-83 ("A bigger . . . mass-produced")
- D) Lines 86-89 ("But these . . . reactors")

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.

Green Bank Silence

There are no pinging cell phones, there is no way to send or receive text messages, and all Internet connections are slow and come from a wire plugged into a socket.

There aren't even any radio stations. **1** How do people communicate with each other there? In fact, it's a US **2** town; called Green Bank, West Virginia. To some people, life in Green Bank would be a nightmare. To visitors and the fewer than 200 people who lived there, it's a paradise.

1

Which question most logically sets up the response that follows in the next sentence?

- A) NO CHANGE
- B) Why are so many features of modern life unavailable there?
- C) Where in the United States is this town located?
- D) Is this a remote outpost on an inhospitable part of the planet?

2

- A) NO CHANGE
- B) town:
- C) town;
- D) town, it's

[1] Green Bank is not an engineered utopian community, however. [2] It's in the National Radio Quiet Zone, a 13,000-square-mile area where wireless signals were made illegal in 1958, just after the completion of an astronomy observatory in Green Bank. [3] Scientists chose the spot because [3] they're surrounded by the Allegheny Mountains. [4] The observatory now houses the Robert C. Byrd Green Bank Telescope, a radio telescope capable of detecting energy emitted from other galaxies [4] that aren't our own, up to 14 billion years ago. [5] The mountains help block radio signals coming from outside the Quiet Zone. [6] Just as a person needs to be away from bright city lights in order to see the stars at night, the telescope needs to be in a place with no other radio frequencies [5] be able to detect faint signals arriving from light-years away. [6]

3

- A) NO CHANGE
- B) it's
- C) its
- D) their

4

- A) NO CHANGE
- B) besides ours,
- C) beyond the borders of ours,
- D) DELETE the underlined portion.

5

- A) NO CHANGE
- B) is able
- C) is enabled
- D) to be able

6

- To make this paragraph most logical, sentence 5 should be placed
- A) where it is now.
 - B) after sentence 2.
 - C) after sentence 3.
 - D) after sentence 6.

While the Quiet Zone laws make operating many types of modern businesses difficult, some local companies use the lack of wireless signal as an asset. Tourism has been particularly successful in the Quiet Zone. The owners of Green Bank Cabins, a group of rustic vacation cabins, advertise that the experience of staying on their property is “a taste of yesteryear.” For plugged-in urbanites 7 who use their cell phones for everything from communication to entertainment, the isolation in Green Bank is a more unusual experience than touring a foreign city, lying on a crowded beach, or taking a cruise to another country.

The lack of wireless signal can be an advantage for full-time residents as well. When students 8 leave Green Bank to go to college, they tell their new classmates

7

- A) NO CHANGE
- B) which they use
- C) whose cell phones they use
- D) their cell phones used

8

- A) NO CHANGE
- B) emigrate from
- C) flee
- D) retreat from

that they gathered with friends around bonfires on weekends instead of going to shopping malls. Jay [9] Lockman a scientist, at the observatory, joins an informal band in the evenings. [10] “It’s just like trying to see the stars from a brightly lit football field,” he explains. Other people have moved to Green Bank for health reasons. [11] Thanks to the telescope, Green Bank is a haven for people who want—or need—a simpler way of life.

9

- A) NO CHANGE
- B) Lockman, a scientist,
- C) Lockman, a scientist
- D) Lockman a scientist

10

At this point, the writer wants to include a quotation from Lockman that connects the previous sentence to the paragraph’s main point. Which of the following quotations from Lockman best accomplishes this goal?

- A) NO CHANGE
- B) “We start together and we end together, and sometimes that just seems astonishing,”
- C) “A typical quasar will give off radio waves that are a billionth, of a billionth, of a millionth of a watt when they get to Earth,”
- D) “It really goes back to the time when if you wanted to hear music, you had to play it yourself,”

11

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

These residents suffer from electromagnetic hypersensitivity, or EHS, and report experiencing headaches or dizziness when they’re exposed to radio frequencies.

Should the writer make this addition here?

- A) Yes, because it provides details about an idea introduced in the previous sentence.
- B) Yes, because it ties this paragraph to the previous paragraph.
- C) No, because it contradicts a claim made elsewhere in the passage.
- D) No, because it is not related to the paragraph’s main point.

Questions 12–22 are based on the following passage.

Crafting Mathematical Models

When mathematician Euclid developed a new theory of geometry, he [12] initiates a paradigm shift. Rejecting the prevailing mathematical model of ancient Greece,

[13] proofs and hypotheses were used to calculate the shapes, lines, and planes of objects instead of memorizing algorithms. Modeling the shape of a planet, determining the amount of paint needed to cover a wall, or calculating the angle of a basketball shot for a three-pointer can be done using Euclidean geometry. Euclid's most significant book, *Elements*, served as the main source for teaching mathematics for more than two thousand years.

Despite the prominence of Euclid's theory, in the mid-nineteenth century mathematicians found a surface that does not [14] attest to Euclid's rules. The [15] discovery, of the “hyperbolic plane” in which a surface curves away from itself at every point, introduced a form of new geometry. Examples of the hyperbolic plane, such as lettuce leaves and corals, are abundant in real life, and all belong to the category of non-Euclidean geometry.

12

- A) NO CHANGE
- B) had initiated
- C) initiated
- D) will initiate

13

- A) NO CHANGE
- B) the approach used proofs and hypotheses to calculate
- C) proofs and hypotheses calculated
- D) Euclid used proofs and hypotheses to calculate

14

- A) NO CHANGE
- B) conform to
- C) integrate with
- D) yield to

15

- A) NO CHANGE
- B) discovery of the “hyperbolic plane”
- C) discovery of the “hyperbolic plane,”
- D) discovery—of the “hyperbolic plane”—

16 Mathematicians were keen to have a physical structure to demonstrate the complexity and features of the hyperbolic plane, but its curvature was challenging to design. Italian mathematician Eugenio Beltrami made a prototype by taping together long, skinny strips of paper, **17** perhaps the most creative solution devised. It wasn't until 1997 that Cornell University mathematics professor

16

Which choice best introduces the information in this paragraph?

