

# PSAT/NSMQT

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## October 12, 2022

## US Administration

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# 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 adapted from Edith Wharton, "Writing a War Story." Originally published in 1919.

She, Ivy Spang, of Cornwall-on-Hudson, had been asked to write a war story for the opening number of "The Man-at-Arms," to which Queens and  
 Line 5 Archbishops and Field Marshals were to contribute poetry and photographs and patriotic sentiment in autograph! And her full-length photograph in nurse's dress was to precede her prose; and in the table of contents she was to figure as "Ivy Spang, author of  
 10 *Vibrations: A Book of Verse.*" She was dizzy with triumph, and went off to hide her exultation in a quiet corner of Brittany, where she happened to have an old governess, who took her in and promised to defend at all costs the sacredness of her mornings—for Ivy knew that the morning hours of  
 15 great authors were always "sacred." She shut herself up in her room with a ream of mauve paper, and began to think. At first the process was less exhilarating than she had expected. She knew so much about the war that  
 20 she hardly knew where to begin; she found herself suffering from a plethora of impressions. Moreover, the more she thought of the matter, the less she seemed to understand how a war story—or any story, for that matter—was written. Why did stories  
 25 ever begin, and why did they ever leave off? Life didn't—it just went on and on. This unforeseen problem troubled her exceedingly, and on the second morning she stealthily broke from her seclusion and slipped out for a walk on the beach.

30 She had been ashamed to make known her projected escapade, and went alone, leaving her faithful governess to mount guard on her threshold while she sneaked out by a back way.

There were plenty of people on the beach, and  
 35 among them some whom she knew; but she dared not join them lest they should frighten away her "Inspiration." She knew that "Inspirations" were fussy and contrarious, and she felt rather as if she were dragging along a reluctant dog on a string.

40 "If you wanted to stay indoors, why didn't you say so?" she grumbled to it. But the Inspiration continued to sulk.

She wandered about under the cliff till she came to an empty bench, where she sat down and gazed at the  
 45 sea. After a while her eyes were dazzled by the light, and she turned them toward the bench and saw lying on it a battered magazine—the midsummer "All-Story" number of "Fact and Fiction." Ivy pounced upon it.

50 She had heard a good deal about not allowing one's self to be "influenced," about jealously guarding one's originality, and so forth. But her story had to be written, and she didn't know how to begin it; so she decided just to glance casually at a few beginnings.

55 The first tale in the magazine was signed by a name great in fiction, one of the most famous names of the past generation of novelists. The opening sentence ran: "In the month of October, 1914—" and Ivy turned the page impatiently. She may not have known much  
 60 about story-writing, but she did know that that kind of a beginning was played out. She turned to the next.

"My God!" roared the engineer, tightening his grasp

on the lever, while the white, sneering face under the red lamp . . .”

65 No; that was beginning to be out of date, too.

“They sat there and stared at it in silence. Neither spoke; but the woman’s heart ticked like a watch.”

70 That was better; but best of all she liked: “Lee Lorimer leaned to him across the flowers. She had always known that this was coming . . .” Ivy could imagine tying a story on to that.

But she had promised to write a war story; and in a war story the flowers must be at the end and not at the beginning.

75 At any rate, there was one clear conclusion to be drawn from the successive study of all these opening paragraphs; and that was that you must begin in the middle, and take for granted that your reader knew what you were talking about.

80 Yes; but where was the middle, and how could your reader know what you were talking about when you didn’t know yourself?

85 After some reflection, and more furtive scrutiny of “Fact and Fiction,” the puzzled authoress decided that perhaps, if you pretended hard enough that you knew what your story was about, you might end by finding out toward the last page. “After all, if the reader can pretend, the author ought to be able to,” she reflected. And she decided (after a cautious glance over her 90 shoulder) to steal the magazine and take it home with her for private dissection.

1

As used in line 8 “figure” most nearly means

- A) appear.
- B) form.
- C) reason.
- D) calculate.

2

The passage indicates that when Ivy begins to work on the story she feels

- A) overwhelmed, because she finds it difficult to organize her ideas.
- B) discouraged, because her deadline for completing the story is approaching.
- C) excited, because her work will be featured with that of royalty.
- D) inspired, because she is able to spend time by the ocean.

3

It can reasonably be inferred from the passage that one realization Ivy comes to about stories is that

- A) the best ones are typically written in a few days.
- B) there is a skill to writing them that she is incapable of learning.
- C) there is an artificiality to them that she had not anticipated.
- D) they must address issues relevant to a particular historical time.

4

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

- A) line 22-24 (“Moreover . . . written”)
- B) line 24-26 (“Why did . . . and on”)
- C) line 55-57 (“The first . . . novelists”)
- D) line 89-91 (“And she . . . dissection”)

5

In the context of the passage, the sentence in line 37-39 (“She knew . . . string”) mainly serves to emphasize Ivy’s

- A) frustrations with the crafting of her story.
- B) dilemma about accepting her assignment.
- C) obstacles in writing for a popular audience.
- D) distress about her lack of literary fame.

6

The use of “pounced” in line 48-49 has the main effect of suggesting Ivy’s

- A) deceptiveness.
- B) eagerness.
- C) physical agility.
- D) crude manners.

7

Ivy criticizes the opening sentences of the first two stories in the magazine because they

- A) are overly dramatic and sentimental.
- B) represent the work of inexperienced writers.
- C) lack specific details.
- D) are unoriginal and old-fashioned.

8

The passage most strongly suggests that Ivy reaches which conclusion about the writing of fiction?

- A) It might involve a level of uncertainty that she had failed to consider previously.
- B) It can be facilitated by imitating the language of successful authors whom she admires.
- C) It is a creative undertaking that must reflect the beauty of nature.
- D) It is a secretive process that can be communicated to only a select few.

9

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

- A) line 40-42 (“If you . . . sulk”)
- B) line 52-54 (“But her . . . beginnings”)
- C) line 80-82 (“Yes . . . yourself”)
- D) line 83-87 (“After . . . page”)

**Questions 10-18 are based on the following passages.**

Passage 1 is adapted from Erica Whyman, "Should the Arts Get Public Money? Yes." ©2011 by BBC. Passage 2 is adapted from David John Marotta, "Public Funding for the Arts." ©2012 by Forbes Media LLC.

**Passage 1**

I am convinced that the arts are a significant public good, that civic well-being is damaged when the arts are unsupported [by public funding] and, while they make an important economic contribution, their profitability is not a sufficient measure of their quality or their success.

I am increasingly uncomfortable with the economic argument, because it suggests that only activities which generate economic growth are deserving of public investment. Caring for the elderly, for instance, would fail this test.

However, it is worth repeating that public money spent on the arts has a proven tendency to turn into money spent elsewhere: on hotel rooms, restaurants, production supplies and, most importantly, jobs.

In Newcastle and Gateshead, every £1 of public investment in the 10 main cultural buildings results in £5 generated by the regional economy, according to the Treasury's own calculations, not least because between us we employ over 2000 people. . . .

Not everyone in this country grows up thinking the arts are for them. Artists and educators are and should be obliged to create opportunities for people from all backgrounds to encounter the very best artistic experiences.

When we do this well, the results are staggering—individual confidence soars and life chances are radically improved.

One example: last year we made a show called Apples, an exhilarating account of growing up in Middlesbrough. . . .

I'd like opponents of arts funding to ask themselves what it might feel like to be 15 in Middlesbrough and to find out there is a play on, in your home town, and it's about you.

The play toured all over the country and went on to win an award in Edinburgh. If our audience had had to pay all the costs of making the show (the modest £400 a week we pay our highly skilled actors, for instance) we would have had to charge £35 a ticket.

Could those young people have come at that price? The market says no. Should they make a contribution, appropriate to their income? I think so, yes.

So for around the price of a cinema ticket, they saw themselves represented on stage and were provoked, entertained and moved. They may even have been turned on to the theatre. They certainly felt less invisible, more significant, better understood.

