Reading Test

60 MINUTES, 47 QUESTIONS

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

DIRECTIONS

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

Questions 1-9 are based on the following passage.

This passage is from Yiyun Li, "Kindness." ©2010 by Yiyun Li. In the passage, the narrator and Nan are female recruits in the Chinese army.

On my left, Nan hummed a tune under her breath while maintaining a perfect shooting position. I was amazed at how soldierly she could act, her posture perfect in formation drills, her impeccable bed-making winning her titles in the internal-affairs contest. Anyone could see her mind was elsewhere, but the military life seemed to provide endless amusement for her; she never misbehaved, and she was among the few who hadn't received any public humiliation. I turned my head slightly, still resting my right cheek on the stock but looking at Nan rather than the target. Her uniform cap was low on her eyebrows, and in the shadow of the cap she squinted with a smile, singing in a very low voice.

"The Last Rose of Summer," she told me when I asked her about the song during the break. Nan was a small girl and looked no more than thirteen years old. She had joined a famous children's choir when she was six, and when the other children her age had entered middle school and left the choir, she had remained because she liked to sing, and she could still pass for a young child. When she reached sixteen, the choir changed its name from "children's choir" to "children and young women's choir." She'd laughed when she told us about it. Would she go back to the choir? one of the girls had asked her, and she'd thought for a moment and said that perhaps after the army she would have to find some other hobbies. One could not possibly remain in a children's choir all her life, she'd said, though she seemed to me the kind of person who could get away with anything she set her heart on. I could imagine her still singing at twenty or thirty among a group of children, looking as young and innocent as them—though this I did not tell Nan. We were friendly toward each other, but we were not friends, perhaps the only two in our platoon who hadn't claimed a close friend eight weeks into the military life. I did not see the need to have someone next to me when I took a walk around the drill grounds after dinner for the fifteen minutes of free time; nor did I need to share my night-watch duty with a special friend, so I was often paired with leftover girls from the other platoons—girls like me who had no one to cling to—and it suited me well to spend half the night with someone as quiet as I was in the front room of the barracks, dozing off in two chairs set as far apart as possible.

Nan was a different case. She was friendly with everyone, including the officers and the conscripts in the cooking squad, and was courted by quite a few girls hoping to become her best friend. You could see that she was used to such attention, amused even, but she would not grant anyone that privilege. Even our squad leader, who had become a favorite of the officers with her increasingly militant treatment of us, was unwilling to assign the most dreadful duties—cleaning the toilets, or the pigsties—to Nan. A less gracious person than Nan would have been the target of envy, yet she seemed untouched by any malignancy.

CONTINUE

One girl, overhearing our conversation, asked Nan to sing "The Last Rose of Summer." Nan stood up from where we were sitting in a circle and flicked dried grass and leaves from her uniform. Her voice seemed to make breathing hard for those around her; her face, no longer appearing amused, had an ancient, ageless look. I wondered what kind of person Nan was to be able to sing like that—she seemed too aloof to be touched by life, but how could she sing so hauntingly if she had not felt the pain described in those songs?

1

The primary purpose of the passage is to depict the

A) initial encounters between Nan and the narrator.
B) personality of Nan and also that of the narrator.
C) effects of military service on Nan and the narrator.
D) differences between Nan's background and the narrator's.

2

Which choice best characterizes the narrator's attitude toward Nan?

A) Admiration and curiosity
B) Indulgence and pity
C) Deference and gratitude
D) Jealousy and resentment

3

As used in line 2, "position" most nearly means

A) geographical location.
B) personal belief.
C) official policy.
D) physical stance.

4

The narrator suggests that she and Nan are similar in that they both

A) view the past with ambivalence.
B) chafe against social conventions.
C) keep other people at a distance.
D) consider friendship a means to an end.

5

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

A) Lines 32-35 ("I could . . . Nan")
B) Lines 35-39 ("We were . . . life")
C) Lines 39-44 ("I did . . . platoons")
D) Lines 45-48 ("and it . . . possible")

CONTINUE

6

Based on the passage, which choice best describes Nan's reaction to the attention she receives from others?

A) She is both puzzled by it and grateful for it.

B) She finds it embarrassing but nonetheless seeks it out.

C) She is delighted by it but pretends to find it distasteful.

D) She neither rejects it outright nor is influenced by it.

7

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

A) Lines 49-52 ("She was . . . friend")

B) Lines 52-54 ("You . . . privilege")

C) Lines 59-61 ("A less . . . malignancy")

D) Lines 63-65 ("Nan stood . . . uniform")

8

Based on the passage, what significance does Nan's performance of the song have for the narrator?

A) It expresses Nan's military spirit.

B) It casts doubt on the other soldiers' attitude toward Nan.

C) It suggests some sadness in Nan's past life.

D) It emphasizes the dilemma that Nan faces.

9

As used in line 70, "touched" most nearly means

A) affected.

B) tapped.

C) handled.

D) flattered.

CONTINUE

Questions 10-19 are based on the following passage and supplementary material.

This passage is adapted from Alain Samson, "Do You Diversify?" ©2012 by Sussex Publishers, LLC.

Most of us probably know the concept of diversification from the perspective of finance. Savvy investors usually don't put all their eggs into one basket. Diversification also occurs when we buy consumer goods. In that domain, however, diversification isn't always the most advantageous strategy. Have you ever opted for variety in purchasing a month's supply of breakfast cereal, only to later regret not having chosen more boxes of your favorite cereal?

Humans live in the moment. We are generally poor predictors of our future preferences and behavior. Perhaps not surprisingly, research has shown that people seek more variety when they choose multiple items for future consumption than when they make choices sequentially, i.e. on an "in the moment" basis. A choice of variety greater than an optimal ("as needed") level is known as the diversification bias.

When people diversify, virtues also tend to be chosen in greater proportion relative to vices. An interesting study on this phenomenon by Read, Loewenstein and Kalyanaraman in 1999 randomly assigned experimental participants to two groups: advance (simultaneous) choice or sequential choice. In the experiment, all participants first had to pick three dates (separated by at least two days) in the future on which they wanted to watch movies (videos). 'Advance choice' individuals had to schedule all movies at the same time, one for viewing on that day, the other two for later evenings. 'Sequential choice' individuals also began by choosing the movie that they wanted to see on that day, but had to return on future days to choose their second and third flicks.

The experimenters coded the movies that were available to participants as either highbrow (foreign, documentaries, Academy Award winners, etc.) or lowbrow (action, romantic comedy, etc.). Results showed that people's choices for on-the-day viewing (on day one) were roughly on equal footing in both experimental conditions. However, compared to people in the sequential choice group, individuals in the advance condition were significantly more likely to choose highbrow movies for future viewing. Among those choosing in sequence, preferences did not change much over time.

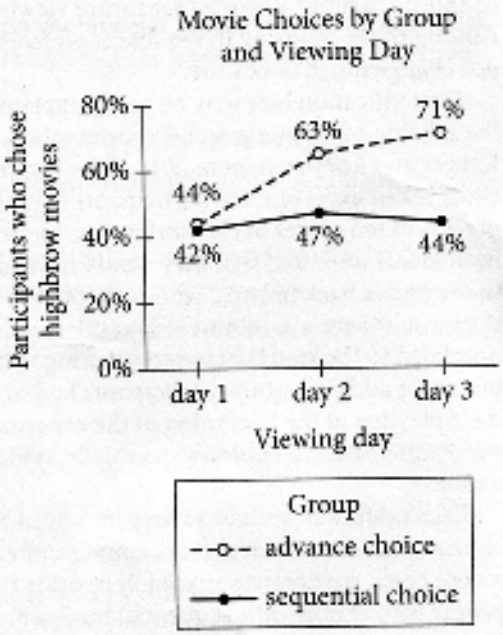
Diversification bias may be partly explained by the spacing of consumption. Experiments by Galak, Kruger and Loewenstein in 2011 show just that. One study asked experimental participants to make a playlist of ten pieces of classical music. Some individuals were told that they would have to listen to the pieces back to back, while others were told that they would have a 2-minute delay (filled with a task unrelated to the study) between listening to the pieces. In addition, some participants had to create their playlists at the beginning of the experiment, while others had to choose sequentially, one piece at a time.

Results showed greater variety for advance choices than sequential choices among individuals whose consumption was spaced. It appears that people who choose on a sequential basis with gaps in between consumption tend to seek lower variety than back-to-back choosers because the satiation effect fades away to some degree. They don't grow tired of the same old choice quite as much. Individuals who plan their consumption in advance, however, tend to overestimate their need for variety when consumption is spaced. Among people who had to choose music for back-to-back consumption, no such difference was found in the experiment. In that group, the diversification bias largely disappeared.

The simple takeaway for savvy consumers: if you want to choose optimally, make your choices on an as-needed basis. If that's not practical, don't over-diversify if there are significant intervals between consumption.

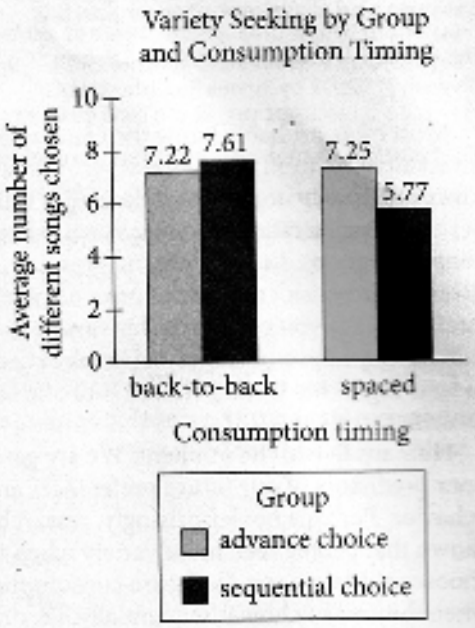
CONTINUE

Figure 1



Adapted from Daniel Read, George Loewenstein, and Shobana Kalyanaraman, "Mixing Virtue and Vice: Combining the Immediacy Effect and the Diversification Heuristic." ©1999 by John Wiley & Sons, Ltd.

Figure 2



Adapted from Jeff Galak, Justin Kruger, and George Loewenstein, "Is Variety the Spice of Life? It All Depends on the Rate of Consumption." ©2011 by Society for Judgment & Decision Making.

10

The main purpose of the question at the end of the first paragraph is to

A) offer advice to consumers about the benefits and pitfalls of diversifying their choices.

B) challenge the idea that consumers do not need to diversify their choices.

C) emphasize the anxiety that consumers feel when faced with the concept of diversification.

D) provide a relatable example of a negative result of diversification for consumers.

CONTINUE

1

11

According to the passage, diversification bias is most likely to occur when consumers

A) base consumption on current circumstances.
B) attempt to make an impression on others.
C) try to anticipate future needs.
D) make choices in response to stress.

12

It can reasonably be inferred from the passage that coding movies as either highbrow or lowbrow enabled the experimenters to

A) determine whether advance choice influences individuals to choose movies perceived to be of higher quality.
B) encourage individuals in the experiment to choose movies of merit that they might not be familiar with.
C) assess whether individuals' choice of movies is a reflection of their familiarity with different movie genres.
D) increase participation by including known preferences of individuals selected for an earlier study.

13

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

A) Lines 20-21 ("When . . . vices")
B) Lines 21-26 ("An interesting . . . choice")
C) Lines 26-29 ("In the . . . videos")
D) Lines 36-39 ("The experimenters . . . etc.")

14

As used in line 41, "roughly" most nearly means

A) coarsely.
B) irregularly.
C) painfully.
D) approximately.

15

As used in line 67, "degree" most nearly means

A) phase.
B) extent.
C) rank.
D) condition.

16

According to figure 1, what percentage of participants in the advance choice group chose highbrow movies for day 2 of the study?