- A) Later, mathematicians would create new geometries based on further refutation of Euclid's rules.
- B) Non-Euclidean geometry had a powerful impact on the fields of science and philosophy as well.
- C) Although it was known for many years to exist, the hyperbolic plane was difficult to model.
- D) This new geometrical theory had profound implications for industrial design.

17

Which choice effectively helps develop the main idea of the paragraph?

- A) NO CHANGE
- B) but this and similar models were time-consuming to make and extremely fragile.
- C) a design which was later improved by mathematician William Thurston.
- D) which was called a pseudosphere.

Daina Taimina realized that she could draw on a hobby she had learned while growing up in Latvia to 18 get to the bottom of it. She turned to crochet 19 (one of her favorite pastimes).

18

- A) NO CHANGE
- B) take it to the next level.
- C) solve this problem.
- D) fix up the conundrum.

19

At this point, the writer wants to include a detail that will help prepare readers for the discussion in the next paragraph. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) (a technique no one had thought to use in this context).
- C) (proving her creativity and innovative thinking).
- D) (a crafting technique that involves using a blunt hook to loop yarn into stitches).

Inspired by viewing Beltrami's preserved paper model, Taimina realized that hyperbolic planes could be modeled by crocheting—all she'd have to do is increase the number of stitches in each row. Stitched in a circle, the result is a constantly growing surface—the first manipulable hyperbolic plane model ever constructed. The benefit of sturdy crocheted models **20** is from properties of the hyperbolic plane become visible to the eye and can be directly experienced through handling. Today, the automobile industry and computer-generated animation **21** relies on models like these to advance their understanding of curvature and multidimensional planes in their designs. Mathematicians also use these models to better teach and theorize about geometry.

22 It took a twentieth-century mathematician turning to an old-fashioned craft to advance geometry in the new millennium.

20

- A) NO CHANGE
- B) are that
- C) are because
- D) is that

21

- A) NO CHANGE
- B) rely
- C) has been relying
- D) relied

22

The writer is considering deleting the underlined sentence. Should the sentence be kept or deleted?

- A) Kept, because it provides an effective conclusion to the overall passage.
- B) Kept, because it reminds the reader of the origin of geometrical mathematics.
- C) Deleted, because it introduces irrelevant information.
- D) Deleted, because it undermines the importance of Euclidean geometry in current mathematics.

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

Virtual Welding

In several parts of North America, rapid growth in the energy industry had led to a need for more skilled welders. Trade schools and community colleges are working to train welders in areas where demand is

23 high, but they need additional resources to do so. One promising means of educating more welders is the use of virtual reality equipment, which allows students to gain valuable experience in welding without costly investments in raw materials.

23

- A) NO CHANGE
- B) high; but
- C) high; so
- D) high

Like flight simulation technology, which gives pilots in training the simulated experience of flying an airplane, virtual reality equipment enables welding students to practice their future trade without the associated costs and risks. Ordinarily, learning to become a welder involves working with a skilled instructor to practice using different materials, **24** practice using different tools, and techniques. Because welding requires making precise, complicated movements while wearing bulky protective gear, often while sparks are flying, it may take many hours of practice to **25** achieve mastery with respect to welding. Virtual reality allows individuals to get this practice without being exposed to hot **26** electrodes. The individuals also do not ruin expensive metal in the process. This can lead to cost **27** savings, in a two-week experiment comparing a traditional training class in welding to a class that split its time equally between traditional and virtual reality training, the cost of the traditional class was \$2,100.71 per student, whereas the class with the virtual component cost \$1,513.61 per student.

24

- A) NO CHANGE
- B) using different tools,
- C) different tools,
- D) tools,

25

- A) NO CHANGE
- B) specifically master and also learn.
- C) master.
- D) gain and develop mastery.

26

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

- A) electrodes or ruining
- B) electrodes, also not ruining
- C) electrodes and ruin
- D) electrodes; also, they do not ruin

27

- A) NO CHANGE
- B) savings
- C) savings and—
- D) savings:

28 Supplementing traditional training with virtual reality can also make the training process faster. The same experiment demonstrated that welding students who took the training course with a virtual component learned welding techniques more quickly than **29** taking the traditional course. On the relatively simple horizontal fillet weld, which involves joining two perpendicular metal **30** parts students in the half-virtual course completed the training in an average of 12.27 hours, while students in the traditional course took 15.05 hours, on average. The results **31** demonstrated that half of the training for beginning welders can be carried out via virtual reality technology.

Average Number of Hours Required to Learn How to Perform Welds

Type of weld (arranged from least to most difficult)	Traditional training, in hours	Half-traditional, half-virtual training, in hours
Horizontal fillet weld	15.05	12.27
Flat groove weld	14.09	11.72
Vertical fillet weld	14.54	11.60
Vertical groove weld	15.31	12.25

Source: Data from Richard T. Stone and Kristopher Watts, "Virtual Reality Integrated Weld Training." ©2011 by Welding Journal.

28

The writer wants to develop the argument of the passage with a point supported by the data in the table. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Traditional training with a proficient welder remains the dominant form of education in the trade.
- C) Some training programs combine hands-on instruction from master welders with a virtual component.
- D) Many types of welds take more than 10 hours to master, and some take more than 15 hours.

29

- A) NO CHANGE
- B) their peers who took
- C) they did in
- D) DELETE the underlined portion.

30

- A) NO CHANGE
- B) parts,
- C) parts—
- D) parts;

31

The writer wants to develop the main claim of the paragraph with relevant information from the table. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) showed that this relatively simple weld actually took longer to learn than several more difficult techniques.
- C) were similar for the three more difficult welding techniques studied in the experiment.
- D) suggested that virtual reality does not provide the same amount of training-time reduction for every type of weld.