The arts have always been able to make a society not just "Big" but cohesive, intelligent and better equipped to speak its mind. It is dangerous, ignorant and churlish to endanger them.

**Passage 2**

Emotionally the choice is presented as saving the arts or cutting them. However the arts are not in question. The issue is government funding of the arts. Should we take money from the most productive forces in the economy to subsidize certain artists chosen by committee?

Supporters claim that subsidizing the arts pays for itself. They suggest that the arts drive the economics of businesses within a community.

There are two problems with this idea. First, if the art is commercial, it is already being funded. And if the art is justified by supporting other businesses, it is also being funded. To the extent a coffee shop can increase its traffic via art exhibits, musical offerings or poetry readings, it is already encouraging artists to perform.

Second is the unseen cost of taking money from the economy that could be used for other purposes. Because of our progressive tax code, the marginal burden of subsidizing art falls largely on the highest tax brackets populated by small business owners and entrepreneurs. This group is the most productive at putting money to work. . . .

We often hear an anecdote about a brilliant artist recognized by the arts community who isn't yet successful commercially. This situation is perceived as tragic, demanding action like providing the artist with a government subsidy. But there [is a] difficult[y] with this point of view.

. . . [T]here is no guarantee that government funding would offer faster recognition than crowd sourcing. Production and distribution costs for art have dropped to a fraction of what they used to be. Without this barrier to competition, more people are willing to share their art for little more than the joy of being recognized. What is lacking is no longer a funding issue but rather sufficient demand for all the art being produced. . . .

90 On what basis can we say an artist should get paid more than society is actually willing to pay? . . . And what measure of the value of art to society do we have except the value society is willing to pay for it?

10

As used in line 26, “staggering” most nearly means

- A) confusing.
- B) astonishing.
- C) distressing.
- D) unpredictable.

11

Based on Passage 1, Whyman would probably agree that when making decisions about funding artistic projects, public officials should prioritize projects that

- A) are likely to increase patronage of local businesses.
- B) impart an uplifting message.
- C) are likely to resonate with audiences.
- D) are relatively inexpensive to execute.

12

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

- A) line 1-6 (“I am . . . success”)
- B) line 16-20 (“In Newcastle . . . people”)
- C) line 36-40 (“The play . . . ticket”)
- D) line 44-47 (“So for . . . theatre”)

13

As used in line 60, “drive” most nearly means

- A) pressure.
- B) operate.
- C) hasten.
- D) stimulate.

14

The author of Passage 2 includes the anecdote in line 75-79 (“We often . . . subsidy”) mainly for the purpose of

- A) emphasizing that a particular problem discussed in the passage is unlikely to be resolved.
- B) presenting a line of thinking that is ultimately debunked in the passage.
- C) conceding that subsidies for artists may be justified in certain circumstances.
- D) suggesting that the struggles faced by artists have been exaggerated.

15

Which choice best describes the relationship between the passages?

- A) Passage 2 provides context for an argument put forth in Passage 1.
- B) Passage 2 refutes the primary claim made in Passage 1.
- C) Passage 2 challenges the cultural relevance of the discussion in Passage 1.
- D) Passage 2 questions the motives of the author of Passage 1.

16

Based on the passages, the author of Passage 1 would most likely disagree with which assumption made by the author of Passage 2?

- A) Some artists are recognized as talented before they succeed financially.
- B) Art can serve to increase a nation's economic activity in general.
- C) The market value of art indicates art's value to society.
- D) Crowdsourcing can be an effective way for artists to gain recognition.

17

It can most reasonably be inferred from the passages that the author of Passage 2 would likely object to the claim made in line 12-15, Passage 1 (“However . . . jobs”), on the grounds that

- A) since market forces determine which businesses thrive, it is unrealistic to assume that the arts influence the success of businesses.
- B) since fewer and fewer people are interested in the arts, the arts are unlikely to produce income for businesses even with government aid.
- C) although the arts currently generate revenue, they may not necessarily generate revenue in the future as they lessen in importance.
- D) if the arts benefit businesses, then businesses will support the arts without the need for government subsidies.

18

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

- A) line 59-61 (“Supporters . . . community”)
- B) line 62-63 (“First . . . also being funded”)
- C) line 68-69 (“Second . . . purposes”)
- D) line 83-84 (“Production . . . to be”)



**Questions 19-27 are based on the following passage and supplementary material.**

This passage is adapted from David L. Chandler, “System Draws Power from Daily Temperature Swings.” ©2018 by the Massachusetts Institute of Technology.

Thermoelectric devices, which can generate power when one side of the device is a different temperature from the other, have been the subject of much research in recent years. Now, a team at MIT has come up with a novel way to convert temperature fluctuations into electrical power. Instead of requiring two different temperature inputs at the same time, the new system takes advantage of the swings in ambient temperature that occur during the day-night cycle.

The new system, called a thermal resonator, could enable continuous, years-long operation of remote sensing systems, for example, without requiring other power sources or batteries, the researchers say.

The findings are being reported by Anton Cottrill, Michael Strano, and seven others in MIT’s Department of Chemical Engineering.

“We basically invented this concept out of whole cloth,” Strano says. “We’ve built the first thermal resonator. It’s something that can sit on a desk and generate energy out of what seems like nothing. We are surrounded by temperature fluctuations of all different frequencies all of the time. These are an untapped source of energy.”

While the power levels generated by the new system so far are modest, the advantage of the thermal resonator is that it does not need direct sunlight; it generates energy from ambient temperature changes, even in the shade. That means it is unaffected by short-term changes in cloud cover, wind conditions, or other environmental conditions, and can be located anywhere that’s convenient—even underneath a solar panel, in perpetual shadow, where it could even allow the solar panel to be more efficient by drawing away waste heat, the researchers say.

The researchers realized that to produce power from temperature cycles, they needed a material that is optimized for a little-recognized characteristic called thermal effusivity—a property that describes how readily the material can draw heat from its surroundings or release it. Thermal effusivity combines the properties of thermal conduction (how rapidly heat can propagate through a material) and thermal capacity (how much heat can be stored in a given volume of material). In most materials, if one of these

properties is high, the other tends to be low. Ceramics, for example, have high thermal capacity but low conduction.

To get around this, the team created a carefully tailored combination of materials. The basic structure is a metal foam, made of copper or nickel, which is then coated with a layer of graphene to provide even greater thermal conductivity. Then, the foam is infused with a kind of wax called octadecane, a phase-change material, which changes between solid and liquid within a particular range of temperatures chosen for a given application.

A sample of the material made to test the concept showed that, simply in response to a 10-degree-Celsius temperature difference between night and day, the tiny sample of material produced 350 millivolts of potential and 1.3 milliwatts of power—enough to power simple, small environmental sensors or communications systems.

“The phase-change material stores the heat,” says Cottrill, the study’s lead author, “and the graphene gives you very fast conduction” when it comes time to use that heat to produce an electric current.

Essentially, Strano explains, one side of the device captures heat, which then slowly radiates through to the other side. One side always lags behind the other as the system tries to reach equilibrium. This perpetual difference between the two sides can then be harvested through conventional thermoelectrics. The combination of the three materials—metal foam, graphene, and octadecane—makes it “the highest thermal effusivity material in the literature to date,” Strano says.