A) 44%
B) 47%
C) 63%
D) 71%

17

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

A) Overall, more members of the sequential choice group chose highbrow movies than did members of the advance choice group.
B) Fewer than 60% of members of the advance choice group chose highbrow movies for day 3.
C) The difference in the percentage of highbrow movies chosen by members of both groups tended to decrease over time.
D) The percentages of participants choosing a highbrow movie in the advance choice and the sequential choice groups were closest on day 1.

CONTINUE

18

It can be inferred from the passage that the difference indicated in figure 2 between the sequential- and the advance-choice spaced consumption groups might be explained by the fact that the sequential-choice spaced consumption group as a whole had a

A) more difficult time creating playlists.
B) higher tolerance for repetition.
C) need for greater diversity.
D) lesser appreciation of different classical composers.

19

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

A) Lines 48-49 ("Diversification . . . consumption")
B) Lines 57-60 ("In addition . . . time")
C) Lines 67-68 ("They . . . much")
D) Lines 73-74 ("In that . . . disappeared")

Questions 20-28 are based on the following passage.

This passage is adapted from Katherine Bourzac, "A Strange New Material That's Super-Strong and Super-Light." ©2014 by MIT Technology Review.

A new type of material, made up of nanoscale struts crisscrossed like the struts of a tiny Eiffel Tower, is one of the strongest and lightest substances ever made. If researchers can figure out how to make the stuff in large quantities, it could be used as a structural material for making planes and trucks, as well as in battery electrodes.

In conventional materials, strength, weight, and density are correlated. Ceramics, for example, are strong but also heavy, so they can't be used as structural materials where weight is critical—for example, in the bodies of cars. And when ceramics fail, they tend to fail catastrophically, shattering like glass.

Researchers led by Caltech materials scientist Julia Greer found that by carefully designing nanoscale struts and joints, it is possible to make materials that are not only very strong but light enough to float through the air like a feather. What's more, the method can make ceramics, metals, and other materials that can recover after being crushed, like a sponge.

At the nanoscale, it turns out, the usual strength-weight-density rules do not apply to materials. In this size range, the structural and mechanical properties of ceramics become less tied to properties such as weight, and they can be altered more precisely. "For ceramics, smaller is tougher," says Greer. This means that nanoscale trusses made from ceramic materials can be both very light—unsurprising, since they are mostly air—and extremely strong.

In 2011, researchers at HRL Laboratories, a private engineering research company, created one of the lightest materials ever made, a microlattice of hollow metal tubes. Greer worked with the company to characterize the material and later chose to take on the greater challenge of making ceramics with similar properties. This required fine-tuning structures at the nanoscale, meaning the materials are even more difficult to produce.

To make the ceramic nano trusses, Greer's lab uses a technique called two-photon interference lithography. It's akin to a very low-yield 3-D laser printer. This method is used to create the desired

CONTINUE

structure, a lattice, out of a polymer. The polymer lattice is then coated with a ceramic such as alumina. Oxygen plasma etches out the polymer, leaving behind a lattice of hollow ceramic tubes.

Greer's lab showed that by changing the thickness of the tube walls, it's possible to control how the material fails. When the walls are thick, the ceramic shatters under pressure as expected. But trusses with thinner walls, just 10 nanometers thick, buckle when compressed and then recover their shape. "You don't expect these materials to recover—you expect them to be brittle and to fracture," says Christopher Spadaccini, an engineer who specializes in materials manufacturing at the U.S. Department of Energy's Lawrence Livermore National Laboratory in California.

The new materials might be particularly interesting for use in batteries, notes Nicholas Fang, a mechanical engineer at MIT who is also working on nanostructured ceramics. Nanostructures have a very high surface area and are lightweight, a combination that could make for a fast-charging battery that stores a lot of energy in a convenient package. In fact, Greer says she is collaborating with German electronics company Bosch to apply her designs to lithium-air batteries.

20

It can reasonably be inferred from the passage that one of the challenges that investigators of nanoscale materials face is that

A) it is hard to identify applications in which these materials would be useful.

B) there are too few trained scientists to work on these materials.

C) these materials currently cannot be mass-produced.

D) the public is skeptical regarding the safety of these materials.

21

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

A) Lines 4-7 ("If researchers . . . electrodes")

B) Lines 12-14 ("And when . . . glass")

C) Lines 23-24 ("At the . . . materials")

D) Lines 32-35 ("In 2011 . . . tubes")

22

According to the passage, a disadvantage of conventional ceramics as structural materials is that they

A) are not as strong as are other conventional materials.

B) fragment into numerous pieces under stress.

C) have few qualities that are of commercial value.

D) are difficult to produce economically in large quantities.

23

Which choice best supports the idea that compared with some other nanoscale materials, ceramic nanomaterials are relatively difficult to work with?

A) Lines 15-19 ("Researchers . . . feather")

B) Lines 28-31 ("This . . . strong")

C) Lines 38-40 ("This . . . produce")

D) Lines 41-43 ("To make . . . lithography")

24

The author's reference to "a feather" (line 19) mainly serves to

A) emphasize how little nanoscale materials weigh.

B) point to the precision with which nanoscale materials are made.

C) highlight the fragility of nanoscale materials.

D) suggest the visual appeal of nanoscale materials.

CONTINUE

25

As used in lines 21-22, the phrase "like a sponge" suggests that nanoscale materials can

A) take on different shapes.

B) be of practical use.

C) readily absorb liquids.

D) resume their original shape.

26

The passage implies that an advantage of nanoscale materials when compared with more conventional materials is that

A) the physical properties of nanoscale materials can be manipulated with fewer errors.

B) the weight and density of nanoscale materials make them easier to work with in a laboratory.

C) nanoscale materials are readily available for many different commercial and industrial uses.

D) nanoscale materials are of primary interest to the air transportation industry.

27

The author includes a quotation from Christopher Spadaccini in the seventh paragraph (lines 49-60) primarily to

A) emphasize the volatile nature of ceramic nanoscale materials.

B) identify one of the leading researchers of ceramic nanoscale materials.

C) point out potential new research areas related to ceramic nanoscale materials.

D) call attention to the counterintuitive behavior of ceramic nanoscale materials.

28

The main purpose of the last paragraph is to

A) discuss the widespread commercial interest in nanoscale materials.

B) compare the work of two researchers on nanoscale materials.

C) suggest a possible application for nanoscale materials.

D) defend an innovative approach to studying nanoscale materials.

Questions 29-37 are based on the following passages.

Passage 1 is adapted from Toni Morrison, "What the Black Woman Thinks about Women's Lib." ©1971 by The New York Times Company. Passage 2 is adapted from Mia McKenzie, "'How Can White Women Include Women of Color in Feminism?' Is a Bad Question. Here's Why." ©2015 by BGD Press, Inc.

Passage 1

What do black women feel about Women's Lib? Distrust. It is white, therefore, suspect. In spite of the fact that liberating movements in the black world have been catalysts for white feminism, too many movements and organizations have made deliberate overtures to enroll blacks and have ended up by rolling them. They don't want to be used again to help somebody gain power—a power that is carefully kept out of their hands. They look at white women and see them as the enemy—for they know that racism is not confined to white men, and that there are more white women than men in this country, and that 53 percent of the population sustained an eloquent silence during times of greatest stress. The faces of those white women hovering behind that black girl at the Little Rock school in 1957 do not soon leave the retina of the mind.[1]

When she was interviewed by Nikki Giovanni last May in *Essence* magazine, Ida Lewis, the former editor-in-chief of *Essence*, was asked why black women were not more involved in Women's Lib, and she replied: "The Women's Liberation Movement is basically a family quarrel between white women and white men. And on general principles, it's not good to get involved in family disputes. Outsiders always get shafted when the dust settles. On the other hand, I must support some of the goals [equal pay, child-care centers, etc.]. . . . But if we speak of a liberation movement, as a black woman I view my role from a black perspective—the role of black women is to continue the struggle in concert with black men for the liberation and self-determination of blacks. White power was not created to protect and preserve us as women. Nor can we view ourselves as simply American women. We are black women, and as such we must deal effectively in the black community." . . .

But there is not only the question of color, there is the question of the color of experience. Black women are not convinced that Women's Lib serves their best interest or that it can cope with the uniqueness of their experience, which is itself an alienating factor. The early image of Women's Lib was of an élitist organization made up of upper-middle-class women with the concerns of that class (the percentage of women in professional fields, etc.) and not paying much attention to the problems of most black women.

[1] Segregationists heckled the first black students to attend Little Rock Central High School.

Passage 2

[W]omen of color have been creating feminist movements (under whatever names we've called them), both formally and informally, since before "feminism" was even a word. Throughout history, women of color have fought for their rights, in ways both large and small, both documented and undocumented, and their fighting has impacted not only their lives and the lives of the women in their communities, but every feminist issue that has come after them. Women of color have always been here doing this work.

From Sojourner Truth to Ida B. Wells, from Gloria Anzaldúa to Yuri Kochiyama, from Leslie Marmon [Silko] to Rajini Thiranagama, from Shirley Chisholm to Wilma Mankiller, from Coretta Scott King to Cherrie Moraga, women of color have shaped women's movements in this country (and everywhere).

When we talk about feminism and "inclusion" we need to remember that feminism doesn't belong to white women by default. There is no feminism without women of color. . . .

Women of color feminisms are inherently more complex than white feminisms because women of color experience oppression at more intersections. Adding a racialized experience, and all of the things that come with one, to an experience of womanhood, necessarily complicates and deepens any feminist analysis.

There are oppressions that women of color experience that are unique to us as a group, and oppressions that we face in our different racial groupings that make our experiences further unique. A black woman's experiences of oppression are very different from an Asian woman's experiences of oppression. . . .

Our voices, our analyses, push feminist conversation forward to places where it would never be equipped to go without us. Our experiences, and our ability to articulate those experiences in ways

CONTINUE

that only we can, makes those conversations exponentially more valuable and useful to feminism and its goals of equality and equity for all women. To be able to fully benefit from these analyses, they must be *centered*, not simply "included". "Including" them, as an afterthought of a much less robust mainstream, white feminism, misses the entire point.

29

In lines 15-17 of Passage 1, Morrison most likely refers to the scene at the Little Rock school in order to

A) suggest that a similar response would occur if black women were to join in the movement for women's liberation.

B) provide an example that demonstrates why black women are skeptical of alliances with white women.

C) offer a personal recollection of an event that became famous.

D) emphasize that both white and black women need to bring about reforms.

30

It can reasonably be inferred from Passage 1 that Ida Lewis would most likely recommend that black women follow which course of action?

A) Oppose the specific proposals of women's liberation as harmful to black women

B) Work with white women to make women's liberation more inclusive

C) Spend more time trying to understand the role of black men in families

D) Focus energy on achieving the aims of black people rather than those of white people

31

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

A) Lines 24-25 ("And on . . . disputes")

B) Lines 25-26 ("Outsiders . . . settles")

C) Lines 28-33 ("But if . . . blacks")

D) Lines 33-34 ("White . . . as women")

32

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

A) safeguard.

B) perpetuate.

C) retain.

D) conserve.

33

As used in line 65, "shaped" most nearly means

A) patterned.

B) embodied.

C) streamlined.

D) influenced.

34

The main purpose of the last paragraph in Passage 2 is most likely to solidify McKenzie's argument that

A) famous women of color who made historical contributions have not received the recognition they deserve.

B) feminists can achieve their goals for equal rights only when women of color are embraced as key participants in the process.

C) women of color have traditionally been expected to share the same political goals as those of white women.

D) all women of color are usually portrayed as having experienced the same types of oppression.

35

One major way in which Morrison's discussion of the women's movement in Passage 1 differs from McKenzie's discussion of the movement in Passage 2 is that Morrison

A) questions black women's exclusion from the movement, while McKenzie questions whether women of color should be included in the movement.