Virtual reality simulation **32** can use sound effects and vibrating parts as well as visual components. In particular, it cannot capture the complexity of the most difficult types of welding. **33** Still, virtual reality has great potential to increase the speed and effectiveness of training while reducing its costs. Welders who need to sharpen their skills find substantial value in training in a virtual environment. As Dean Nutter, chair of the Welding Department of Okanagan College in British Columbia, Canada, says, “You put the helmet on, pick up the torch, and you feel like you’re welding.”

32

Which choice most effectively introduces the point made in this paragraph?

- A) NO CHANGE
- B) should be incorporated into even more welding training programs.
- C) works best as a supplement to, rather than a replacement for, hands-on experience with actual welding materials.
- D) has been shown to be effective for training people to perform a variety of types of welding.

33

- A) NO CHANGE
- B) Indeed,
- C) Moreover,
- D) Therefore,

Questions 34–44 are based on the following passage.

A Vision Fragmented: Jacob Lawrence's *Migration Series*

[1] Sixty small paintings on boards were the centerpiece of the 2015 exhibit *One Way Ticket: Jacob Lawrence's Migration Series* at New York's Museum of Modern Art (MoMA). [2] Lawrence completed the paintings, which he called panels, in 1941. [3] They feature **34** strong, bold lines; simple, somewhat abstract recurring forms; and a limited palette of vibrant primary colors. [4] The series recounts the story of the Great Migration, the historic demographic **35** shift, during that more than six million African Americans, including Lawrence's parents, moved from the rural South to the urban North in search of a better life. [5] The exhibit marked one of the rare occasions in which all sixty panels had been shown together. **36**

34

- A) NO CHANGE
- B) strong bold lines, simple somewhat abstract recurring forms,
- C) strong, bold lines, simple, somewhat, abstract recurring forms,
- D) strong bold lines; simple somewhat abstract recurring forms;

35

- A) NO CHANGE
- B) shift in that
- C) shift, that
- D) shift during which

36

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

In addition, each panel has a caption written by the artist.

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

- A) after sentence 2.
- B) after sentence 3.
- C) after sentence 4.
- D) after sentence 5

The series was divided shortly after its completion. The Phillips Collection in Washington, DC, obtained the odd-numbered panels; MoMA obtained the even-numbered ones. **37** Although Lawrence was leased with the success of the series, the division prevented museumgoers from experiencing the series as the artist intended. Art critic Peter Schjeldahl rightly calls the division “as misbegotten as would be, say, bisecting the *Mona Lisa*.”

37

At this point, the writer wants to acknowledge a possible counterargument to the claim that follows in the paragraph. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Regardless of the intentions of the Phillips Collection and MoMA,
- C) While dividing the series may have allowed more people to see the individual panels,
- D) Lawrence knew that the decision to divide the series was a controversial one, and

38 Schjeldahl's claim is intriguing. Panel 1, for example, depicts a crowded train station with three ticket windows labeled "Chicago," "New York," and "St. Louis"—popular destinations during the Great Migration. Panel 2 depicts a lone white man at work. Its caption explains one reason the North was attractive to southern 39 migrants. There was a labor shortage in the North. Without the overview provided by Panel 1 or the context provided by Panel 2, the coherence of the series is compromised. The problem 40 is compounded as the narrative unfolds.

38

Which choice most effectively introduces the topic of the paragraph?

- A) NO CHANGE
- B) Trains feature prominently in the *Migration Series*.
- C) The series highlights the fact that many migrants traveled to the North to pursue work.
- D) Partially displaying the series interrupts its continuity.

39

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

- A) migrants: a northern labor shortage.
- B) migrants, a reason that was tied to a northern labor shortage.
- C) migrants—a labor shortage in the North that attracted many southerners.
- D) migrants, and that reason was the North's labor shortage.

40

- A) NO CHANGE
- B) mushrooms
- C) really goes downhill
- D) is ratcheted up

Lawrence's process reflected the unity with which he desired to imbue the work. Working sequentially, he first outlined the images on each panel. Next, he painted each panel, one color at a time. He painted the yellow bell on the northbound train in Panel 5, for instance, then applied the same yellow to the 41 passengers blankets in Panel 6. After dozens more appearances, 42 Panel 60 features a dress in the yellow, Lawrence's aesthetic

41

- A) NO CHANGE
- B) passengers' blankets
- C) passenger's blankets'
- D) passengers blanket's

42

- A) NO CHANGE
- B) Lawrence features the yellow in a dress in Panel 60.
- C) a dress in Panel 60 features the yellow.
- D) the yellow is featured in a dress in Panel 60.

choices were driven by his belief that the Great Migration was of universal import. 43 “The art world is a very elitist world. One did not just go into galleries,” Lawrence explained in a 1995 public television interview.

As 44 evidenced by the critical and popular success of *One Way Ticket*, the *Migration Series*, all sixty panels of it, has indeed resonated with audiences. Rather than maintaining the status quo of odd panels in Washington and even panels in New York, the Phillips Collection and MoMA should work together to permanently reunify Lawrence’s masterpiece.

43

At this point, the writer wants to include a quotation from Lawrence that supports the claim in the previous sentence. Which choice most effectively accomplishes this goal?

- A) NO CHANGE
- B) “I think my interest in Black history, history in general but Black history in particular, came from the community”
- C) “So many people of my age, we were born in the North, but our roots were southern because of our parents, … our customs, mores, were all southern,”
- D) “I would like for people to…feel, look, this is me. This is mankind, or womankind,”

44

- A) NO CHANGE
- B) evidence of
- C) evidence for
- D) evidenced to

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.