Figure 1

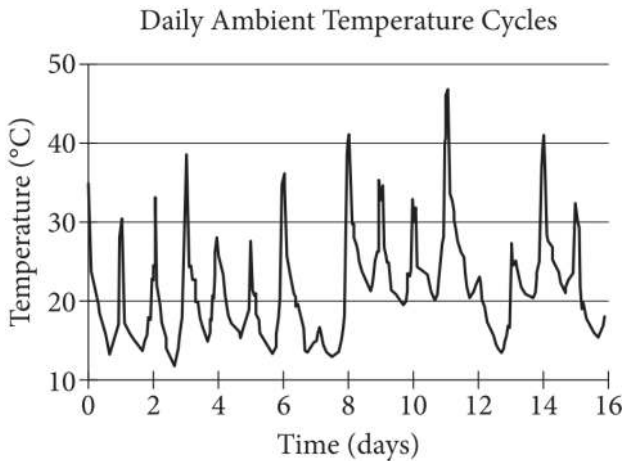
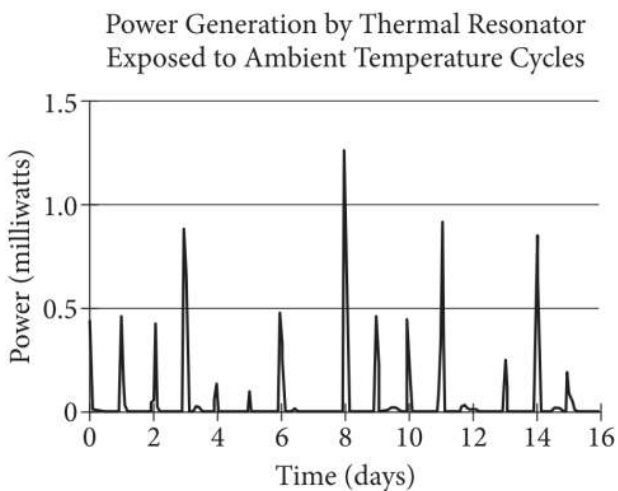


Figure 2



Figures adapted from Anton L. Cottrill et al., “Ultra-High Thermal Effusivity Materials for Resonant Ambient Thermal Energy Harvesting.” ©2018 by Anton L. Cottrill et al.

19

The main purpose of the passage is to

- A) highlight the potential drawbacks of a recent invention.
- B) underscore the urgency for research in a specific field.
- C) provide an overview of a well-known process.
- D) discuss the significance of a new finding.

20

Which choice best supports the idea that, in addition to generating power, thermal resonators can have indirect benefits?

- A) line 4-6 (“Now . . . power”)
- B) line 17-20 (“We basically . . . nothing”)
- C) line 28-34 (“That . . . say”)
- D) line 35-40 (“The researchers . . . release it”)

21

According to the passage, with regard to thermal effusivity, materials are generally

- A) more effective at conducting heat than they are at storing heat.
- B) more effective at storing heat than they are at conducting heat.
- C) equally effective at storing and conducting heat.
- D) unable to effectively store and conduct heat simultaneously.

22

As used in line 49, “tailored” most nearly means

- A) reconciled.
- B) constructed.
- C) converted.
- D) altered.

23

The main rhetorical effect of the use of “simply” (line 58) and “tiny” (line 60) is primarily to

- A) convey the remarkable productivity of the material in the thermal resonator that Cottrill’s team developed.
- B) demonstrate a challenge that Cottrill’s team faced in building the thermal resonator.
- C) emphasize the controversial nature of one of Cottrill’s team’s findings.
- D) underscore the inevitability of an unwanted result in Cottrill’s team’s research.

24

Based on the passage, which choice best describes one aspect of the relationship between the two sides of the thermal resonator?

- A) One side must be exposed to a higher temperature than the other side.
- B) One side communicates the environmental conditions to the other side.
- C) One side stores and conducts heat, and the other side uses the heat to generate energy.
- D) One side must always be cooler in temperature than the other side.

25

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

- A) line 52-56 (“Then . . . application”)
- B) line 64-67 (“The phase-change . . . current”)
- C) line 68-71 (“Essentially . . . equilibrium”)
- D) line 73-77 (“The combination . . . says”)

26

According to figure 1, what was the highest ambient temperature on day 2?

- A) Approximately 10°C
- B) Approximately 20°C
- C) Approximately 35°C
- D) Approximately 45°C

27

Based on both figures, approximately how large was the peak power generated by the thermal resonator on the three days with the highest ambient temperatures?

- A) 0–0.25 milliwatts
- B) 0.25–0.75 milliwatts
- C) 0.75–1.25 milliwatts
- D) 1.25–1.5 milliwatts

**Questions 28-37 are based on the following passage and supplementary material.**

This passage is adapted from Daniel H. Pink, *Drive: The Surprising Truth about What Motivates Us*. ©2009 by Daniel H. Pink.

Line Three researchers, psychologists Mark Lepper,  
David Greene, and Richard Nisbett, watched a  
classroom of preschoolers for several days and  
5 identified the children who chose to spend their “free  
play” time drawing. Then they fashioned an experiment  
to test the effect of rewarding an activity these children  
clearly enjoyed.

The researchers divided the children into three  
groups. The first was the “expected-award” group. They  
10 showed each of these children a “Good Player”  
certificate—adorned with a blue ribbon and featuring  
the child’s name—and asked if the child wanted to  
draw in order to receive the award. The second group  
was the “unexpected-award” group. Researchers asked  
15 these children simply if they wanted to draw. If they  
decided to, when the session ended, the researchers  
handed each child one of the “Good Player” certificates.  
The third group was the “no-award” group. Researchers  
asked these children if they wanted to draw, but neither  
20 promised them a certificate at the beginning nor gave  
them one at the end.

Two weeks later, back in the classroom, teachers set  
out paper and markers during the preschool’s free play  
period while the researchers secretly observed the  
25 students. Children previously in the “unexpected-  
award” and “no-award” groups drew just as much, and  
with the same relish, as they had before the experiment.  
But children in the first group—the ones who’d  
expected and then received an award—showed much  
30 less interest and spent much less time drawing. Even  
two weeks later, those alluring prizes—so common in  
classrooms and cubicles—had turned play into work.

To be clear, it wasn’t necessarily the rewards  
themselves that dampened the children’s interest.  
35 Remember: When children didn’t expect a reward,  
receiving one had little impact on their intrinsic  
motivation. Only contingent rewards—if you do this,  
then you’ll get that—had the negative effect. Why? “If-  
then” rewards require people to forfeit some of their  
40 autonomy. They’re no longer fully controlling their  
lives. And that can spring a hole in the bottom of their  
motivational bucket, draining an activity of its  
enjoyment.

Lepper and Greene replicated these results in  
45 several subsequent experiments with children. As time  
went on, other researchers found similar results with  
adults. Over and over again, they discovered that  
extrinsic rewards—in particular, contingent, expected,  
“if-then” rewards—snuffed out intrinsic drive.

50 These insights proved so controversial—after all,  
they called into question a standard practice of most  
companies and schools—that in 1999 Edward Deci  
and two colleagues reanalyzed nearly three decades of  
studies on the subject to confirm the findings. “Careful  
55 consideration of reward effects reported in 128  
experiments leads to the conclusion that tangible  
rewards tend to have a substantially negative effect on  
intrinsic motivation,” they determined. “When  
institutions—families, schools, businesses, and athletic  
60 teams, for example—focus on the short-term and opt  
for controlling people’s behavior,” they do  
considerable long-term damage.

Take an industrial designer who loves his work and  
try to get him to do better by making his pay  
65 contingent on a hit product—and he’ll almost certainly  
work like a maniac in the short term, but become less  
interested in his job in the long term. As one leading  
behavioral science textbook puts it, “People use  
rewards expecting to gain the benefit of increasing  
70 another person’s motivation and behavior, but in so  
doing, they often incur the unintentional and hidden  
cost of undermining that person’s intrinsic motivation  
toward the activity.”

**Effects of Expected Tangible Rewards on Free-Choice Behavior in Children as a Function of Time**

| <i>Timing</i> | <i>Number of experiments</i> | <i>Effect on intrinsic motivation</i> |
|---------------|------------------------------|---------------------------------------|
| Immediately   | 30                           | -0.40                                 |
| Within 1 week | 12                           | -0.49                                 |
| After 1 week  | 12                           | -0.53                                 |

Adapted from Edward L. Deci, Richard Koestner, and Richard M. Ryan, “A Meta-Analytic Review of Experiments Examining the Effects of Extrinsic Rewards on Intrinsic Motivation.” ©1999 by the American Psychological Association.