B) focuses on black women's feelings of alienation toward the movement, while McKenzie focuses on how women of color play a crucial role in the campaign for women's rights.

C) describes the movement from a historical perspective, while McKenzie describes the current structure of the movement.

D) argues for a more positive assessment of the goals of the movement, while McKenzie argues for a more critical assessment of the accomplishments of the movement.

36

Based on Passage 2, McKenzie would most likely respond to Morrison's statement in lines 43-48 of Passage 1 ("The early . . . women") by

A) pointing out that the fight for women's rights is now primarily driven by the successful accomplishments of black women.

B) acknowledging that feelings of alienation among black women during the early stages of the women's movement are well established.

C) noting that many early feminist efforts were led by women of color whose achievements were sometimes unrecorded.

D) highlighting the differences between black women and other women of color during early women's movements.

37

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

A) Lines 52-58 ("Throughout . . . them")

B) Lines 71-73 ("Women . . . intersections")

C) Lines 78-81 ("There . . . unique")

D) Lines 85-87 ("Our voices . . . without us")

CONTINUE

Questions 38-47 are based on the following passage and supplementary material.

This passage is adapted from Carl Zimmer, "Looking for Ways to Beat the Weeds." ©2013 by The New York Times Company.

The past century brought a slew of weed-killing chemicals. They helped boost agricultural productivity, although they also caused environmental damage. And it didn't take long for them to become less effective at killing weeds. Farmers responded by increasing their dose, but weeds became even more resistant. Eventually, they had to abandon the old herbicides and turn to new ones. Today 217 species of weeds are resistant to at least one herbicide, according to the *International Survey of Herbicide Resistant Weeds*.

Weeds become resistant through evolution. Compared with complex traits like dormancy and mimicry, resistance can be quite simple to evolve. In some cases, a weed needs just one mutation to blunt the effect of herbicides.

In the 1970s, there was great hope for a new herbicide called glyphosate. Early studies revealed no resistance evolving in weeds, raising hopes that, at last, farmers had escaped from evolution. In the 1980s, its manufacturer increased glyphosate's popularity by introducing genetically modified crops carrying a gene that gave them resistance to the herbicide. Instead of using several different herbicides, many farmers could now use just one.

Some critics predicted that interbreeding between genetically modified crops and wild plants would create "superweeds"—hybrid plants carrying the resistance gene. So far, though, only a few cases have been documented.

And yet the weeds have become resistant to glyphosate anyway. They did so the old-fashioned way: through evolution.

"It's easy to say, 'We've used it for years and it never developed resistance,'" Norman Ellstrand, a genetics professor at the University of California, said. He argues that the reason was that farmers applied glyphosate to relatively little farmland. As they applied it to more and more acreage, they raised the evolutionary reward for mutations that allowed weeds to resist glyphosate. "That ups the selection pressure tremendously," he said.

Glyphosate-resistance is now rampant. Twenty-four species of weeds have evolved it, and they are expanding their range around the world. Earlier this year, the agricultural consulting firm Stratus reported that half of American farms had glyphosate-resistant weeds in 2012, up from 34 percent the year before.

Glyphosate's manufacturer has developed crops that can resist an older herbicide called dicamba. Another biotechnology producer, meanwhile, has developed crops resistant to a different herbicide called 2,4-D. The environmental impact of the products is now being evaluated by the Agriculture Department.

Some researchers have argued that weeds could be foiled by combining two resistance genes in one plant, so that farmers could apply two herbicides at once. The odds of a weed having resistance to both chemicals would be tiny.

David Mortensen, a weed biologist at Penn State University, rejects these claims. He notes that some weeds are already resistant to dicamba, and others to 2,4-D. In the journal *Trends in Genetics*, a team of French and American weed scientists present another reason to worry about these new crops: weeds can become resistant to more than one herbicide at once. Spraying with one chemical can drive the evolution of an all-purpose stress response system, which can defend the weed against other chemicals.

If farmers plant a large area with the new crops, Dr. Mortensen predicted, they will drive the evolution of a new generation of resistant weeds.

"I am quite certain that this is a short-lived solution," he said.

Dr. Mortensen and his colleagues are investigating controlling weeds by planting crops like winter rye that can kill weeds by blocking sunlight and releasing toxins. "You want to spread the selection pressure across a number of things that you're doing, so that the selection pressure is not riding on one tactic," he said.

To some extent, evolution-guided strategies are not new. Scientists have explored them for battling other enemies, like bacteria that evolve resistance to antibiotics.

"We should be looking at this more carefully," Dr. Ellstrand said. "And we're just getting to it now."

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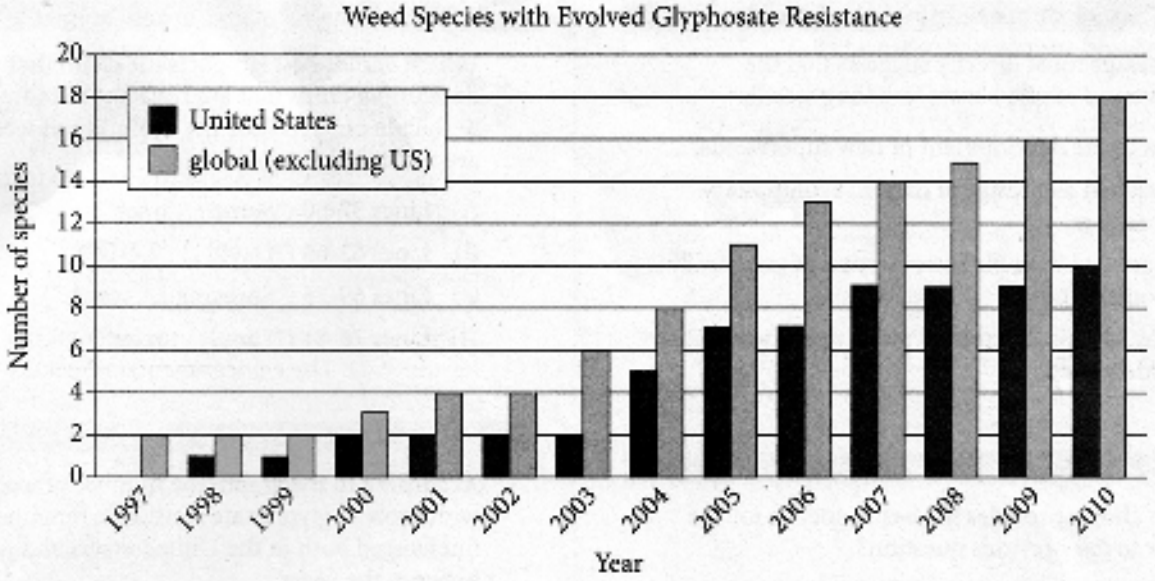


Adapted from Micheal D. K. Owen, "Herbicide-Resistant Weeds in Genetically Engineered Crops," a statement given to the US House of Representatives Subcommittee on Domestic Policy in 2010.

38

The main purpose of the passage is to

A) offer a solution for a little-understood problem involving the use of herbicides.

B) propose alternatives to a traditional farming process.

C) denounce a controversial method of reducing the growth of weeds.

D) shed light on a troublesome phenomenon within the agricultural industry.

39

The main purpose of the first paragraph is to

A) provide historical context for an ongoing problem.

B) introduce an argument that is later disproven.

C) compare earlier failures with current successes.

D) offer an explanation for a newly emerging trend.

40

The author suggests that the main reason farmers abandoned older herbicides was that the herbicides

A) caused environmental damage.

B) were ineffective against weeds with evolved dormancy and mimicry.

C) killed the crops they were designed to protect.

D) lost their ability to control weeds.

41

As used in line 28, "carrying" most nearly means

A) transporting.

B) showing.

C) encompassing.

D) containing.

CONTINUE

42

The passage most directly suggests that the effectiveness of glyphosate in killing weeds

A) led to the development of new superweeds.
B) lessened as a result of natural evolutionary processes.
C) increased with the introduction of genetically modified crops.
D) was largely unexpected given that it was not widely used.

43

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

A) Lines 20-24 ("In the . . . herbicide")
B) Lines 26-29 ("Some . . . gene")
C) Lines 31-33 ("And . . . evolution")
D) Lines 50-51 ("Glyphosate's . . . dicamba")

44

As used in line 40, "raised" most nearly means

A) lifted.
B) enhanced.
C) collected.
D) awakened.

45

Which choice best supports the claim that developing crops that are resistant to more than one herbicide can promote the evolution of weeds that are resistant to more herbicides?

A) Lines 57-60 ("Some . . . once")
B) Lines 62-65 ("David . . . 2,4-D")
C) Lines 69-75 ("Spraying . . . weeds")
D) Lines 76-81 ("I am . . . toxins")

46

According to the graph, the number of weed species with evolved glyphosate resistance remained unchanged both in the United States and globally between the years

A) 1997 and 1998.
B) 1999 and 2000.
C) 2001 and 2002.
D) 2008 and 2009.

47

The graph indicates that in the year 2008, the number of weed species with evolved glyphosate resistance

A) grew by one species from the previous year in countries other than the United States.
B) expanded by more than one species from the previous year in the United States.
C) increased beyond any previously recorded number both in the United States and globally.
D) remained unchanged from the previous year in the United States and globally.

STOP

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

Writing and Language Test

35 MINUTES, 44 QUESTIONS

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

DIRECTIONS

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

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

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

Questions 1-11 are based on the following passage.

Models of Artistry: The Blaschka Glass Flowers

The Harvard Museum of Natural History in Cambridge, Massachusetts, **1** is home: to the Ware Collection of Blaschka Glass Models of Plants, a collection of more than four thousand botanical models. Commonly known as the glass flowers, these small sculptures of plants were made from 1887 to 1936 by father and son artisans Leopold and Rudolf Blaschka in their workshop near Dresden, Germany. A Harvard botany professor, unsatisfied with the teaching tools

1

A) NO CHANGE
B) is home to
C) is, home to,
D) is home to:

available to him—papier-mâché models crumbled, wax models melted, and 2 what occurred with pressed plants was the problem of fading—commissioned the Blaschkas to produce the models.

[1] Because they were created for careful study, the glass flowers had to be 3 particularized and scientifically accurate. [2] To that end, the Blaschkas closely 4 studied the plants they modeled, often sketching or painting them before they ever started working with glass. [3] They meticulously crafted every stamen, every pistil, every stem—every part of every model—to scale. [4] Other series present fruits gradually decaying. [5] The models, most more than a century old, are still used in research by some contemporary botanists. 5

2

A) NO CHANGE
B) the problem with pressed plants was that they faded—
C) fading was an issue with pressed plants—
D) pressed plants faded—

3

A) NO CHANGE
B) picky
C) precise
D) peculiar

4

A) NO CHANGE
B) studied, the plants they modeled
C) studied the plants, they modeled,
D) studied, the plants, they modeled

5

The writer wants to add the following sentence.

> Several series of models depict the different stages of pollination.

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

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

CONTINUE

The flowers are so convincingly lifelike that 6 they defy description. The yellow centers of tiny bluet blossoms seem to be fuzzy; the dusky crimson petals of a rose seem velvety. Brown-spotted orange lilies appear to droop under the weight of 7 there trumpet-shaped blooms. In a 2007 interview, author Jamaica Kincaid remarked on the flowers' verisimilitude. "I began immediately to think that real flowers were the imitation, that the flowers I saw before me in my garden were an imitation of things that were in glass," she recalled.

The Blaschkas used a variety of methods to create the models. After heating the glass, they sculpted some models with simple tools like pliers and knives. They shaped others with their breath through the use of glassblowing techniques. To achieve realistic colors, the Blaschkas sometimes started with thin rods of colored glass. 8 Other times they baked metal oxide or colored ground glass onto cooled glass. The methods they employed were 9 dictations for the plant they were modeling. The translucent lavender of a humble viola, for example, demanded a different technique than did the deep purple of a regal bearded iris.