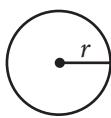
DIRECTIONS

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

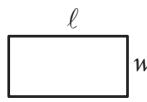
NOTES

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

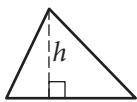
REFERENCE



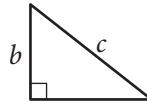
$$\begin{aligned} A &= \pi r^2 \\ C &= 2\pi r \end{aligned}$$



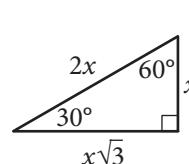
$$A = lw$$



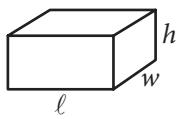
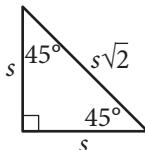
$$A = \frac{1}{2}bh$$



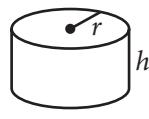
$$c^2 = a^2 + b^2$$



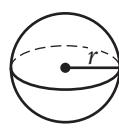
Special Right Triangles



$$V = lwh$$



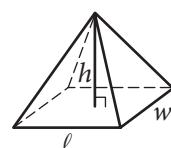
$$V = \pi r^2 h$$



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



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



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

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

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

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



1

If $\frac{j}{6} = 3$ and $5k=40$, what is the value of $\frac{j}{k}$?

- A) $\frac{4}{9}$
- B) $\frac{5}{8}$
- C) $\frac{9}{4}$
- D) $\frac{17}{2}$

2

Jenna has practiced a total of 150 hours for her sport this year. If Jenna practices exactly 10 hours each week, which of the following equations can be solved to find the total number of weeks, x , she practiced this year?

- A) $10x = 150$
- B) $\frac{x}{10} = 150$
- C) $x + 10 = 150$
- D) $x - 10 = 150$

3

Which of the following is an equation of the line in the xy -plane that has a slope of 2 and passes through the point $(0, -3)$?

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

4

$$3x - y = 8$$

$$\frac{x + y}{2} = 8$$

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

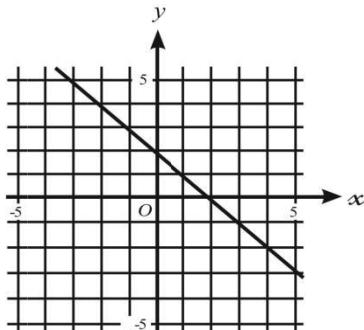
- A) 4
- B) 6
- C) 8
- D) 12



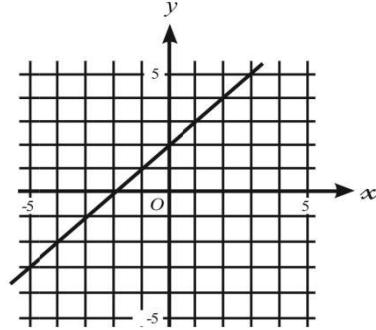
5

Which of the following represents the graph of the equation $x+y=2$ in the xy -plane?

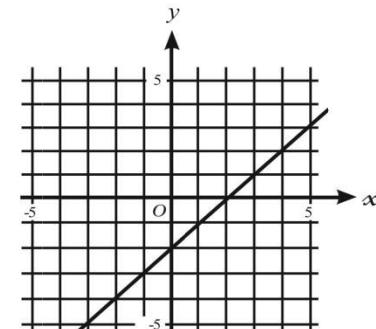
A)



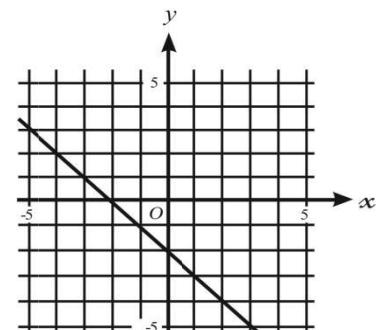
B)



C)



D)



6

$$\frac{4}{x-2} + \frac{2}{x} = \frac{8}{x^2 - 2x}$$

What value of x satisfies the equation above?

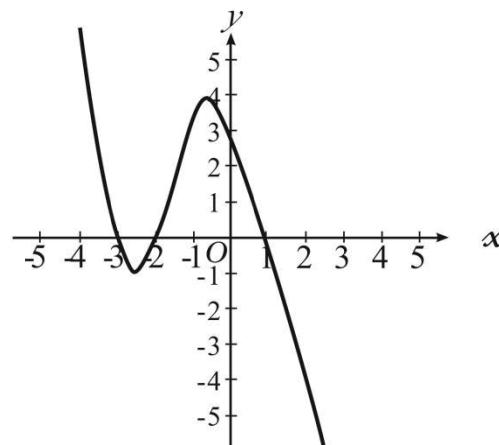
A) 0

B) 2

C) 14

D) No value of x satisfies the equation.

7



The graph of function f , where $y=f(x)$, is shown in the xy -plane. What is the value of $f(0)$?

A) -2

B) 0

C) 1

D) 3



8

$$p(t) = (3t + 4)^2$$

$$r(t) = 6t^2 + 7$$

The polynomial functions p and r are defined above.
Which of the following is equivalent to

- $p(t) - r(t)$?
- A) 1
 - B) $3t^2 + 9$
 - C) $3t^2 + 24t + 9$
 - D) $3t^2 + 24t + 23$

9

The population of Boston in 2010 was r . If there is a net population increase of x people each year in Boston, which of the following represents the population of Boston y years after 2010?

- A) $x + ry$
- B) $r + xy$
- C) $r + x(2010 - y)$
- D) $r + x(y - 2010)$

10

$$(x - 5)^2 + (y + 2)^2 = 3$$

Which of the following describes the graph in the xy -plane of the equation above?

- A) A circle
- B) A line
- C) A parabola
- D) A square

11

If $\frac{2x+2x}{5} = 12$, what is the value of $4x$?

- A) 15
- B) 30
- C) 60
- D) 120



12

$$a = x(x+2)$$

$$b = x(x+1)$$

$$c = x(x-1)$$

In the equations above, a , b , and c are given in terms of x . Which of the following expressions is equivalent to $a-b+c$?

- A) x^2
- B) $x^2 + 2$
- C) $x^2 + 2x$
- D) $2 - x^2$

13

$$3x - y = -2$$

$$2x^2 - y = 0$$

If (x, y) is a solution to the system of equations above, which of the following is a possible value of xy ?

- A) 10
- B) 12
- C) 14
- D) 16

14

If x and y are positive, which of the following is equivalent to $x\sqrt{x(x+y)}$?