28

Which choice best describes the overall structure of the passage?

- A) The author introduces a study, advances an interpretation of the study's findings, and then summarizes follow-up studies that support that interpretation.
- B) The author identifies a behavior, discusses why that behavior is poorly understood, and then proposes an explanation for that behavior.
- C) The author describes a previous experiment on a topic, expresses doubt about the experiment's findings, and then presents a new experiment that provides greater insight into that topic.
- D) The author mentions a controversial theory, explains the origins of that controversy, and then offers research findings to defend a particular position on that theory.

29

It can reasonably be inferred from the passage that Lepper, Greene, and Nisbett's experiment was designed to ensure that all children who

- A) were part of the expected-award group were not distracted by the promise of an award while drawing.
- B) displayed comparable levels of enthusiasm for drawing would be grouped together.
- C) participated in the experiment were known to enjoy drawing.
- D) did not receive an award would maintain their motivation to draw.

30

As used in line 27, "relish" most nearly means

- A) diversion.
- B) flavor.
- C) pleasure.
- D) style.

31

Based on the passage, people are most likely to retain intrinsic motivation for an activity when they

- A) intermittently receive encouragement from others.
- B) independently determine their level of control.
- C) directly manage the variables that affect an outcome.
- D) routinely refuse to accept rewards for the quality of their work.

32

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

- A) line 28-32 (“But children . . . work”)
- B) line 33-34 (“To be . . . interest”)
- C) line 37-38 (“Only . . . effect”)
- D) line 38-41 (“If-then . . . lives”)

33

In line 41-43 (“And that . . . enjoyment”), the author’s description of a bucket primarily functions as

- A) an observation that summarizes the author’s main point.
- B) an illustration that reinforces the author’s argument.
- C) a transition from a discussion of a single study to one involving multiple studies.
- D) a qualification that challenges an aspect of the researchers’ findings.

34

An important implication of the research studies described in the passage is that they provide ample evidence that

- A) the forces influencing human motivation continue to baffle scientists.
- B) recent studies of schools and the workplace are more detailed than were older studies.
- C) the perceived value of an object can vary between subjects of the same study.
- D) widely accepted customs may be less beneficial than they were previously thought to be.

35

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

- A) line 47-49 (“Over . . . drive”)
- B) line 50-54 (“These . . . findings”)
- C) line 54-58 (“Careful . . . determined”)
- D) line 58-62 (“When . . . damage”)

36

Based on the table, which statement best describes how children reacted to expected tangible rewards during free-choice time?

- A) Children experienced an immediate decrease in intrinsic motivation followed by a further decrease in intrinsic motivation over time.
- B) Children experienced an immediate increase in intrinsic motivation followed by a decrease in intrinsic motivation over time.
- C) While children initially experienced a sharp decrease in intrinsic motivation, their intrinsic motivation eventually stabilized.
- D) Throughout the experiment, the children's intrinsic motivation remained unchanged.

37

A student in a social science class claims that the data in the table fully support the example provided in line 63-67 (“Take . . . term”). Is the student correct or incorrect, and why?

- A) Correct, because the table shows that the offer of an expected tangible reward decreases intrinsic motivation at the same rate as would an unexpected tangible reward, which is reflected in the example.
- B) Correct, because the example demonstrates that the offer of an expected tangible reward initially increases motivation, which is reflected in the table.
- C) Incorrect, because the table demonstrates that the offer of an expected tangible reward immediately decreases intrinsic motivation, which is not reflected in the example.
- D) Incorrect, because the example demonstrates the effect of an unexpected tangible reward, whereas the table demonstrates the effect of an expected tangible reward.



**Questions 38-47 are based on the following passage.**

This passage is adapted from George Musser, "Cometlike Objects Could Be Spreading Life from Star to Star throughout the Milky Way." ©2018 by American Association for the Advancement of Science.

When the U.S. football field–size, cigar-shaped object ‘Oumuamua entered our solar system last year, it didn’t just give us our first glimpse of an interstellar piece of rock. It also bolstered the plausibility of space rocks spreading life among the stars by ferrying microbes between distant star systems, according to a new study. “Life could potentially be exchanged over thousands of light-years,” says author Idan Ginsburg, a postdoc at the Harvard-Smithsonian Center for Astrophysics.

The idea, known as panspermia, has been around for centuries. Some astronomers have even speculated that life on Earth was seeded by microbes that hitched a ride on debris ejected from another life-harboring world in the solar system, perhaps on meteorites from Mars. But it seemed improbable that life could have come from interstellar space.

Take computer simulations in 2003 by planetary scientist H. Jay Melosh, now at Purdue University. The analysis revealed that about a third of the meteorites shot off Earth were eventually thrown out of the solar system by Jupiter or Saturn, but that the process took millions or tens of millions of years—a long stretch for even the toughest bugs or spores to be exposed to the vacuum and radiation of space. And vanishingly few rocks would ever be captured by some distant system, Melosh found.

The outlook improves if the receiving system is a binary star, which has a more complex gravitational field than the solar system. Yet any system that’s good at capturing is also good at ejecting, meaning refugees from another system are far more likely to be tossed back out in a game of interstellar hot potato than to settle on a hospitable world.

‘Oumuamua is providing fresh hope for the idea of galactic panspermia. For the telescopic survey that found it, the Panoramic Survey Telescope and Rapid Response System, to have detected such an object in the region it had scanned, our galaxy needs to have 1 trillion of them per cubic light-year, according to a study published earlier this year. To fill space like this, every star in the Milky Way would have to eject 10 quadrillion such objects, and a few should be passing through our solar system at any given moment.

In the new study, Ginsburg, along with astrophysicists Manasvi Lingam and Abraham Loeb, calculated the chances of such objects delivering life to an alien world. A star system such as Alpha Centauri would ensnare a few thousand rocks of ‘Oumuamua’s size every year, and our solar system might snag one a century, the team estimates.

The researchers then multiplied this capture rate by the number of stars an interstellar object will encounter before whatever bugs it carries all die. If the objects move, like ‘Oumuamua, at a velocity of 26 kilometers per second through interstellar space, 10 million of them will be captured somewhere in the Milky Way in a million years. “If you look at the galaxy as a whole, you expect this to happen fairly often,” Ginsburg says.

But astronomer Ed Turner of Princeton University says the authors may be reading too much into the single example of ‘Oumuamua. “There’s no rigorous mathematical argument you can write about one event evaluated a posteriori [from an observation],” he says.

And even if our galaxy is thick with ‘Oumuamuas, they are unlikely vectors of panspermia, Melosh says. ‘Oumuamua is way too big to have been ejected from an inhabited planet, he says.

Still, Loeb says more data could settle where galactic panspermia is plausible. Additional discoveries of interstellar interlopers would clarify their prevalence, and Loeb says the detection of life on other worlds would show whether it tends to cluster, as it would if it arose in one place and spread elsewhere.

38

The main purpose of the passage is to

- A) report the results of a study that casts doubt on the idea that a particular space rock originated outside the solar system.
- B) discuss research that may lend support to the idea that space rocks can carry microbes from one star system to another.
- C) describe recent experiments that tested opposing hypotheses about how space rocks are ejected from stars' gravitational fields.
- D) explain new technologies that can be used to determine how long microbes can survive on space rocks in interstellar space.

39

As used in line 5, "spreading" most nearly means

- A) distributing.
- B) opening.
- C) applying.
- D) lengthening.