6

Which choice most effectively sets up the examples that follow in the paragraph?

A) NO CHANGE
B) they could only be made of glass.
C) it's difficult to believe they're made of glass.
D) it's hard to imagine using them in a classroom.

7

A) NO CHANGE
B) their
C) they're
D) its

8

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

A) Kept, because it illustrates the importance of heat in the Blaschkas' sculpting process.
B) Kept, because it provides an additional example of a method the Blaschkas used to produce the models.
C) Deleted, because it unnecessarily repeats information about the Blaschkas' techniques provided earlier in the passage.
D) Deleted, because it fails to explain why the glass needs to be cooled before it is colored.

9

A) NO CHANGE
B) dictations with
C) dictated to
D) dictated by

CONTINUE

Leopold Blaschka **10** assigned credit for the attainment of his goals to his family's long legacy of glassmaking: "The only way to become a glass modeler of skill, I have often said to people, is to get a good great-grandfather who loved glass." Thanks to a 2016 renovation of the collection, **11** the Blaschka family's legacy is sure to continue to enlighten and delight for generations.

10

A) NO CHANGE
B) chalked up his good work
C) gave credit for the stuff he got done
D) attributed his accomplishments

11

The writer wants to conclude the passage by referencing the future while referring back to the idea at the beginning of the paragraph. Which choice most effectively accomplishes this goal?

A) NO CHANGE
B) staff at other museums would do well to replicate Harvard's restoration methods in future renovations.
C) it's unknown at this time when the next renovation will be.
D) the classrooms of tomorrow are more likely to feature computer models than glass ones.

Questions 12-22 are based on the following passage.

Keeping Ground Sound Down

Schiphol Airport, south of Amsterdam in the **12** Netherlands was built in 1916 on a polder, a lake bed that was transformed into dry land when levees were installed to block the water. The flatness and openness of the area made it ideal for airplane takeoffs and landings, but it was these very qualities that caused sounds made within the polder to be significantly amplified. When a new runway was opened at Schiphol—already a busy airport—in 2003, residents living up to 18 miles away began to **13** whine that the low, droning sound of engines could be heard at all hours. They demanded a **14** reduction, in noise levels.

12

A) NO CHANGE
B) Netherlands;
C) Netherlands,
D) Netherlands:

13

Which choice is most consistent with the style and tone of the passage?

A) NO CHANGE
B) moan
C) expostulate
D) complain

14

A) NO CHANGE
B) reduction—
C) reduction
D) reduction:

CONTINUE

Airport officials were faced with a problem. High-frequency sounds like noise from highway traffic have short wavelengths and can be blocked with concrete barriers that reflect most of the waves. However, the low-frequency roar of airplane engines has a longer wavelength that bends over such barriers, a process known as diffraction, and is therefore harder to block. A potential solution **15** presents itself in the autumn of 2008 when people noticed that the noise diminished after fields surrounding the airport were plowed. It turned out that where one large sound-blocking barrier was ineffective, many small ones could succeed: a scientific research group confirmed that the sloping sides of furrows farmers plowed into the soil **16** was scattering the sound waves emerging from Schiphol.

15

A) NO CHANGE
B) presented
C) would have presented
D) will have presented

16

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

CONTINUE

17 Knowing that noise pollution is doubling every twenty years, airport officials enlisted the help of H+N+S Landscape Architects and artist Paul de Kort, 18 who designed an 80-acre outdoor space called Buitenschot Land Art Park. The main feature of the park, built with the aid of GPS data, is a series of 150 straight, symmetrical 19 trenches. These trenches have ten-foot ridges. Together, these ridges form large geometric shapes. The ridges are spaced 11 meters apart, 20 a distance roughly equal to the wavelength of the low-frequency noise. Between them are bike paths and works of sculpture, as the park was designed to give people a place to enjoy as well as to reduce noise

17

Which choice provides the most effective transition from the previous paragraph?

A) NO CHANGE
B) Hoping to keep costs as low as possible,
C) With the approval of these farmers,
D) Acting on this newfound knowledge,

18

A) NO CHANGE
B) he
C) and who
D) being the one who

19

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

A) trenches, the ten-foot ridges together of which
B) trenches; each has a ten-foot ridge, but when they are together, they
C) trenches that have ten-foot ridges; together, though, these ridges
D) trenches with ten-foot ridges that together

20

The writer wants to include supporting information that helps link this paragraph with the previous paragraph. Which choice most effectively accomplishes this goal?

A) NO CHANGE
B) with de Kort relying on experiments that had been conducted by German scientist Ernst Chladni in the seventeenth century.
C) meaning that the entire park constitutes a relatively large-scale landscaping project.
D) and they have been described by journalists as resembling waves approaching a beach.

pollution. "I tried to create a symbiosis between a purely functional landscape of horizontal ridges and a pleasant environment," de Kort said. Monitoring points were set up to provide feedback about noise levels after the initial stage of the park was completed in 2013; scientists measured a roughly 20 percent drop in perceived airplane noise. **21**

Schiphol's approach to noise reduction has inspired other similar projects, including at airports in Melbourne, Australia, and London, UK. **22** In these parks, art and science combine to meet the needs of residents along with the demands of industry.

21

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

> Officials hope that a planned extension of the park will eventually reduce perceived noise by the target level of 50 percent.

Should the writer make this addition here?

A) Yes, because it clarifies the methods scientists used to measure reductions in perceived noise.

B) Yes, because it makes clear that the completed park is likely to be highly effective at reducing noise levels.

C) No, because it does not provide enough detail about how the proposed extension would work.

D) No, because it contradicts claims made about the park earlier in the paragraph.

22

The writer wants a conclusion that returns to the themes of the passage. Which choice best accomplishes this goal?

A) NO CHANGE

B) Those who live near airports should realize that total noise elimination is unlikely to be achieved without major advances in jet-engine technology.

C) Parks like these not only fulfill the needs of those who live near airports but also satisfy the demands of environmental activists worldwide.

D) As the Schiphol example makes abundantly clear, when citizens demand change, governments listen.

CONTINUE

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

Civics for the People

Political strategist Christine Pelosi once said, "Voting is a civic sacrament—[it's] the highest responsibility we have as Americans." Since the voting age was changed to eighteen in the early 1970s, voter turnout in the United States among eighteen- to twenty-four-year-old citizens 23 will have been consistently lower than that of citizens in older demographics. To address this low turnout, communities, organizations, and schools should engage youth in conversations about civics. Civics education can be informal, such as the discussion of politics with 24 peers, or formal, such as high school civics classes. 25 In the modern world, civics education has two main 26 goals; to inform individuals about the responsibilities of active citizenship and to examine the structure of the US government.

23

A) NO CHANGE
B) has been
C) were
D) was being

24

Which choice best matches the tone of the passage?

A) NO CHANGE
B) buddies,
C) chums,
D) pals,

25

Which choice is the most appropriate transition from the previous sentence?

A) NO CHANGE
B) Dealing with several topics,
C) Helpful to young people,
D) Regardless of the medium,

26

A) NO CHANGE
B) goals to:
C) goals to
D) goals: to

CONTINUE

27 Many students find that they enjoy studying civics. A national survey 28 accomplished after the 2012 presidential election found that voter turnout was 63.1 percent among eighteen- to twenty-four-year-old respondents who reported having studied civics in school, compared with only 43 percent among respondents in the same age group who did not. The survey also found that the respondents who had studied civics were more likely to correctly answer questions about the US governmental system and have knowledge of current political issues than were those who did not report any civics education.

27

Which sentence best introduces this paragraph?

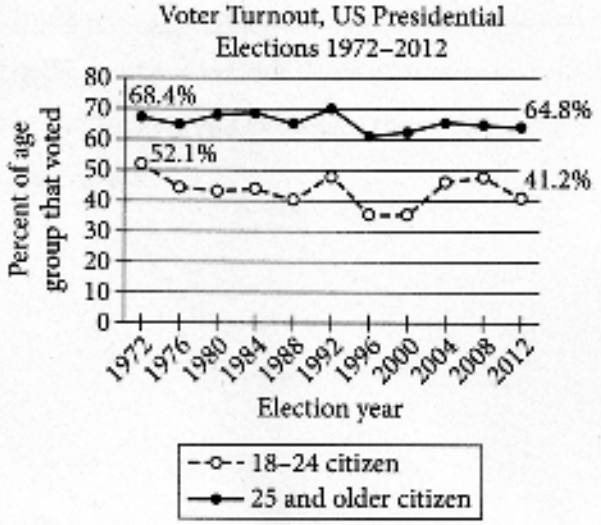
A) NO CHANGE
B) Young voters appear to be less knowledgeable about the electoral process than older voters.
C) A robust civics education has been associated with a more informed and engaged constituency.
D) Voter turnout is lower than it should be in all groups, but it is particularly low among young people.

28

A) NO CHANGE
B) enacted
C) conducted
D) fulfilled

CONTINUE

Conversely, civic illiteracy has been linked with low youth-voter turnout. Although the 2012 presidential election was highly publicized, only 41.2 percent of citizens aged eighteen to twenty-four **29** voted compared with 64.8 percent of citizens aged twenty-five and older. In other words, barely two in every five young **30** citizens, showed up at the polls. In the 1988, 1996, and 2000 presidential elections, the percentage of youth voters was even lower. For midterm elections, the data present a more dismal scene: a paltry 21.3 percent, little more than one in five, of eighteen- to twenty-four-year-old citizens voted in the 2010 midterm election. If more youth voters engaged in civic **31** discourse, when these numbers would increase.



Adapted from CIRCLE, "The Youth Vote in 2012." ©2013 by CIRCLE (The Center for Information and Research on Civic Learning and Engagement).

29

At this point, the writer wants to provide information from the figure to illustrate that youth-voter turnout is low. Which choice best accomplishes this goal?

A) NO CHANGE
B) voted; furthermore, turnout among citizens aged twenty-five and older remained fairly constant between 1972 and 2012.
C) voted; turnout in this demographic has varied by more than 10 percent from one election to the next.
D) voted compared with less than 40 percent in this demographic in the 2000 election.

30

A) NO CHANGE
B) citizens
C) citizens—
D) citizens;

31

A) NO CHANGE
B) discourse, afterwards
C) discourse;
D) discourse, perhaps

Since elected officials make decisions that affect their constituents, it is important for citizens to stay informed about current events and pending legislation. As former Detroit mayor Hazen Pingree warns, 32 "Charity, in short, is the handmaid of economic oppression." Civics education may be one way to combat this 33 problem. As it provides a space for youth to converse on the importance of voting, the mechanisms of governmental power, and policies impacting society.

32

The writer wants to include a relevant quotation to support the argument of the passage. Which choice best accomplishes this goal?

A) NO CHANGE
B) "Voter apathy was, and will remain the greatest threat to democracy."
C) "One member of the body politic cannot suffer except at the expense of all of the members."
D) "Government is the creature of the people and the corporations are the creature of the government."

33

A) NO CHANGE
B) problem,
C) problem, as
D) problem; as

CONTINUE

Questions 34-44 are based on the following passage.

Problem Solving through Math

Students taking mathematics courses may wonder how the skills 34 he or she acquires in the classroom can be 35 applied for real-world issues. But the solutions to many practical problems require computation, creativity, and mathematical modeling, a combination of skills used by operations research (OR) analysts. Imagine a new restaurant owner trying to decide how much food to purchase on the basis of available storage space, each food's shelf life, and customer demand. 36 An OR analyst would use his or her strong foundation in both math and problem solving in advising the restaurant owner. More generally, it is precisely this background that enables OR analysts to help companies 37 decrease the time spent training employees.