- A) $x^2\sqrt{y}$
- B) $2x\sqrt{y}$
- C) $\sqrt{x^4+x^3y}$
- D) $\sqrt{x^3+x^2y}$

15

Which of the following is equivalent to $\tan(x^\circ)$?

- A) $\frac{\sin(90^\circ - x^\circ)}{\cos(90^\circ - x^\circ)}$
- B) $\frac{\cos(90^\circ - x^\circ)}{\sin(90^\circ - x^\circ)}$
- C) $-\tan(90^\circ - x^\circ)$
- D) $\sin(x^\circ) - \cos(x^\circ)$

**DIRECTIONS**

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

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

Write →
answer
in boxes.

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

← Fraction line

Grid in result.

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

← Decimal point

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

Answer: 2.5

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

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

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

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

Answer: 201 – either position is correct

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

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

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



16

The total amount of registration fees paid by participants at a conference was \$12,400. Each participant who registered on the day of the conference paid a \$150 fee, and each participant who registered in advance paid a \$125 fee. If 74 participants registered in advance, how many participants registered on the day of the conference?

17

$$-3x + \frac{1}{2}y = \frac{2}{3}$$

$$-9x + \frac{3}{2}y = k$$

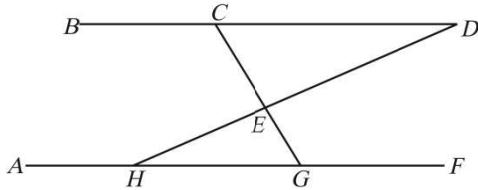
In the system of equations above, k is a constant. For what value of k does the system of equations have infinitely many solutions?

18

In the equation $y=(x-3)(x-a)$, a is a positive constant. If the graph of the equation in the xy -plane intersects the y -axis at the point $(0, 15)$, what is the value of a ?



19



In the figure above, $\overline{AF} \parallel \overline{BD}$, and \overline{CG} and \overline{DH} intersect at E . If $HE = 16$, $ED = 24$, and $CG = 20$, what is the length of \overline{EG} ?

20

$$g(n) = 12,000(0.66)^{\frac{n}{12}}$$

The function g above can be used to determine the value, in dollars, of a piece of equipment after n months. If the value of the equipment decreases each year by $x\%$ of its value the preceding year, what is the value of x ?

STOP

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



Math Test – Calculator

55 MINUTES, 38 QUESTIONS

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

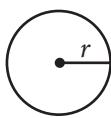
DIRECTIONS

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

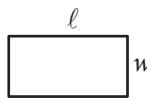
NOTES

1. The use of a calculator is **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.

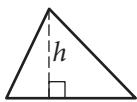
REFERENCE



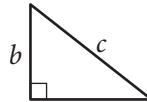
$$\begin{aligned}A &= \pi r^2 \\C &= 2\pi r\end{aligned}$$



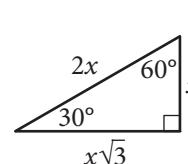
$$A = lw$$



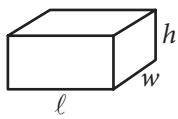
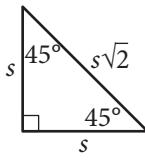
$$A = \frac{1}{2}bh$$



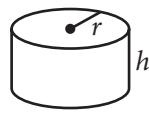
$$c^2 = a^2 + b^2$$



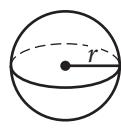
Special Right Triangles



$$V = lwh$$



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



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



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



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

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

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

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



1

Ms. Engels took her 29 students to the library. If 12 students each checked out exactly 2 books, 3 students each checked out exactly 3 books, and the rest of the class each checked out only 1 book, how many total books did the students in Ms. Engels's class check out from the library?

- A) 27
- B) 29
- C) 43
- D) 47

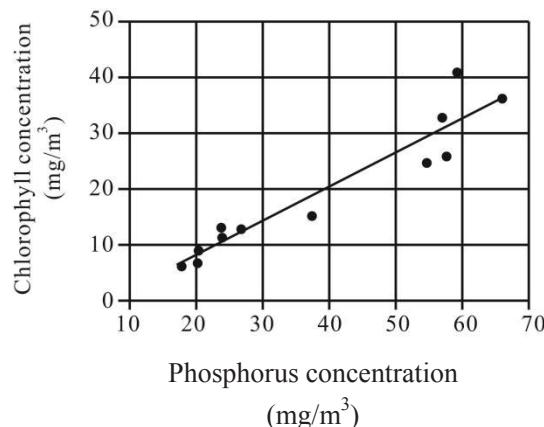
2

Jamal purchased 8.75 gallons of gasoline, for which he paid \$18.40. Which of the following is closest to the price, in dollars, Jamal paid per gallon of gasoline?

- A) \$2.04
- B) \$2.10
- C) \$2.20
- D) \$2.30

3

Concentrations of Phosphorus
and Chlorophyll in a Lake



The scatterplot above shows the concentrations, in milligrams per cubic meter (mg/m^3), of phosphorus and chlorophyll that were measured in a lake for 12 different years. A line of best fit for the data is also shown. According to the line of best fit, when the concentration of phosphorus in the lake is $40 \text{ mg}/\text{m}^3$, which of the following is the best prediction for the concentration of chlorophyll in the lake?

- A) $60 \text{ mg}/\text{m}^3$
- B) $40 \text{ mg}/\text{m}^3$
- C) $20 \text{ mg}/\text{m}^3$
- D) $10 \text{ mg}/\text{m}^3$



4

If $\frac{a}{7} = 8$, what is the value of $2a$?

- A) 14
- B) 16
- C) 56
- D) 112

5

A cheetah can run at a maximum speed of 113 kilometers per hour. What is the cheetah's maximum speed, to the nearest mile per hour? (1 mile is approximately 1.61 kilometers.)