40

Based on the passage, one challenge to the possibility that Ginsburg raises in the quotation in line 7-8 ("Life . . . light-years") has been that while evidence suggests that

- A) life can survive on objects in interstellar space, objects are so rarely ejected from star systems that this capability is likely of little practical consequence.
- B) some kinds of star systems appear to have conditions hospitable to life, those systems are likely to quickly eject most interstellar objects that they capture.
- C) objects originating on a life-bearing body can be ejected from a star system, this process takes so much time that any life on the objects is unlikely to survive.
- D) most star systems regularly capture objects traveling through interstellar space, these objects are much more likely to go into orbit around the star than to land on a planet.

41

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

- A) line 16-17 ("But . . . space")
- B) line 20-25 ("The analysis . . . space")
- C) line 25-27 ("And . . . found")
- D) line 30-34 ("Yet . . . world")

42

In the context of the passage, the quotation in line 58-59 (“If you . . . often”) mainly serves to

- A) provide an interpretation of the analysis Ginsburg and his team conducted.
- B) defend the methods that Ginsburg and his team used to reach their conclusions.
- C) highlight that Ginsburg and his team’s findings were consistent with their predictions.
- D) suggest a possible focus for new research that may build on Ginsburg and his team’s study.

43

In the passage, Turner cautions that the conclusions of Ginsburg’s team about ‘Oumuamua are

- A) dependent on assumptions that may not be true in general.
- B) contradicted by data collected by another team.
- C) limited by the technology that is currently available to observe space objects of this kind.
- D) based on characteristics that are not typical of space objects of this kind.

44

Based on the passage, there is reason to believe that a space object acting as a vehicle for panspermia would most likely

- A) have escaped from a system with a gravitational field that is less complex than that of the system from which ‘Oumuamua escaped, because debris rarely escapes complex gravitational fields.
- B) be similar in shape to ‘Oumuamua, because the researchers demonstrated that such space rocks are commonly captured by the Milky Way.
- C) be smaller than ‘Oumuamua, because planets that support life are unlikely to eject debris similar in size to ‘Oumuamua.
- D) travel at faster speeds than ‘Oumuamua, because ‘Oumuamua’s relatively slow speed minimizes its chances of arriving at a hospitable planet before any organisms it carries would die.

45

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

- A) line 28-30 (“The outlook . . . solar system”)
- B) line 54-58 (“If the . . . years”)
- C) line 66-67 (“And . . . Melosh says”)
- D) line 68-69 (“Oumuamua . . . he says”)

46

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

- A) establish.
- B) colonize.
- C) contract.
- D) land.

47

Based on the passage, if life was found on another planet, which additional discovery would be most consistent with the conclusions of Ginsburg’s team?

- A) The same region of the galaxy contains other planets that are also home to life.
- B) The planet is in a star system that ejects a relatively high number of objects.
- C) The star system of the planet is more similar to our solar system than to Alpha Centauri.
- D) The life-forms on the planet typically have longer life spans than do life-forms on Earth.

# STOP

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

**No Test Material On This Page**

# Writing and Language Test

35 MINUTES, 44 QUESTIONS

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

## DIRECTIONS

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

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

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

Questions 1-11 are based on the following passage and supplementary material.

### Digital Meet and Greets

In a traditional job fair, prospective employees gather in a **1** room filled with booths to browse for information and chat with representatives of different employers. In a virtual job fair, the “room” only exists **2** at an online location, the “booths” are web links, and all the participants are sitting in front of computers, connecting via digital means such as instant messaging or video chat. Although they may lack in-person interaction, virtual job fairs offer a more convenient, less costly experience for participants than do traditional job fairs.

1

- A) NO CHANGE
- B) room, filled with booths to browse for information
- C) room filled with booths, to browse for information
- D) room filled with booths to browse for information,

2

- A) NO CHANGE
- B) exclusively online,
- C) online,
- D) as an online room,

In a recent Forbes.com article, Georgene Huang, cofounder and CEO of women’s job portal Fairygodboss, writes about the convenience of virtual fairs for both applicants and employers. For applicants, the digital format allows nonlocal and even international job seekers to meet with employers without having to travel. While having to host thousands more applicants could present a problem for employers, **3** for example, virtual fairs also allow for easy control of the number of participants. Any job seeker can show up to in-person fairs, **4** and virtual fairs allow employers to prescreen candidate résumés and not invite—or specifically request a one-on-one meeting with—applicants based on how well they meet employers’ listed qualifications, such as **5** education, level work; experience, or veteran status.

3

- A) NO CHANGE
- B) furthermore,
- C) meanwhile,
- D) DELETE the underlined portion.

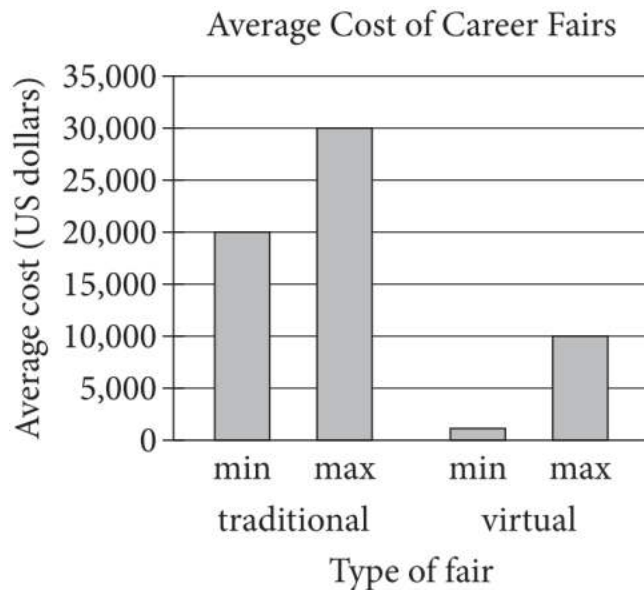
4

- A) NO CHANGE
- B) but
- C) then
- D) DELETE the underlined portion.

5

- A) NO CHANGE
- B) education level; work
- C) education level, work
- D) education level work

Though convenience is an important advantage, perhaps the biggest benefit of virtual fairs is their low cost. According to data gathered by InterCall Solutions and KRT Marketing, a traditional fair typically costs, on average, a minimum of \$20,000 and a maximum of \$30,000 for a company to host. **6** In-person fairs, on the other hand, have an average minimum cost of \$1,000 and an average maximum cost of \$10,000. **7** The high cost of traditional fairs **8** is due to various expenses—including travel costs for hiring managers, production costs of promotional materials, and rental fees for booth



Sources: Data from “Don’t Go Bankrupt Hosting a Career Fair—Part One.” ©2013 by InterCall Solutions; and from Nicole Morris, *Need to Know: Virtual Career Fairs*. ©2010 by KRT Marketing.

6

Which choice most accurately represents the information in the graph?

- A) NO CHANGE
- B) Traditional
- C) Career
- D) Virtual

7

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

A company that hosts both a traditional fair and a virtual fair would have to spend on average more than \$20,000.

Should the writer make this addition here?

- A) Yes, because it accurately uses information from the graph to highlight how affordable virtual fairs are.
- B) Yes, because it explains the difference between the minimum and maximum costs of fairs.
- C) No, because it provides unnecessary information about the combined cost of hosting fairs.
- D) No, because it fails to include the maximum cost of virtual fairs.

8

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



space—that aren't required for online fairs. These financial savings can be passed on to applicants via

9 way cheaper costs to crash fairs.

Although many people still prefer the face-to-face interaction of traditional fairs, such in-person contact isn't always an advantage. Huang notes that the digital distance of virtual fairs can foster a fairer job-seeking

10 environment, this protects applicants from employers who prioritize physical presentation (such as hairstyle or clothing choice) over qualifications.

11 Overall, virtual fairs offer a clear improvement on the traditional job fair model.

9

- A) NO CHANGE
- B) lower fair entrance fees.
- C) fewer bucks being charged to get into fairs.
- D) decreased fiscal outlay for fair ingress.

10

- A) NO CHANGE
- B) environment. Protecting
- C) environment protecting
- D) environment, protecting

11

- A) NO CHANGE
- B) However,
- C) Still,
- D) Therefore,

Questions 12-22 are based on the following passage.