34

A) NO CHANGE
B) you acquire
C) we acquire
D) they acquire

35

A) NO CHANGE
B) in application to
C) applied to
D) applying with

36

Which choice most effectively incorporates the claims made earlier in the paragraph?

A) NO CHANGE
B) For a business like this, an OR analyst's skills are hardly necessary.
C) Several OR analysts may be hired to ensure that the restaurant's other employees are doing their jobs properly.
D) Only OR analysts who have run similar businesses in the past would be able to contribute to the restaurant owner's future success.

37

Which choice provides the most effective introduction to the main topic of the passage?

A) NO CHANGE
B) lessen the time it takes their employees to perform their duties.
C) improve their processes and use resources effectively.
D) boost their profits and promote their products.

CONTINUE

OR analysts create mathematical models, tailored to specific companies and issues, to predict how systems will work when put into place. **38** However, logistics companies, which sort and deliver packages across the country, **39** employs OR analysts to model how their truck drivers can make the best use of time and fuel. An OR analyst might also use models to help a manufacturer maximize its profits while minimizing spending on raw materials and production. Companies save time and money by using such models to test ideas before implementing changes in process.

38

A) NO CHANGE
B) Furthermore,
C) For instance,
D) At any rate,

39

A) NO CHANGE
B) is employing
C) employ
D) has been employing

CONTINUE

Because many schools do not offer OR as a major, a degree in a related field is usually needed to get a job. After graduating with a degree in mathematics from Tuskegee University in Alabama, Kenya T. McLin wondered how she could make use of her knowledge of math. **40** Soon after graduating, McLin found a fulfilling job as an OR analyst with the US Army. Working as part of a team of OR analysts, **41** computer software enables McLin to run simulations demonstrating the impact that proposed solutions to logistical problems may have on Army missions. One project that McLin participated in was the experimental launch of a 10-inch, 10-pound nanosatellite that allows soldiers in remote locations to communicate safely with headquarters. Before the satellite was launched, McLin and other OR analysts and engineers **42** ensured—using math—that the satellite would be invisible from the ground but could transmit text and images effectively.

40

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

> Tuskegee University, founded in 1881 by Booker T. Washington, was also the site of the Tuskegee Airmen flight training program during the Second World War.

Should the writer make this addition here?

A) Yes, because it provides context for the information about Army missions given in the paragraph.

B) Yes, because it sets up the discussion that follows about McLin's career.

C) No, because it overstates the impact of McLin's education on her ability to secure a position in OR analysis.

D) No, because it blurs the focus of the paragraph with loosely related information about Tuskegee University.

41

A) NO CHANGE

B) McLin's access to computer software enables her

C) the use of computer software enables McLin

D) McLin uses computer software

42

A) NO CHANGE

B) ensured—and verified, using math—

C) ensured by using math—that is, mathematics—

D) ensured—using math—and confirmed

CONTINUE

As more companies and government agencies seek to cut costs and increase **43** productivity. They are hiring graduates from STEM (science, technology, engineering, and mathematics) programs to help them **44** condense inefficiencies. McLin says that the "field is constantly growing and developing, which allows opportunity for innovation and creativity." Math might not always be associated with creativity, but in OR the two come together to make processes more efficient.

43

A) NO CHANGE
B) productivity; they
C) productivity: they
D) productivity, they

44

A) NO CHANGE
B) reduce
C) moderate
D) restrain

STOP

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

Math Test – No Calculator

25 MINUTES, 17 QUESTIONS

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

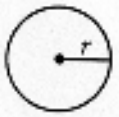
DIRECTIONS

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

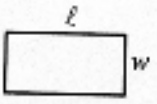
NOTES

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

REFERENCE

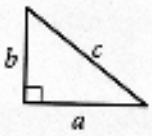


$A = \pi r^2$
$C = 2\pi r$

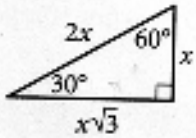


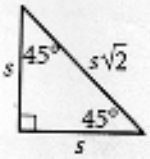
$A = \ell w$

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

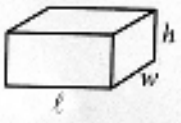


$c^2 = a^2 + b^2$





Special Right Triangles

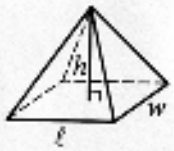


$V = \ell wh$

$V = \pi r^2 h$

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

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



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

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

CONTINUE

1

$5x + 15$

Which of the following is equivalent to the given expression?

A) $5(x + 3)$

B) $5(x + 10)$

C) $5(x + 15)$

D) $5(x + 20)$

2

$x^2 = 64$

Which of the following values of x satisfies the given equation?

A) -8

B) 4

C) 32

D) 128

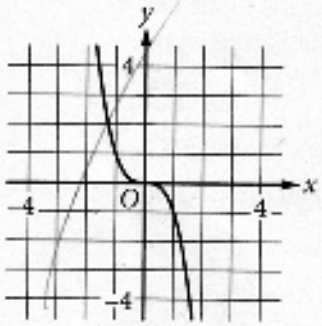
CONTINUE

3

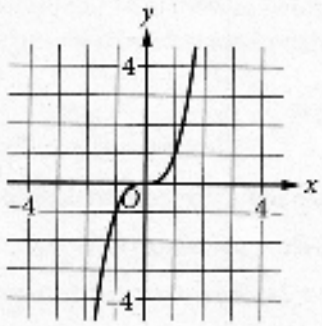
x	y
0	0
1	1
2	8
3	27

The table shown includes some values of x and their corresponding values of y. Which of the following graphs in the xy-plane could represent the relationship between x and y ?

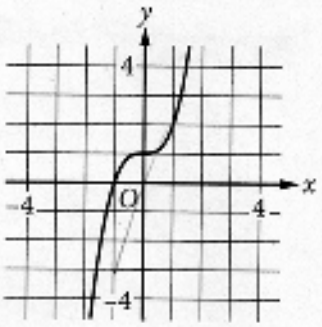
A)



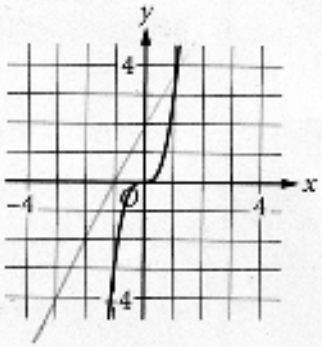
B)



C)



D)



4

$$y = 2x + 3$$
$$x = 1$$

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

A) $(1, 2)$

B) $(1, 5)$

C) $(2, 3)$

D) $(2, 7)$

5

$$f(x) = 2(3^x)$$

For the function f defined above, what is the value of $f(2)$?

A) 9

B) 12

C) 18

D) 36

6

The graph of the function f is a line in the xy-plane. If the line has slope $\frac{3}{4}$ and $f(0) = 3$, which of the following defines f ?

A) $f(x) = \frac{3}{4}x - 3$

B) $f(x) = \frac{3}{4}x + 3$

C) $f(x) = 4x - 3$

D) $f(x) = 4x + 3$

7

$$3x - 80 = 10 + x - 38$$

What value of x satisfies the given equation?

A) 54

B) 45

C) 26

D) -27

CONTINUE

8

$$x + y = 12$$
$$y = x^2$$

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

A) 0
B) 1
C) 2
D) 3

9

Koshiq adds baking soda to an empty beaker during an experiment. The beaker, when empty, has a mass of 50 grams. Each tablespoon of baking soda has a mass of about 33 grams. The function m models the relationship between the total combined mass of the beaker and baking soda $m(b)$, in grams, and the amount of baking soda b, in tablespoons, added to the beaker. Which of the following could define function m ?

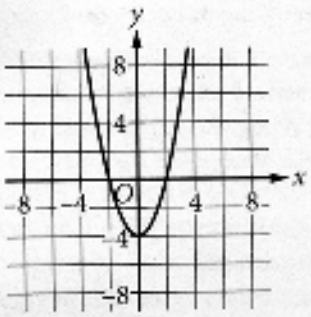
A) $m(b) = 33(b + 50)$
B) $m(b) = 33b + 50$
C) $m(b) = 50(b + 33)$
D) $m(b) = 50b + 33$

10

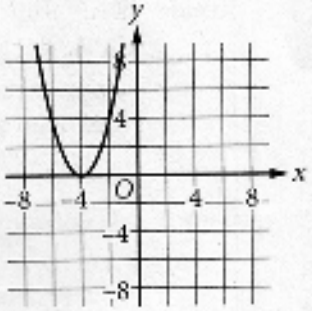
$$f(x) = x^2 + 4$$

The function f is defined as shown. Which of the following graphs in the xy-plane could be the graph of $y = f(x)$?

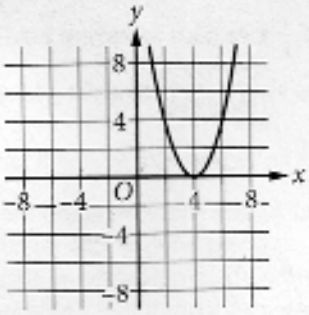
A)



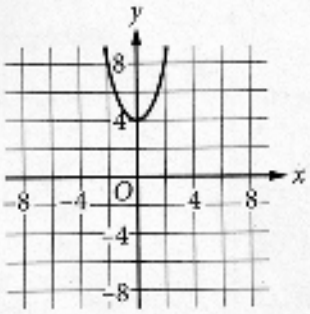
B)



C)



D)

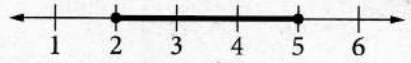


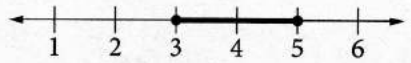
CONTINUE

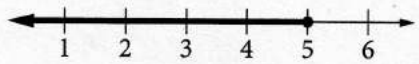
11

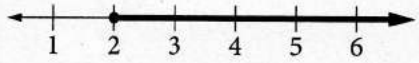
$$x \leq 5$$
$$2x + y \geq 10$$

If $y = 6$, which of the following represents all values of x that satisfy the system of inequalities above?

A) 

B) 

C) 

D) 

12

$$T = 0.01(P - 40{,}000)$$

In a city, the property tax T, in dollars, is calculated using the formula above, where P is the value of the property, in dollars. Which of the following expresses the value of the property in terms of the property tax?

A) $P = 100T - 400$

B) $P = 100T + 400$

C) $P = 100T - 40{,}000$

D) $P = 100T + 40{,}000$

13

What is the length of one side of a square that has the same area as a circle with radius 2 ?