- A) 56
- B) 70
- C) 112
- D) 182

6

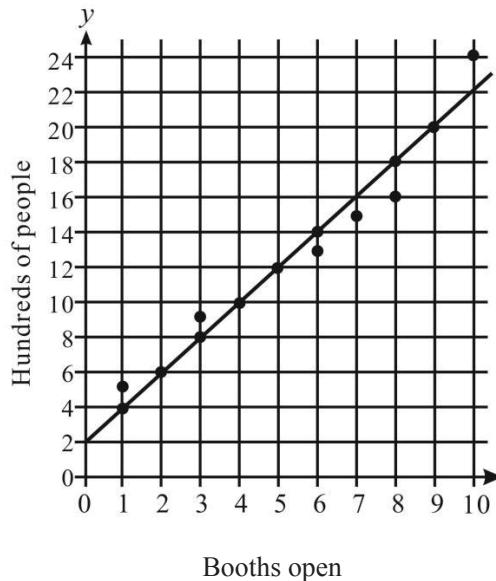
A development company is advertising that the mean area of the apartments in a new complex is 1,450 square feet. The complex consists of 10 buildings with a total of 1,000 apartments. A sample of 50 apartments will be selected from the complex to test the company's statement about the mean apartment area. Which of the following is an unbiased sampling method?

- A) Select the first 50 apartments built.
- B) Select the first 50 apartments that are occupied.
- C) Select at random 5 top-floor apartments from each of the buildings.
- D) Select at random 50 apartments from all the apartments in the 10 buildings.



7

The scatterplot below shows the number of people, in hundreds, who visited a new farmers market each of the first 14 days it was open and the number of booths open at the market each of the 14 days. A line of best fit is also shown.



Which of the following could be an equation of this line of best fit for the data?

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

8

Magaly rode her bike 6 miles in 45 minutes. At this rate, how long would it take her to ride her bike 22 miles?

- A) 2 hours and 5 minutes
- B) 2 hours and 20 minutes
- C) 2 hours and 45 minutes
- D) 2 hours and 56 minutes

9

Animal type	Zoo			Total
	Philadelphia	National	Phoenix	
Amphibians	8	20	4	32
Birds	25	71	57	153
Fish	12	39	3	54
Mammals	71	84	50	205
Reptiles	20	50	19	89
Total	136	264	133	533

The table above shows the number of animals in three different zoos, categorized by type. If an animal is to be selected at random from the Philadelphia zoo for observation, what is the probability that the animal will be an amphibian?

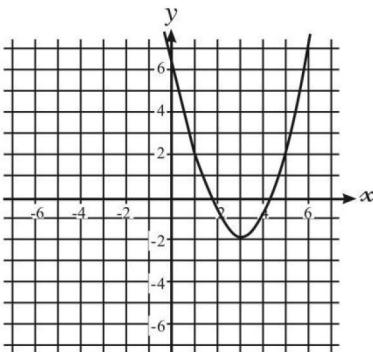
- A) $\frac{8}{533}$
- B) $\frac{8}{136}$
- C) $\frac{32}{533}$
- D) $\frac{8}{32}$



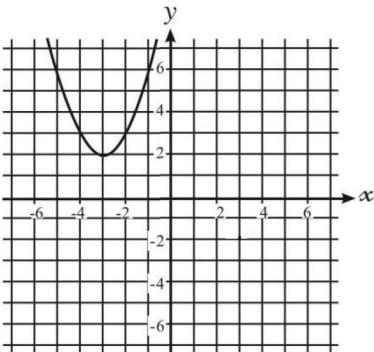
10

Which of the following is the graph of $y = -(x + 3)^2 - 2$?

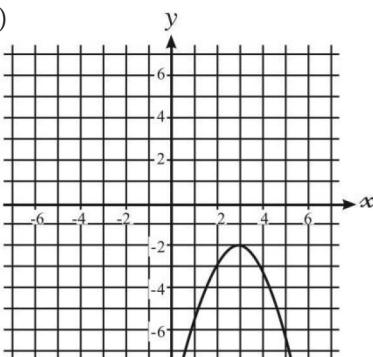
A)



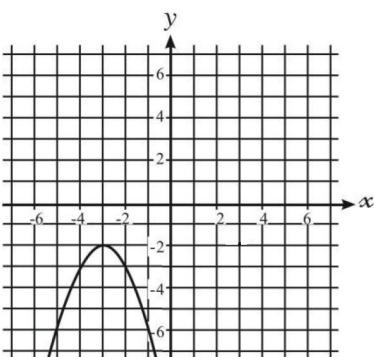
B)



C)



D)





11

$$g(x) = x^3 - 1$$

The function g is defined above. If $s=4$, what is the value of $g(s+1)$?

- A) 63
- B) 64
- C) 124
- D) 125

12

Which of the following expressions is equivalent to

$$\sqrt[3]{8x^3y^5}, \text{ where } x \text{ and } y \text{ are positive?}$$

- A) $2xy^{\frac{5}{3}}$
- B) $8xy^{\frac{5}{3}}$
- C) $2x^3y^5$
- D) $\frac{8}{3}xy^2$

13

The electric charge of a single electron is called the electron charge and can be measured in coulombs (C). The table below shows four measurements of the electron charge made in the early 1900s.

Electron charge (C)
-1.639×10^{-19}
-1.641×10^{-19}
-1.647×10^{-19}
-1.641×10^{-19}

What is the mean of these measurements, in coulombs?

- A) -4.118×10^{-20}
- B) -1.641×10^{-19}
- C) -1.642×10^{-19}
- D) -1.568×10^{-19}



14

The formula $B = \frac{703w}{h^2}$ is used to determine body mass index, B , based on a person's weight w , in pounds, and height h , in inches. Which of the following can be used to determine a person's height, in inches, based on weight and body mass index?

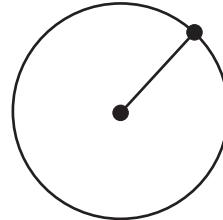
- A) $h = \sqrt{\frac{703w}{B}}$
- B) $h = \sqrt{\frac{B}{703w}}$
- C) $h = \frac{703w}{B}$
- D) $h = \frac{B}{703w}$

15

Which of the following is an equation of a line in the xy -plane that is parallel to the line with equation $2x+3y=18$?