**Mary Ann Shadd Cary**

[1] When abolitionist Frederick Douglass asked readers of his newspaper, the *North Star*, what should be done to improve the lives of African Americans, he received a letter that caught his eye. [2] Douglass printed the 1848 letter in its entirety, drawing attention to Cary and launching her lifelong career as an activist. [3] It was penned by Mary Ann Shadd Cary, a twenty-five-year-old free African American woman who stated plainly, “We should do more and talk less.” [4] A member of both the abolitionist and suffragist movements, Cary insisted that greater emphasis be given to the rights of African American women, who were **12** diminished in both groups. [5] Her activism illuminates the nuances of those social movements: though **13** its members may have been working toward similar goals, they were not always united. **14**

Five years after her letter was published, Cary started her own abolitionist newspaper, the *Provincial Freeman*. She produced it from Canada, where she had moved after Congress passed the Fugitive Slave Act in 1850. The *Provincial Freeman* was far more critical and radical than its **15** peers, as Cary advocated not only for the abolition of slavery but also for the full integration and equality of African Americans. In support of these goals,

**12**

- A) NO CHANGE
- B) limited
- C) trivialized
- D) marginalized

**13**

- A) NO CHANGE
- B) their
- C) her
- D) one’s

**14**

To make this paragraph most logical, sentence 2 should be placed

- A) where it is now.
- B) after sentence 3.
- C) after sentence 4.
- D) after sentence 5.

**15**

Which choice most logically builds on the statement made earlier in the sentence?

- A) NO CHANGE
- B) peers, as Cary had attended a Quaker boarding school in Pennsylvania in her youth.
- C) peers, being Canada’s first antislavery newspaper.
- D) peers and was published weekly.

Cary stressed the need to address the poverty of free African Americans and admonished activists who supported segregated schools. Her newspaper also emphasized the importance of women’s rights in a movement that was largely male dominated.

“The tone of her paper has been at times harsh,” Douglass once said of Cary. But the two abolitionists did agree on several points, including the concept of **16** uplift essentially—that African Americans should focus on education, hard work, thrift, and morality as a way of **17** declaring their equality. **18** Cary put this idea into practice by founding and teaching at schools for African Americans in the United States and Canada.

Cary continued to produce and write articles for the Provincial Freeman until the start of the Civil War, when she returned permanently to the United States. Though her career as a newspaper publisher had **19** ended, however Cary continued to fight for the rights of African Americans, particularly African American women. After

16

- A) NO CHANGE
- B) uplift, essentially:
- C) uplift—essentially
- D) uplift. Essentially,

17

- A) NO CHANGE
- B) announcing
- C) contending
- D) asserting

18

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

- A) Kept, because it offers a relevant counterclaim to the main claim of the paragraph.
- B) Kept, because it supports and elaborates on a claim made in the previous sentence.
- C) Deleted, because it blurs the focus of the passage by introducing an irrelevant example.
- D) Deleted, because it undermines the main claim of the paragraph.

19

- A) NO CHANGE
- B) ended:
- C) ended, so
- D) ended,

Emancipation, she became involved in the women's suffrage movement, which **20** were generally focused on the concerns of white women; Cary argued for the importance of voting rights for women of all races.

**21** Cary's accomplishments may be little remembered today, but her story exposes the tensions within the abolitionist and suffragist movements, which were not unified groups but collections of different voices.

**22** However, women would not win the right to vote for many years still.

20

- A) NO CHANGE
- B) have been
- C) was
- D) are

21

- A) NO CHANGE
- B) Carys accomplishments
- C) Cary's accomplishment's
- D) Carys' accomplishment's

22

The writer wants an effective conclusion to the passage that returns to an idea expressed at the beginning of the passage. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) Her commitment to action helped bring unity to those voices.
- C) Frederick Douglass continued the struggle to achieve rights for African Americans until he died in 1895.
- D) Unfortunately, her unorthodox views alienated some people in the abolitionist movement.

Questions 23-33 are based on the following passage.

### Austen’s Use of “Very”

Nineteenth-century British author Jane Austen is often celebrated for advancing the art of the novel by using precise language that allows readers unprecedented access to characters’ thoughts and feelings. It’s surprising, then, to learn that Austen often used the same words quite frequently. One word in **23** particular, the modifier “very”—appears hundreds of times in each of her six major works, **24** significantly more often than in other popular early nineteenth-century novels. As literary critic Janine Barchas has shown, however, this feature was far from accidental: Austen uses repetition to achieve specific artistic effects.

[1] In fact, the first critic to notice Austen’s heavy use of “very,” J. F. Burrows, did indeed assume it to be a sign of carelessness—not on the author’s part, but rather on the part of one of her characters. [2] Noticing the **25** word’s repeated recurrence in the dialogue of Mr. Woodhouse, a character in *Emma* (1815), **26** an assumption was made by Burrows that the word was symptomatic of the character’s narrow worldview. [3] Mr.

23

- A) NO CHANGE
- B) particular the modifier—
- C) particular, the modifier,
- D) particular—the modifier

24

The writer is considering deleting the underlined portion, adjusting the punctuation as needed. Should the underlined portion be kept or deleted?

- A) Kept, because it provides historical context that helps establish the uniqueness of an aspect of Austen’s writing.
- B) Kept, because it makes a claim about novels by Austen’s contemporaries that is elaborated on in the next paragraph.
- C) Deleted, because it provides information about Austen’s writing that is not consistent with the details in the sentence that follows.
- D) Deleted, because it fails to provide sufficient detail about the differences between Austen’s novels and other novels of the same period.

25

- A) NO CHANGE
- B) word’s recurrence
- C) repetition of the word “very” more than once
- D) recurrence of the word in the conversation and

26

- A) NO CHANGE
- B) the word’s use was assumed by Burrows to be
- C) Burrows assumed that the word was
- D) the word, according to an assumption made by Burrows, was

Woodhouse is content to stay in one place; **27** so too, Burrows suggested, is he content with a “limited and repetitive” idiolect, or individual dialect. **28**

This reading **29** will have overlooked both the scope and the significance of repetition in *Emma*. When Barchas ran a digital search of the novel, she found that “very” appeared 1,212 times, once every 133 words—or nearly twice as often as in any of Austen’s other novels. Moreover, its use is not **30** reduced to Mr. Woodhouse.

27

- A) NO CHANGE
- B) if so,
- C) so much,
- D) even so,

28

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

Repeating a word too often might indicate a lack of attention.

The best placement for the sentence is

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

29

- A) NO CHANGE
- B) overlooks
- C) has been overlooking
- D) will overlook

30

- A) NO CHANGE
- B) restricted
- C) condensed
- D) narrowed

The novel's other characters, and even **31** their narrator, are all likely to refer to something or someone as “very good” or “very charming” rather than “good” or “charming.” At times they even use “very” to end a thought, as when a character declares, “Well, that is so very!—” This frequency shows that Austen’s use of “very” was more than just a way to mark off certain characters; it was a way to define the entire community of Highbury in *Emma*.

The repetition of “very” is not just an idiolect but also what Barchas calls an “imagined sociolect”: a local dialect that Austen uses to characterize her fictional world. In particular, Austen uses “very” to imbue the speech patterns of her characters with a natural cadence while also emphasizing the potentially claustrophobic atmosphere of Highbury. *Emma* **32** introduces readers to an assertive, commanding female protagonist. The repetition of “very” becomes another way to make the novel’s setting feel enclosed. **33** In spite of this, what may have seemed like Austen’s overuse turns out to have been highly effective.

31

- A) NO CHANGE
- B) it’s
- C) its
- D) there

32

Which choice most effectively supports the discussion of *Emma* in the paragraph?

- A) NO CHANGE
- B) received few accolades from the writers who were Austen’s contemporaries.
- C) contains multiple scenes in which characters solve puzzles or play games together.
- D) often evokes images of confinement, such as closed doors and cramped carriages.