A) 2

B) $\sqrt{2\pi}$

C) $2\sqrt{\pi}$

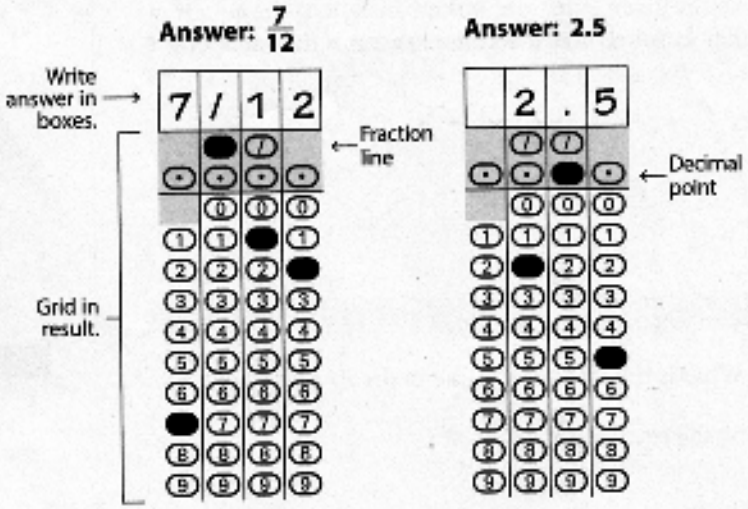
D) 2π

CONTINUE

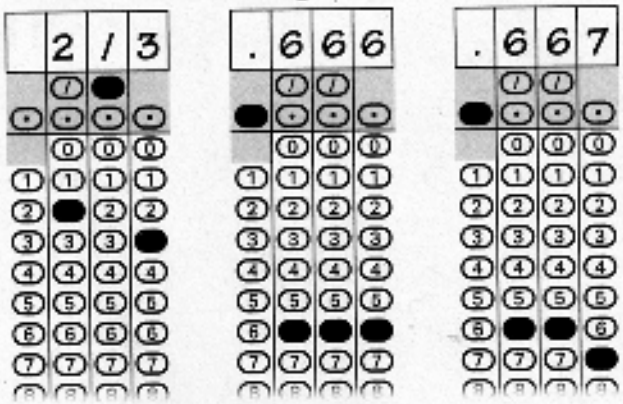
DIRECTIONS

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

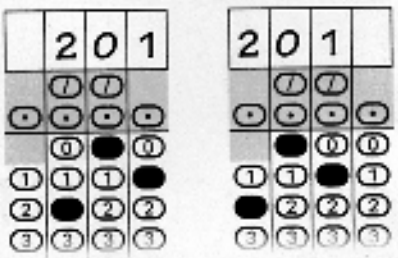
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
2. Mark no more than one bubble in any column.
3. No question has a negative answer.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



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



Answer: 201 – either position is correct



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

CONTINUE

14

$$6x + k = 6x + 5$$

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

15

What is the slope of the line in the xy-plane defined by the equation $y = \frac{x}{3} + 6$?

16

Each molecule of compound X consists of 1 atom of element A and 2 atoms of element D. A molecule of compound X has a mass of 44 atomic mass units (amu). The mass of 1 atom of element A is 12 amu. What is the mass, in amu, of 1 atom of element D?

17

$$\left(\frac{1}{2}x + \frac{3}{2}\right)\left(\frac{3}{2}x + \frac{1}{2}\right)$$

The expression above is equivalent to $ax^2 + bx + c$, where a, b, and c are constants. What is the value of b ?

STOP

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

Math Test – Calculator

45 MINUTES, 31 QUESTIONS

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

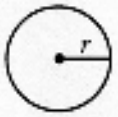
DIRECTIONS

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

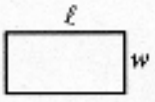
NOTES

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

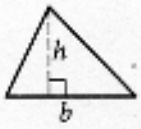
REFERENCE



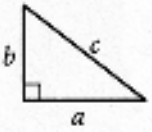
$A = \pi r^2$
$C = 2\pi r$



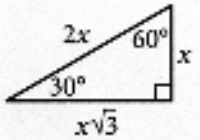
$A = \ell w$

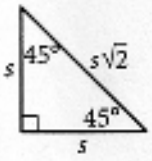


$A = \frac{1}{2}bh$

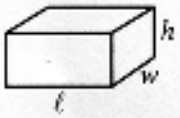


$c^2 = a^2 + b^2$

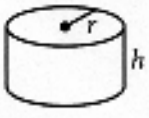




Special Right Triangles



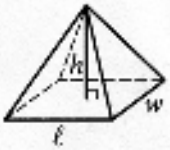
$V = \ell wh$



$V = \pi r^2 h$

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

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

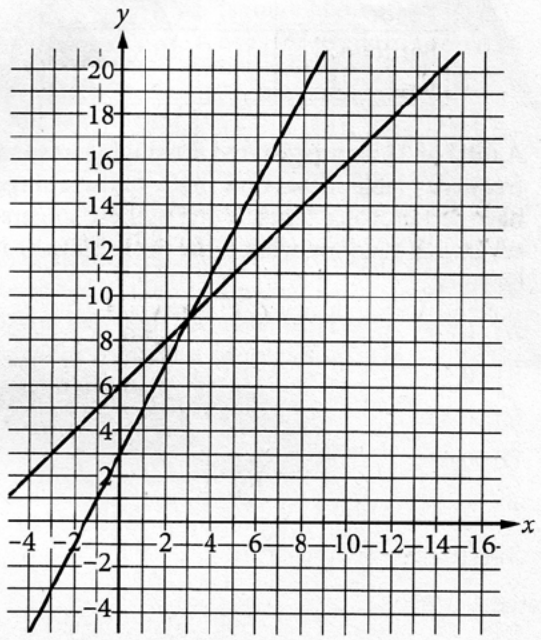


$V = \frac{1}{3}\ell wh$

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

1

A system of two linear equations is graphed in the xy-plane below.



Which of the following points is the solution to the system of equations?

A) (3, 9)

B) (6, 15)

C) (8, 10)

D) (12, 18)

2

Shaquan has 7 red cards and 28 blue cards. What is the ratio of red cards to blue cards that Shaquan has?

A) 1 to 4

B) 4 to 1

C) 1 to 7

D) 7 to 1

3

Which of the following is equivalent to $2x^3 + 4$?

A) $4(x^3 + 4)$

B) $4(x^3 + 2)$

C) $2(x^3 + 4)$

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

4

If $t = 4u$, which of the following is equivalent to $2t$?

A) $8u$

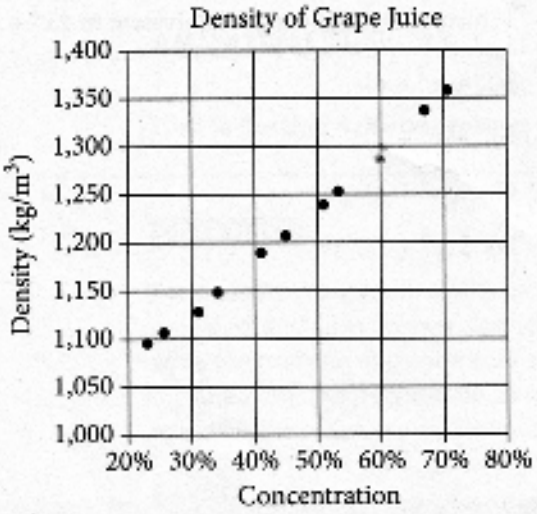
B) $2u$

C) u

D) $\frac{1}{2}u$

CONTINUE

5



The densities of different concentrations of grape juice are shown in the scatterplot above. According to the trend shown by the data, which of the following is closest to the predicted density, in kilograms per cubic meter (kg/m^3), for grape juice with a concentration of 60%?

A) 1,200

B) 1,250

C) 1,300

D) 1,350

6

Voice type	Number of singers
Countertenor	4
Tenor	6
Baritone	10
Bass	5

A total of 25 men registered for singing lessons. The frequency table shows how many of these singers have certain voice types. If one of these singers is selected at random, what is the probability he is a baritone?

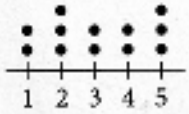
A) 0.10

B) 0.40

C) 0.60

D) 0.67

7



The given dot plot shows 12 data values. How many of the values are equal to 1 ?

A) 0

B) 1

C) 2

D) 3

8

Five Smallest Countries in 2016

Country	Land area (square kilometers)
Monaco	2.0
Nauru	21
San Marino	61
Tuvalu	26
Vatican City	0.44

The table above shows the land area, in square kilometers, of the five smallest countries of the world in 2016. Based on the table, what is the mean land area of the 5 smallest countries in 2016, to the nearest square kilometer?

A) 20

B) 22

C) 61

D) 110

9

In a study, the data from a random sample of a population had a mean of 37, with an associated margin of error of 3. Which of the following is the most appropriate conclusion that can be made about the population mean?

A) It is less than 37.

B) It is greater than 37.

C) It is between 34 and 40.

D) It is less than 34 or greater than 40.

10

The cost of a certain shirt is $20 before a 5% sales tax is added. What is the total cost, including sales tax, to purchase the shirt?

A) $20.05

B) $20.50

C) $21.00

D) $25.00

11

The function f is defined by $f(x) = 3x - 3$. For what value of x is $f(x) = 48$?

A) 15

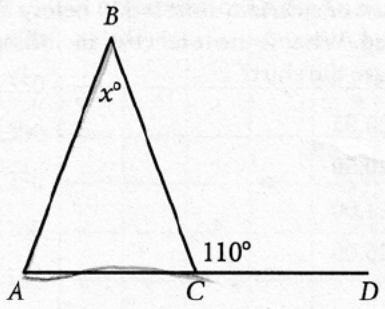
B) 17

C) 51

D) 141

CONTINUE

12



In the given figure, $\overline{AC}$ extends to point D. If the measure of $\angle BAC$ is equal to the measure of $\angle BCA$, what is the value of x ?

A) 110

B) 70

C) 55

D) 40

13

15, 14, 18, 17, x

The mean and the median of the five numbers above are equal. Which of the following is NOT a possible value of x ?

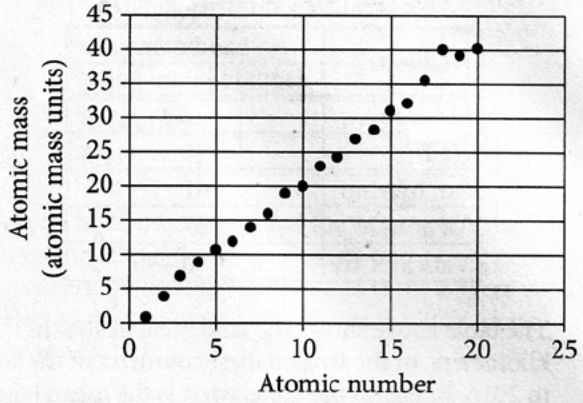
A) 6

B) 11

C) 16

D) 21

14



The scatterplot above shows the atomic number, x, and atomic mass, y, of the first twenty chemical elements on the periodic table. The graph of which of the following equations is a line that most closely fits the data?

A) $y = x - 3$

B) $y = x + 4$

C) $y = 2x - 1$

D) $y = 2x + 8$

Questions 15 and 16 refer to the following information.

Characteristics for Rock Types

Rock type	Weight per volume (lb/ft^3)	Cost per pound
Basalt	180	\$0.18
Granite	165	\$0.09
Limestone	120	\$0.03
Sandstone	135	\$0.22

A city is planning to build a rock retaining wall, a monument, and a garden in a park. The table above shows four rock types that will be considered for use in the project. Also shown for each rock type is its weight per volume, in pounds per cubic foot (lb/ft^3), and the cost per pound, in dollars.

15

$0.03(120w) + 0.18(180z) + 3{,}385.80 = 7{,}576.20$

The equation above shows the total cost, in dollars, of the rocks used in the project in terms of the number of ft^3 of limestone, w, and the number of ft^3 of basalt, z. All four rock types are used in the project. Which of the following is the best interpretation of 3,385.80 in this context?

A) The cost of the granite and sandstone needed for the project

B) The cost of the basalt and limestone needed for the project

C) The cost of the basalt needed for the project

D) The cost of the sandstone needed for the project

16

Only basalt, granite, and limestone will be used in the garden. The rocks in the garden will have a total weight of 1,000 pounds. If 330 pounds of granite is used, which of the following equations could show the relationship between the amounts, x and y, in ft^3, for each of the other rock types used?

A) $165x + 180y = 670$

B) $165x + 120y = 1{,}000$

C) $120x + 180y = 670$

D) $120x + 180y = 1{,}000$

17

For which of the following equations is there no solution?