- A) $2x+3y=12$
- B) $2x-3y=10$
- C) $3x+2y=9$
- D) $3x-2y=4$

16



A ball is being swung in a circular path with a fixed radius, as shown above. The centripetal acceleration, a_c , of the ball can be determined with the equation $a_c = bv^2$, where b is a constant. Some values of velocity v , in meters per second, and a_c , in meters per second squared, are shown in the table below.

v	a_c
2	2
4	8
6	18

What would be the centripetal acceleration, in meters per second squared, of the ball if the velocity of the ball were 5 meters per second?

- A) 10
- B) 11
- C) 12.5
- D) 13

**Questions 17 and 18 refer to the following information.**

A public relations expert developed the model $P(x)=0.5x+15$ to predict a political candidate's performance in a certain upcoming election based on the amount the candidate spent on advertising. In the model, $P(x)$ is the percentage of votes, and x is the number of dollars, in thousands, spent on advertising. For example, if a candidate spends \$0 on advertising, the model predicts that the candidate will receive 15% of the votes.

17

Based on the model, if a candidate receives 40% of the votes in the election, how much did the candidate spend on advertising?

- A) \$20,000
- B) \$35,000
- C) \$40,000
- D) \$50,000

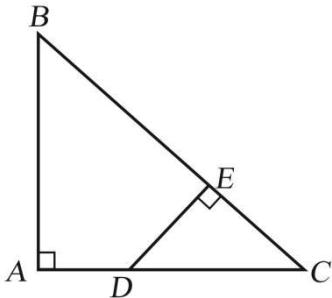
18

Which of the following statements best describes the prediction model?

- A) For every \$1,000 spent on advertising, a candidate's performance in the election increase by 15 percentage points.
- B) For every \$1 spent on advertising, a candidate's performance in the election increase by 15 percentage points.
- C) For every \$1,000 spent on advertising, a candidate's performance in the election increase by 0.5 percentage points.
- D) For every \$1 spent on advertising, a candidate's performance in the election increase by 0.5 percentage points.



19



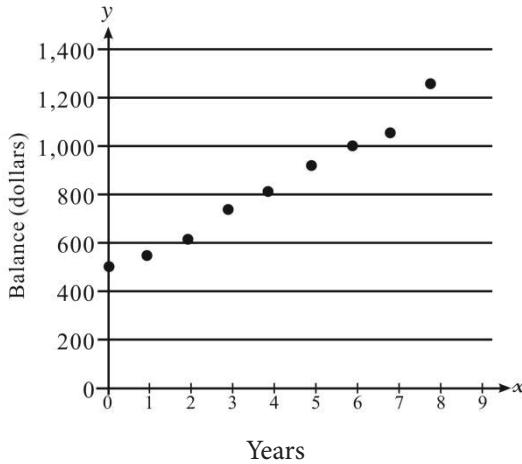
Note: Figure drawn to scale.

In the figure above, triangle ABC and triangle EDC are right triangles. If $EC = 6\sqrt{3}$ and the cosine of angle ABC is $\frac{1}{2}$, what is the length of segment ED ?

- A) 6
- B) $6\sqrt{3}$
- C) 12
- D) 18

20

Savings Account Balance



The scatterplot in the xy -plane above shows the balance y , in dollars, of a savings account after x years. Which of the following functions best models the data in the scatterplot?

- A) $y = (500)^{x+1}$
- B) $y = 500(0.12)^x$
- C) $y = 500(0.12)^{x+1}$
- D) $y = 500(1.12)^x$

21

$$4x + 2 = rx + 8$$

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

- A) 4
- B) 6
- C) 8
- D) 16



22

In June, 20 people enrolled in a cooking class. In July, the number of people who enrolled increased 150%. How many people enrolled in the cooking class in July?

- A) 30
- B) 50
- C) 70
- D) 170

23

52, 58, 12, 62, 62, 70, 66, 68, 53, 67

The list above shows the number of points a basketball team scored in each of 10 games. During the 10 games, the team scored a total of 570 points. If the outlier is removed from this data set, how will the mean and median change?

- A) Both the mean and the median will increase.
- B) Both the mean and the median will decrease.
- C) The mean will increase and the median will not change.
- D) The mean will decrease and the median will not change.

24

According to the consumer price index, the price of a certain product has increased by the same number of cents each month since January 2015. Which of the following function types could correctly be used to model this situation, where a and b are positive constants and t is the number of months since January 2015? (Assume the price of the product was not zero in January 2015.)

- A) $f(t) = abt$
- B) $f(t) = a(b)^t$
- C) $f(t) = a + b^t$
- D) $f(t) = a + bt$

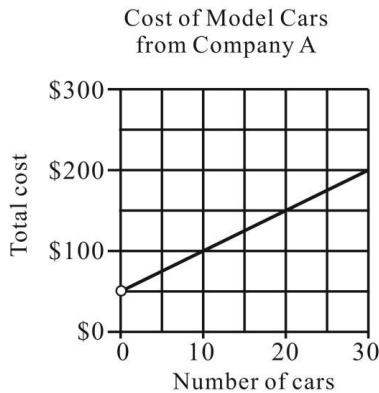
25

There are 324 employees at the main office of a company, and the ratio of men to women at this office is 5 to 7. There are 288 employees at a branch office of the same company, and the ratio of men to women at this office is 5 to 4. If all of the employees at the main office and the branch office attend the annual company meeting, which of the following is closest to the percentage of the total number of employees from these two offices who are men?

- A) 43%
- B) 48%
- C) 52%
- D) 57%



Questions 26 and 27 refer to the following information.



The manager of a toy store compares the cost of ordering model cars from two toy companies. Both companies charge a flat fee plus a fixed cost per car.

- The graph above shows the total cost that Company A charges for an order of cars.
- The total cost, in dollars, that Company C charges for an order of n cars is given by the function $c(n) = 4n + 80$, where $n > 0$.