33

- A) NO CHANGE
- B) On the other hand,
- C) In this regard,
- D) For instance,

Questions 34-44 are based on the following passage.

### A Flipped Perspective on Plesiosaurs

Most marine animals that use flippers to swim, such as sea lions and turtles, have two distinct pairs of the 34 appendages. For these animals with flippers, they use the front pair for propulsion and the back pair for steering. The flippers in one pair differ markedly in size and shape from 35 the other pair. In contrast, the plesiosaur, a large marine reptile that lived during the Mesozoic 36 era that possessed four nearly identical large flippers. 37 This configuration has been known to scientists, through fossil evidence, for two centuries. As Luke Muscutt, a researcher at the University of Southampton, observes, “Having four big flippers like

34

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

- A) appendages, with the front pair used
- B) appendages; they use the front pair of their appendages
- C) appendages and use their front flippers—that is, the front pair—
- D) appendages, and they have a front pair they use

35

- A) NO CHANGE
- B) those in the other pair.
- C) the size and shape of the other pair.
- D) that of the other flippers.

36

- A) NO CHANGE
- B) era and possessed
- C) era, possessed
- D) era, possessing

37

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

- A) NO CHANGE
- B) Plesiosaurs were likely alive during the time of the dinosaurs but are not considered dinosaurs.
- C) New technologies are allowing scientists to study flippers across multiple species and look for similarities.
- D) This feature has long puzzled paleontologists, who have wondered how an animal with such flippers could move efficiently through the water.



that is rather strange.” Thanks to 3-D printing technology, **38** for example, researchers are closer than ever to understanding plesiosaur motion.

[1] A team led by Muscutt deserves credit for the breakthrough. [2] The researchers used a 3-D printer to create foot-long plastic replicas of two plesiosaur flippers, based on the fossil evidence and data from modern flippers. [3] They then attached the flippers to a robot meant to mimic a plesiosaur’s movements. [4] As the robot’s flippers moved in the current, the dye leaked out through small holes, allowing the researchers to **39** trace the interaction of the flippers and the current as **40** they “swam” through the water. **41**

38

- A) NO CHANGE
- B) though,
- C) furthermore,
- D) in other words,

39

- A) NO CHANGE
- B) sketch
- C) copy
- D) trail

40

- A) NO CHANGE
- B) one
- C) the robot
- D) the researchers

41

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

After filling the flippers with colored dye, the researchers submerged the robot in a tank of water through which a current flowed.

The best placement for the sentence is

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

Through their simulations, Muscutt and his colleagues determined that the plesiosaur would have moved most efficiently through the water by flapping all four flippers. Rather than using one pair of flippers for propulsion and one pair for steering, plesiosaurs most likely used all four flippers to propel themselves forward. The team also found that adjusting the angles of the flippers as it swam **42** which the fossils show the plesiosaur would have been able to do—would have allowed the plesiosaur to optimize its energy usage. At certain angles, the rear flippers could have taken advantage of the current created by the front flippers—**43** if the plesiosaur were coordinated enough. Such an adjustment would have increased the rear flippers’ thrust by approximately 60 percent and efficiency by 40 percent.

The results of the plesiosaur simulations are both helping paleontologists finally understand how this unique creature moved and **44** shed new light on the engineering of flipper propulsion. Muscutt hopes that the team’s insights into propulsion might “eventually have a real-world application—as a propulsion system for undersea vehicles, for instance, that could help make them more maneuverable, [more] efficient and quieter.”

42

- A) NO CHANGE
- B) which the fossils show the plesiosaur would have been able to do,
- C) (which the fossils show the plesiosaur would have been able to do)
- D) —which the fossils show the plesiosaur would have been able to do,

43

The writer wants to add a comparison that illustrates the point being made in the sentence. Which choice best accomplishes this goal?

- A) NO CHANGE
- B) much like birds flying at the rear of a formation.
- C) a different kind of swimming than that employed by other marine animals.
- D) though a living animal is obviously not the same as a robot.

44

- A) NO CHANGE
- B) sheds
- C) will shed
- D) shedding

## STOP

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

**No Test Material On This Page**



# Math Test – No Calculator

25 MINUTES, 17 QUESTIONS

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

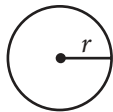
## DIRECTIONS

For questions 1-13, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle 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

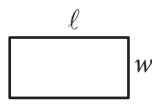
- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated,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

## REFERENCE

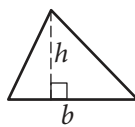


$$A = \pi r^2$$

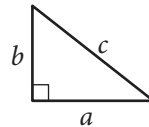
$$C = 2\pi r$$



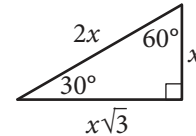
$$A = \ell w$$



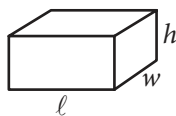
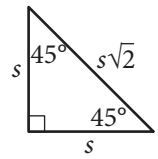
$$A = \frac{1}{2}bh$$



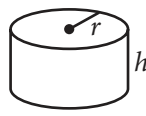
$$c^2 = a^2 + b^2$$



Special Right Triangles



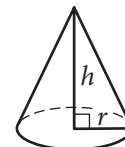
$$V = \ell wh$$



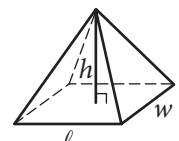
$$V = \pi r^2 h$$



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



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



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

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

The number of radians of arc in a circle is  $2\pi$ .

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



1

$$2(y - 5) = 14$$

What is the solution to the given equation?

- A) 33
- B) 23
- C) 12
- D) 2

2

$$\begin{aligned}y &< 2x \\ y &> -x + 3\end{aligned}$$

Which of the following points in the  $xy$ -plane satisfies the given system of inequalities?

- A) (1, 1)
- B) (3, 0)
- C) (3, 2)
- D) (4, -2)

3

In the linear function  $f$ ,  $f(0) = 2$  and  $f(-6) = 0$ . Which equation defines  $f$ ?

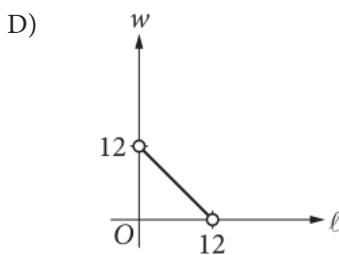
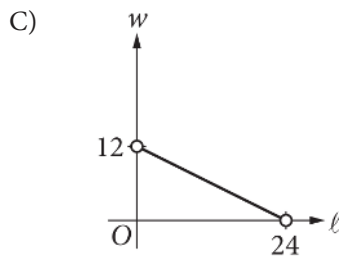
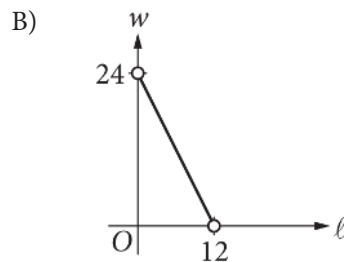
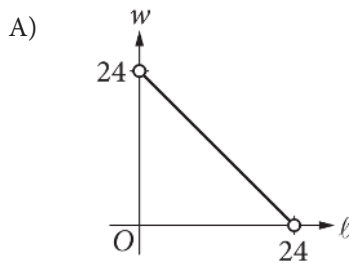
- A)  $f(x) = \frac{1}{3}x - 6$
- B)  $f(x) = \frac{1}{3}x + 2$
- C)  $f(x) = 3x - 6$
- D)  $f(x) = 3x + 2$



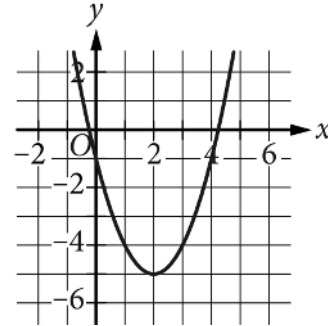
4

$$2\ell + 2w = 24$$

The relationship between the possible lengths,  $\ell$ , and corresponding widths,  $w$ , of any rectangle with a perimeter of 24 is given by the equation shown. Which of the following is a graph of this equation in the  $\ell w$ -plane?