I. $2(x + 5) = x - 3 + x - 4$

II. $x + x + x + 4 = 2(x + 2) + x$

A) Neither

B) I only

C) II only

D) I and II

CONTINUE

Questions 18 and 19 refer to the following information.

$$b + s = 280$$
$$354b + 80s = 88{,}160$$

In 1773, chests of various teas were thrown into the Boston Harbor during the Boston Tea Party. Each chest contained only one type of tea. The tea included b chests of Bohea tea, each containing 354 pounds of tea, and s chests of Singlo tea, each containing 80 pounds of tea. The system of equations above models the number of chests of Bohea tea and Singlo tea thrown into the harbor and the number of pounds of Bohea tea and Singlo tea thrown into the harbor.

18

Which of the following is the best interpretation of the number 88,160 in this context?

A) The total number of chests of Bohea tea and Singlo tea thrown into the harbor

B) The total weight, in pounds, of Bohea tea thrown into the harbor

C) The total weight, in pounds, of Singlo tea thrown into the harbor

D) The total weight, in pounds, of Bohea tea and Singlo tea thrown into the harbor

19

How many more chests of Bohea tea than chests of Singlo tea were thrown into the harbor during the Boston Tea Party?

A) 40

B) 100

C) 200

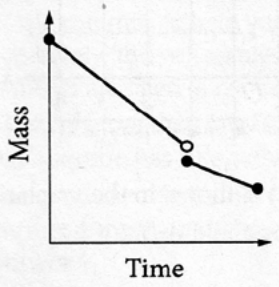
D) 274

CONTINUE

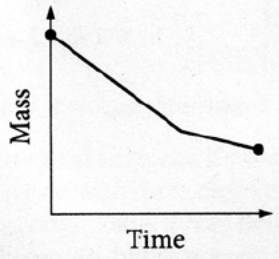
20

After a rocket is launched, it begins to burn fuel, and the total mass decreases at a constant rate. After the fuel burns for several minutes, a portion of the rocket is discarded, causing an instantaneous 10% loss of mass. At the same time that the rocket portion is discarded, the rate at which the rocket burns fuel decreases. Of the following, which graph could represent the total mass of the rocket over time?

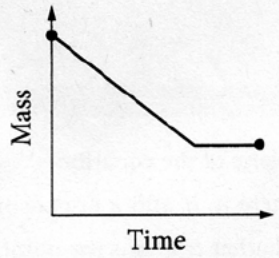
A)



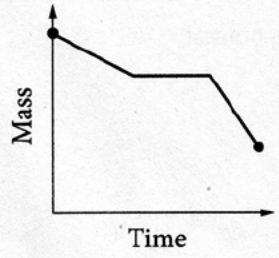
B)



C)



D)



21

If $p = 3x + 4$ and $v = x + 5$, which of the following is equivalent to $pv - 2p + v$?

A) $3x^2 + 12x + 7$

B) $3x^2 + 14x + 17$

C) $3x^2 + 19x + 20$

D) $3x^2 + 26x + 33$

22

$$2x^2 = 200$$

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

A) 4

B) 2

C) 1

D) 0

23

On June 9, 1973, a horse named Secretariat ran a distance of 12.0 furlongs in 144 seconds. What was the average speed, in miles per hour, that Secretariat ran for the 12.0 furlongs on that day?
(1 mile = 8 furlongs)

A) 33.5

B) 37.5

C) 42.5

D) 45.0

CONTINUE

24

Rectangle A has length 15 and width w. Rectangle B has length 20 and the same length-to-width ratio as rectangle A. What is the width of rectangle B in terms of w ?

A) $\frac{4}{3}w$

B) $w + 5$

C) $\frac{3}{4}w$

D) $w - 5$

25

The number k is 36% greater than 50. If k is the product of 50 and r, what is the value of r ?

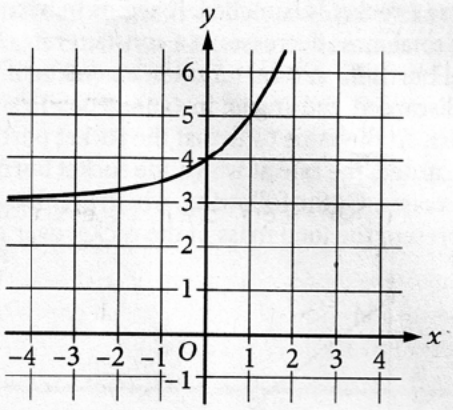
A) 36

B) 3.6

C) 1.36

D) 0.36

26



The graph of $y = f(x)$ is shown in the xy-plane. Which of the following could define f ?

A) $f(x) = x + 4$

B) $f(x) = x^2 + 4$

C) $f(x) = x^4 + 3$

D) $f(x) = 2^x + 3$

27

The graph in the xy-plane of the equation $y = a(x - h)^2 + k$, where a, h, and k are positive constants, is a parabola that contains the point $(2, 4)$. The graph of $y = a(x - h)^2 + 2k$ must contain which of the following points?

A) $(2 - k, 4)$

B) $(2 + k, 4)$

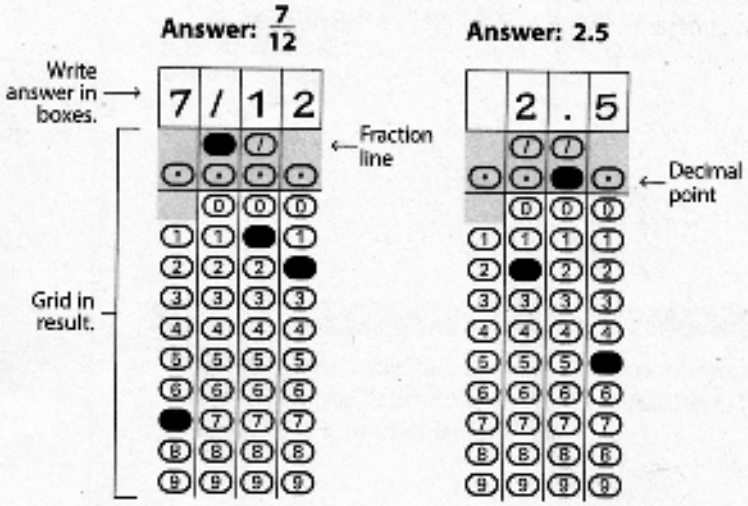
C) $(2, 4 - k)$

D) $(2, 4 + k)$

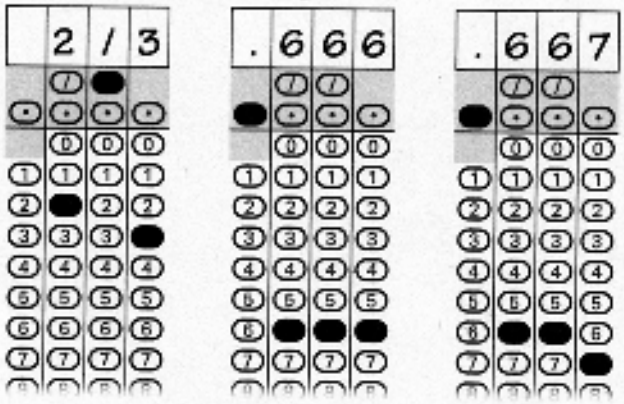
DIRECTIONS

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

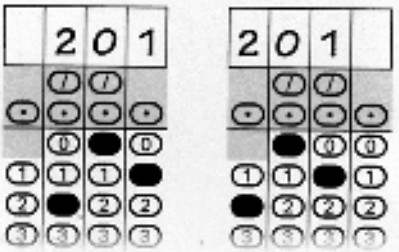
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
2. Mark no more than one bubble in any column.
3. No question has a negative answer.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



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



Answer: 201 – either position is correct



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

CONTINUE

28

If $3x + 2 = 8$, what is the value of $9x + 6$?

29

The function h is defined by $h(x) = (4 - x)(3 + x)$.
What is the value of $h(3)$?

CONTINUE

Questions 30 and 31 refer to the following information.

Votes Cast in Two Elections

Year	Votes for Candidate X	Votes for Candidate Y
2010		11,900
2014	6400	9600

The incomplete table above shows the numbers of all votes cast in two consecutive elections for the mayor of a city. The same two candidates were the only people for whom votes were cast in each election.

30

If a vote cast for one of the two candidates in the 2014 election is selected at random, what is the probability that the selected vote was cast for Candidate X?

31

If 70% of the votes cast in the 2010 election were cast for Candidate Y, how many votes were cast for Candidate X in this election?

STOP

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

Do not turn to any other section.

Answer Key

Wednesday, Oct. 10, Test Form

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

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

Math Test – No Calculator	
SECTION 3	
1	D
2	B
3	C
4	B
5	C
6	A
7	C
8	A
9	A
10	D
11	B
12	D
13	D
14	8, 9
15	144
16	13/5, 2.6
17	10/3, 15/4, 25/6, 3.33, 3.75, 4.16, 4.17

Math Test – Calculator	
SECTION 4	
1	C
2	D
3	B
4	A
5	A
6	B
7	D
8	C
9	A
10	C
11	D
12	A
13	C
14	D
15	D
16	A
17	D
18	B
19	D
20	B
21	C
22	D
23	B
24	C
25	C
26	A
27	B
28	3
29	6
30	480
31	285

NOTE: For schools participating in the test administration study or research group in fall 2018, correct answers will not be provided. Correct answers will also not be provided for the Saturday, Oct. 13, test form.

Wednesday, Oct. 24, Test Form

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

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

Math Test – No Calculator	
SECTION 3	
1	A
2	A
3	B
4	B
5	C
6	B
7	C
8	D
9	B
10	D
11	A
12	D
13	C
14	5
15	1/3, .333
16	16
17	5/2, 2.5

Math Test – Calculator	
SECTION 4	
1	A
2	A
3	D
4	A
5	C
6	B
7	C
8	B
9	C
10	C
11	B
12	D
13	A
14	C
15	A
16	C
17	B
18	D
19	C
20	A
21	B
22	D
23	B
24	A
25	C
26	D
27	D
28	24
29	6
30	2/5, .4
31	5100

NOTE: For more detailed information about scores, visit **psat.org/resources**.

Score Conversion

Score conversions show how raw scores are converted into test scores, cross-test scores, and subscores.

IMPORTANT TO NOTE

- The section score for the Evidence-Based Reading and Writing section is calculated by adding the Reading Test score to the Writing and Language Test score and multiplying that figure by 10.
- The section score for the Math section is calculated by multiplying the Math Test score by 20.
- There is no advantage or disadvantage in taking any particular test form.
- On every test, certain scores are not available, and are referred to as "score gaps." Score gaps emerge as a result of a statistical process called *equating* in which the number of questions answered correctly and the difficulty of the questions are both considered when scoring across the different tests taken nationwide. Although the College Board works to develop tests with the same level of difficulty, the questions in them differ and therefore some can be slightly easier or harder than others. This can influence the placement of the score gaps throughout the scaled score range. With equating, test scores are equivalent and valid, regardless of when students tested or the level of difficulty of the test they took.

NOTE: Score conversions will not be available for the Saturday, October 13 test form or for schools participating in the test administration study or research group.