26

The manager wants to order at least 12 cars from Company C but spend no more than \$250 on the order. Which of the following systems of inequalities represents these constraints?

- A) $n \geq 12$
 $4n + 80 \leq 250$
- B) $n \geq 12$
 $4n - 80 \leq 250$
- C) $n \leq 12$
 $4n + 80 \geq 250$
- D) $n \leq 12$
 $4n + 80 \leq 250$

27

If the total cost of purchasing n cars from Company C is less than the total cost of purchasing n cars from Company A, which of the following inequalities represents all possible values of n ?

- A) $0 \leq n < 30$
B) $0 \leq n < 200$
C) $30 \leq n < 200$
D) $30 < n$

28

In $\triangle ABC$ and $\triangle DEF$, $AC = DF$ and $BC = EF$. Which of the following additional information is NOT sufficient to prove that $\triangle ABC$ is congruent to $\triangle DEF$?

- A) $AB = DE$
B) $m\angle CAB = m\angle FDE$
C) $m\angle ACB = m\angle DFE$
D) $AB + BC = DE + EF$



29

An economist thinks that the price of an investment will increase at an annual rate of 4%. If the current price of the investment is \$25.25, which of the following equations models the price, P , after t years?

- A) $p = 25.25(1.04t)$
- B) $p = 25.25(0.04^t)$
- C) $p = 25.25(1.04^t)$
- D) $p = 25.25(t^{0.04})$

30

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

The equation above gives the relationship between the temperature measured in degrees Fahrenheit, F , and degrees Celsius, C . At what temperature, in degrees Fahrenheit, will the temperature measured in degrees Celsius be twice the value of the temperature measured in degrees Fahrenheit?

- A) $-\frac{160}{13}$
- B) $\frac{160}{23}$
- C) 160
- D) 320

**DIRECTIONS**

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

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

Write answer →

7	/	1	2
---	---	---	---

← Fraction line

Grid in result.

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

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

← Decimal point

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

2	/	3
---	---	---

.	6	6	6
---	---	---	---

.	6	6	7
---	---	---	---

Answer: 201 – either position is correct

2	0	1
---	---	---

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



31

$$s(p) = 16,000 - 4.5p$$

The function s above gives the remaining free space, in megabytes (MB), on a 16,000 MB memory card that is storing p photos, each with a size of 4.5 MB. If there are 1500 photos on the card, how many MB of free space remain on the card?

32

If $a^2 - 9a + 14 = 0$, what is one possible value of $a + 3$?

33

Seven different surveys of the daily commuting time, in minutes, of Chicago-based employees yielded the values 32, 14, 43, 31, 52, 23, 44. Seven different surveys of the daily commuting time, in minutes, of San Francisco-based employees yielded the values 46, 32, 19, 34, 47, x , 37. If these two data sets have the same mean, what is the value of x ?

34

$$x + 2y = -6$$

$$2x - y = 8$$

If the solution to the system of equations above is (x, y) , what is the value of $x - 3y$?

35

The estimated daytime population of Manhattan, New York, during a weekday is 3.9 million people. The area of Manhattan is approximately 23 square miles. Based on these estimates, what is the daytime population density, in millions of people per square mile, of Manhattan during a weekday, rounded to the nearest hundredth?

36

In the xy -plane, the circle with radius 5 and center $(8, 3)$ contains the point $(w, 0)$. What is one possible value of w ?



Questions 37 and 38 refer to the following information.

Amount of Electricity Generated
From Renewable Sources

State	Amount (billions of kWh)
California	42
Minnesota	12
Pennsylvania	6

The table above shows the amount of electricity, in billions of kilowatt-hours (kWh), generated from renewable sources in three states in the United States in 2009.

37

The amount of electricity generated from renewable sources in California was 10% of the total amount of electricity generated from renewable sources in the United States. What fraction of the total amount of electricity generated from renewable sources in the United States was generated in Pennsylvania?

38

In 2009, 15% of all electricity generated in Minnesota came from renewable sources. Minnesota plans that by 2025, the amount of electricity, x , in billions of kWh, from renewable sources will be 25% of all electricity generated in the state. In Minnesota, if the total amount of electricity generated in 2025 is the same as the total amount generated in 2009, what is the value of x ?

STOP

If you finish before time is called, you may check your work on this section only.

Do not turn to any other section.

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December 2017 USA Answers

Reading				Writing				Math N/Calc		Math W/Calc	
Question	Answer	Question	Answer	Question	Answer	Question	Answer	Question	Answer	Question	Answer
1	A	41	A	1	D	41	B	1	C	1	D
2	C	42	C	2	B	42	D	2	A	2	B
3	B	43	C	3	B	43	C	3	D	3	C
4	A	44	D	4	D	44	A	4	B	4	D
5	D	45	B	5	D			5	A	5	B
6	A	46	B	6	C			6	D	6	D
7	B	47	D	7	A			7	D	7	A
8	D	48	D	8	A			8	C	8	C
9	C	49	C	9	C			9	B	9	B
10	B	50	C	10	D			10	A	10	D
11	C	51	D	11	A			11	C	11	C
12	A	52	B	12	C			12	A	12	A
13	A			13	D			13	D	13	C
14	C			14	B			14	C	14	A
15	B			15	C			15	B	15	A
16	D			16	C			16	21	16	C
17	A			17	B			17	2	17	D
18	C			18	C			18	5	18	C
19	B			19	D			19	8	19	A
20	A			20	D			20	34	20	D
21	A			21	B					21	A
22	C			22	A					22	B
23	B			23	A					23	C
24	C			24	D					24	D
25	C			25	C					25	B
26	A			26	A					26	A
27	B			27	D					27	D
28	C			28	A					28	B
29	C			29	B					29	C
30	D			30	B					30	A
31	D			31	C					31	9250
32	B			32	C					32	5, 10
33	D			33	A					33	24
34	C			34	A					34	14
35	D			35	D					35	0.17
36	B			36	B					36	4, 12
37	D			37	C					37	1/70
38	A			38	D					38	20
39	B			39	A						
40	D			40	A						

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