Wednesday, Oct. 10 Test Form

Raw Score (# of correct answers)	Reading Test Score	Writing and Language Test Score	Math Test Score
48			38
47	38		37.5
46	37		37
45	37		36.5
44	36	38	36
43	36	38	35
42	35	37	34
41	34	36	33
40	34	36	32
39	33	35	31.5
38	32	34	31
37	32	33	30.5
36	31	33	30
35	30	32	29.5
34	30	31	29
33	29	31	28.5
32	29	30	28
31	28	30	27.5
30	27	29	27
29	27	29	26.5
28	26	28	26
27	26	27	25.5
26	25	27	25
25	25	26	24.5
24	25	26	24
23	24	25	24
22	23	24	23.5
21	23	24	23
20	22	23	22.5
19	22	22	22
18	21	21	21.5
17	20	21	21
16	20	20	20.5
15	19	19	20
14	19	18	19.5
13	18	18	19
12	18	17	18.5
11	17	16	18
10	17	16	17
9	16	15	16.5
8	16	14	15.5
7	15	14	14.5
6	14	13	14
5	13	13	13
4	12	12	12
3	11	11	11
2	10	10	10
1	9	9	9
0	8	8	8

Wednesday, Oct. 24 Test Form

Raw Score (# of correct answers)	Reading Test Score	Writing and Language Test Score	Math Test Score
48			38
47	38		35.5
46	36		33.5
45	35		32
44	35	38	31
43	34	36	30.5
42	33	35	29.5
41	32	34	29
40	31	33	28.5
39	30	32	28
38	30	31	27.5
37	29	31	27
36	28	30	26.5
35	28	29	26.5
34	27	29	26
33	26	28	25.5
32	26	28	25
31	25	27	24.5
30	25	26	24
29	25	26	24
28	24	25	23.5
27	24	24	23
26	23	24	22.5
25	22	23	22.5
24	22	22	22
23	21	22	21.5
22	21	21	21.5
21	20	20	21
20	20	20	20.5
19	20	19	20
18	19	19	19.5
17	19	18	19
16	18	18	19
15	18	17	18.5
14	17	17	18
13	17	16	17.5
12	17	16	17
11	16	15	16.5
10	16	15	16
9	15	14	15
8	15	14	14.5
7	14	13	13.5
6	13	13	12.5
5	12	12	12
4	11	11	11
3	10	10	10.5
2	9	10	9.5
1	9	9	8.5
0	8	8	8

Percentiles

A student's percentile rank represents the percentage of students who score equal to or lower than their score. For example, if a student's score is in the 75th percentile, 75% of a comparison group achieved scores at or below that student's score. Two types of percentile ranks, comparing student scores to two different reference populations, are provided in this publication for both total and section scores.

Nationally representative percentiles are derived from a research study of U.S. students in the 10th or 11th grade and are weighted to represent all U.S. students in those grades, regardless of whether they typically take the PSAT/NMSQT or the PSAT 10.

User group percentiles are based on the actual scores of students who took the PSAT/NMSQT and the PSAT 10 in the past three school years.

Percentiles for Total Scores

	10TH GRADE		11TH GRADE	
	PERCENTILES		PERCENTILES	
Total Score	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User
1520	99+	99+	99+	99+
1510	99+	99+	99+	99+
1500	99+	99+	99+	99+
1490	99+	99+	99+	99+
1480	99+	99+	99+	99
1470	99+	99+	99+	99
1460	99+	99+	99+	99
1450	99+	99+	99+	98
1440	99+	99+	99+	98
1430	99+	99	99+	98
1420	99	99	99	97
1410	99	99	99	97
1400	99	99	99	97
1390	99	99	99	96
1380	99	99	99	96
1370	99	99	99	95
1360	99	98	98	95
1350	98	98	98	94
1340	98	98	98	94
1330	98	98	97	93
1320	98	98	97	93
1310	97	97	97	92
1300	97	97	96	91
1290	97	97	96	91
1280	97	96	95	90
1270	96	96	95	89
1260	96	95	94	88
1250	95	95	94	87
1240	95	94	93	86
1230	94	94	92	85
1220	94	93	92	84
1210	93	93	91	83
1200	92	92	90	82
1190	91	91	89	81
1180	91	90	88	79
1170	90	89	87	78
1160	89	88	86	77
1150	88	87	85	75
1140	87	86	84	74
1130	86	85	83	72
1120	84	84	82	70
1110	83	83	81	69

Percentiles for Total Scores (continued)

	10TH GRADE		11TH GRADE	
	PERCENTILES		PERCENTILES	
Total Score	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User
1100	82	81	79	67
1090	81	80	77	65
1080	79	78	76	63
1070	78	77	74	62
1060	76	76	73	60
1050	75	74	70	58
1040	73	72	68	56
1030	71	71	65	54
1020	69	69	63	52
1010	67	67	61	51
1000	65	66	59	49
990	63	64	57	47
980	62	62	55	45
970	60	60	53	43
960	58	58	51	41
950	56	56	48	40
940	54	54	46	38
930	52	53	44	36
920	50	51	42	34
910	48	49	39	32
900	46	47	37	31
890	44	45	35	29
880	42	43	33	27
870	40	41	31	26
860	38	38	29	24
850	36	36	28	23
840	33	34	26	21
830	31	32	24	20
820	28	30	21	18
810	26	28	20	17
800	24	26	18	15
790	22	24	15	14
780	19	22	14	12
770	17	20	12	11
760	15	18	10	10
750	13	16	8	9
740	11	14	8	8
730	9	12	7	7
720	8	10	5	6
710	6	9	3	5
700	5	7	2	4
690	4	6	2	3

	10TH GRADE		11TH GRADE	
	PERCENTILES		PERCENTILES	
Total Score	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User
680	3	5	1	3
670	2	4	1	2
660	2	4	1-	2
650	1	3	1-	2
640	1	2	1-	1
630	1	2	1-	1
620	1	2	1-	1
610	1-	1	1-	1
600	1-	1	1-	1
590	1-	1	1-	1
580	1-	1	1-	1-
570	1-	1	1-	1-
560	1-	1	1-	1-
550	1-	1	1-	1-
540	1-	1-	1-	1-
530	1-	1-	1-	1-
520	1-	1-	1-	1-
510	1-	1-	1-	1-
500	1-	1-	1-	1-
490	1-	1-	1-	1-
480	1-	1-	1-	1-
470	1-	1-	1-	1-
460	1-	1-	1-	1-
450	1-	1-	1-	1-
440	1-	1-	1-	1-
430	1-	1-	1-	1-
420	1-	1-	1-	1-
410	1-	1-	1-	1-
400	1-	1-	1-	1-
390	1-	1-	1-	1-
380	1-	1-	1-	1-
370	1-	1-	1-	1-
360	1-	1-	1-	1-
350	1-	1-	1-	1-
340	1-	1-	1-	1-
330	1-	1-	1-	1-
320	1-	1-	1-	1-
Mean Score	939	934	969	1014
Standard Deviation	170	180	168	197

Percentiles for Section Scores

	10TH GRADE				11TH GRADE			
	Evidence-Based Reading and Writing		Math		Evidence-Based Reading and Writing		Math	
	PERCENTILES		PERCENTILES		PERCENTILES		PERCENTILES	
Section Score	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User
760	99+	99+	99+	99+	99+	99+	99+	99+
750	99+	99+	99+	99+	99+	99+	99+	99
740	99+	99+	99+	99	99+	99	99+	98
730	99+	99+	99	99	99+	99	99	97
720	99+	99+	99	99	99+	98	99	96
710	99	99	99	99	99+	97	98	96
700	99	99	99	98	99+	96	98	95
690	99	98	98	98	99	95	97	94
680	98	98	98	98	99	94	97	93
670	98	97	97	97	98	93	96	93
660	97	97	97	97	97	91	95	92
650	97	96	96	97	96	89	95	91
640	96	95	96	96	95	88	94	90
630	95	94	95	95	93	86	93	89
620	93	92	95	95	91	84	92	87
610	92	91	94	94	90	81	91	85
600	90	89	92	92	88	79	90	83
590	89	87	91	91	86	76	88	81
580	87	85	89	89	85	73	86	78
570	85	83	86	87	82	70	83	75
560	82	80	84	85	80	67	81	72
550	79	78	82	82	77	63	77	69
540	76	75	79	80	74	60	73	65
530	73	72	76	77	71	56	69	62
520	70	68	72	74	67	53	65	58
510	66	65	69	71	63	49	62	55
500	63	62	66	68	60	46	58	52
490	59	59	62	64	55	43	54	48
480	56	55	57	60	50	39	49	44
470	53	52	52	56	46	36	43	40
460	49	49	49	52	42	33	40	36
450	46	45	46	48	39	31	37	33

Percentiles for Section Scores (continued)

	10TH GRADE				11TH GRADE			
	Evidence-Based Reading and Writing		Math		Evidence-Based Reading and Writing		Math	
	PERCENTILES		PERCENTILES		PERCENTILES		PERCENTILES	
Section Score	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User	Nationally Representative Sample	PSAT/NMSQT and PSAT 10 User
440	43	42	40	43	35	28	31	29
430	39	39	36	39	31	25	26	26
420	36	35	31	35	28	22	23	23
410	32	32	26	30	26	20	20	19
400	28	28	23	26	23	17	18	16
390	24	25	19	21	20	15	14	13
380	21	21	15	17	16	12	11	10
370	17	17	12	14	12	10	9	9
360	13	14	10	11	10	8	6	7
350	10	11	7	8	7	6	3	5
340	7	8	5	6	6	5	2	4
330	5	6	3	5	4	3	1	3
320	3	4	2	4	2	2	1	2
310	2	3	2	3	1	2	1-	2
300	1	2	1	2	1-	1	1-	1
290	1-	1	1	2	1-	1	1-	1
280	1-	1	1-	1	1-	1	1-	1
270	1-	1	1-	1	1-	1-	1-	1
260	1-	1	1-	1	1-	1-	1-	1-
250	1-	1-	1-	1	1-	1-	1-	1-
240	1-	1-	1-	1	1-	1-	1-	1-
230	1-	1-	1-	1-	1-	1-	1-	1-
220	1-	1-	1-	1-	1-	1-	1-	1-
210	1-	1-	1-	1-	1-	1-	1-	1-
200	1-	1-	1-	1-	1-	1-	1-	1-
190	1-	1-	1-	1-	1-	1-	1-	1-
180	1-	1-	1-	1-	1-	1-	1-	1-
170	1-	1-	1-	1-	1-	1-	1-	1-
160	1-	1-	1-	1-	1-	1-	1-	1-
Mean Score	468	470	470	464	480	511	489	503
Standard Deviation	94	99	88	93	92	105	88	103

NMSC Selection Index

The National Merit® Scholarship Program is an annual academic competition among high school students for recognition and college scholarships. The program is conducted by National Merit Scholarship Corporation (NMSC), a not-for-profit organization that operates without government assistance.

The NMSC Selection Index

Reported on a scale ranging from 48 to 228, the Selection Index score is calculated by doubling the sum of the Reading, Writing and Language, and Math Test scores. For example, a Reading score of 23, a Writing and Language score of 20, and a Math score of 26.5 would result in a Selection Index score of 139 [2(23+20+26.5)].

How NMSC Uses the Selection Index

NMSC uses the Selection Index score to designate groups of students to receive recognition in the National Merit Scholarship Program. Entry to NMSC's competition for scholarships to be offered in 2020 is determined by students' responses to program entry questions on the 2018 PSAT/NMSQT answer sheet. Both the printed PSAT/NMSQT student score report and the online report show the student's Selection Index, the student's responses to entry items, and whether the student meets participation requirements. Currently, about 1.6 million test takers meet requirements to enter NMSC's competition each year. Almost all entrants are in their third year (grade 11, junior year) of high school.

Of the 1.6 million NMSC program entrants, about 50,000 will earn 2018 PSAT/NMSQT scores high enough to qualify them for recognition. These students will be notified of their standing through their high schools in September 2019. Students who qualify to continue in the competition for scholarships to be offered in 2020 must then meet academic and other requirements specified by NMSC to be considered for awards.

A detailed description of the National Merit Scholarship Program is published in the *Guide to the National Merit Scholarship Program*, mailed to high school principals each fall. For students and parents, information about the competition is given in the *PSAT/NMSQT Student Guide* and at **www.nationalmerit.org**.

For inquiries about any aspect of the National Merit Program—including entry requirements, the selection process, and awards to be offered—contact NMSC directly:

www.nationalmerit.org
847-866-5100
National Merit Scholarship Corporation
1560 Sherman Avenue, Suite 200
Evanston, IL 60201-4897