5



What is an equation of the graph shown?

- A)  $y = (x - 2)^2 - 5$
- B)  $y = (x - 2)^2 + 5$
- C)  $y = (x + 2)^2 - 5$
- D)  $y = (x + 2)^2 + 5$

6

$$\begin{aligned}x + y &= 8 \\x^2 - y^2 &= 32\end{aligned}$$

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

- A) 4
- B) 8
- C) 16
- D) 24



7

The relationship between two variables,  $x$  and  $y$ , is linear. For every increase in the value of  $x$  by 1, the value of  $y$  increases by 4. When the value of  $x$  is 2, the value of  $y$  is 11. Which equation represents this relationship?

- A)  $y = x + 9$
- B)  $y = 2x + 11$
- C)  $y = 3x + 4$
- D)  $y = 4x + 3$

8

$$5x - 10 = \frac{1}{10}(50x - 100)$$

How many solutions does the given equation have?

- A) Zero
- B) Exactly one
- C) Exactly two
- D) Infinitely many

9

$$E(s) = -0.015(s - 45)^2 + 30$$

The equation above models the fuel economy  $E(s)$ , in miles per gallon (mpg) of fuel, of a certain vehicle as a function of constant vehicle speed  $s$ , in miles per hour (mph), where  $20 \leq s \leq 70$ . Based on the model, which of the following is the best interpretation of  $E(25) = 24$  in this context?

- A) When the vehicle has a constant speed of 24 mph, its predicted fuel economy is 25 mpg.
- B) When the vehicle has a constant speed of 24 mph, its predicted fuel economy is 54 mpg.
- C) When the vehicle has a constant speed of 25 mph, its predicted fuel economy is 24 mpg.
- D) When the vehicle has a constant speed of 25 mph, its predicted fuel economy is 55 mpg.



10

$$P(t) = 1,263(1.04)^t$$

The given function  $P$  models the population of a town  $t$  years after 2016. Which of the following functions  $Q$  models the population of the town  $n$  months after 2016?

- A)  $Q(n) = 1,263(1.04)^{\frac{n}{12}}$
- B)  $Q(n) = 1,263(1.04)^{12n}$
- C)  $Q(n) = 1,263((12(1.04))^n)$
- D)  $Q(n) = 1,263\left(\frac{1.04}{12}\right)^n$

11

When  $x = 0$ , the value of  $y$  is 75. The value of  $y$  increases by 9% for every increase of 1 in the value of  $x$ . Which equation represents the relationship between  $x$  and  $y$ ?

- A)  $y = 75(0.91x)$
- B)  $y = 75(1.09x)$
- C)  $y = 75(0.91)^x$
- D)  $y = 75(1.09)^x$

12

In 1994, Sergey Bubka of Ukraine set the world record for men's outdoor pole vaulting. The data in the table shown model his height in the air  $y$ , in feet,  $x$  seconds after leaving the ground.

| Time (seconds) | Height (feet) |
|----------------|---------------|
| 0              | 0             |
| 0.25           | 8             |
| 0.5            | 14            |
| 0.75           | 18            |
| 1.0            | 20            |
| 1.25           | 20            |
| 1.5            | 18            |
| 1.75           | 14            |

Which equation best represents the data in the table?

- A)  $y = -16x^2$
- B)  $y = -16x^2 + 36x$
- C)  $y = 16x^2$
- D)  $y = 16x^2 + 36x$

13

$$2x^2 + 4x - 5 = 0$$

What is one solution to the given equation?

- A)  $-1 + \frac{\sqrt{7}}{2}$
- B)  $-1 + \frac{\sqrt{14}}{2}$
- C)  $1 - \frac{\sqrt{7}}{2}$
- D)  $1 - \frac{\sqrt{14}}{2}$





**DIRECTIONS**

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

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

|   |   |   |   |
|---|---|---|---|
| 3 | 1 | / | 2 |
| ○ | ○ | ○ | ○ |

 is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

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

|   |   |   |   |   |
|---|---|---|---|---|
|   | 7 | / | 1 | 2 |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ |

← Fraction line

Answer: 2.5

|   |   |   |   |
|---|---|---|---|
|   | 2 | . | 5 |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |

← Decimal point

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

|   |   |   |   |
|---|---|---|---|
|   | 2 | / | 3 |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |

|   |   |   |   |
|---|---|---|---|
| . | 6 | 6 | 6 |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |

|   |   |   |   |
|---|---|---|---|
| . | 6 | 6 | 7 |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |

Answer: 201 – either position is correct

|   |   |   |   |
|---|---|---|---|
|   | 2 | 0 | 1 |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |

|   |   |   |   |
|---|---|---|---|
| 2 | 0 | 1 |   |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ |

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



14

$$(b^2 - 3)(b^2 + 3) = b^4 - A$$

In the given equation,  $A$  is a constant. If the equation is true for all values of  $b$ , what is the value of  $A$  ?

15

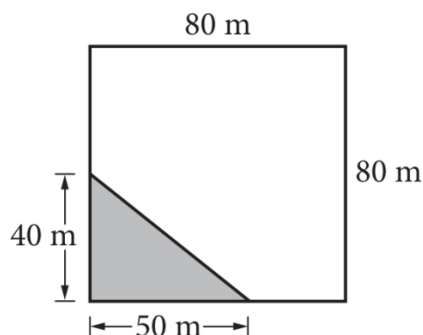
$$-5x + 7y = 92$$

$$8x - 7y = -101$$

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



16



Sandra owns a square field that measures 80 meters (m) on each side. She leases a triangular corner of the field to a farmer. The figure shown represents Sandra's field, and the shaded triangle represents the land that she leases to the farmer. What is the area of the field, in square meters, that Sandra does not lease to the farmer?

17

How many liters of 10% salt solution must be added to 5 liters of 25% salt solution to obtain a 15% salt solution?

**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.

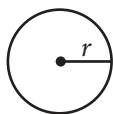
## DIRECTIONS

For questions 1-27, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle 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

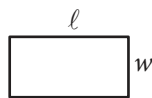
- The use of a calculator is permitted.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- Unless otherwise indicated, the domain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

## REFERENCE

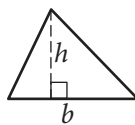


$$A = \pi r^2$$

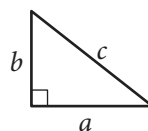
$$C = 2\pi r$$



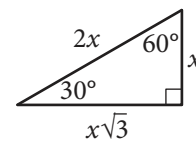
$$A = \ell w$$



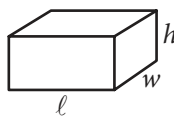
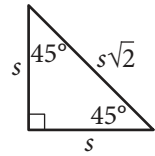
$$A = \frac{1}{2}bh$$



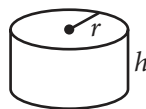
$$c^2 = a^2 + b^2$$



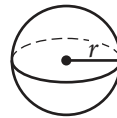
Special Right Triangles



$$V = \ell wh$$



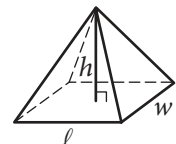
$$V = \pi r^2 h$$



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



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



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

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

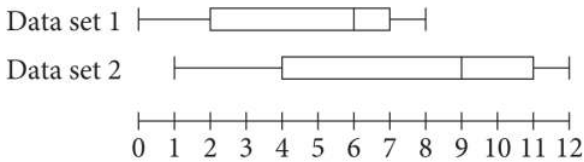
The number of radians of arc in a circle is  $2\pi$ .

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



1

Two data sets are summarized by the box plots shown.



How much greater is the median of data set 2 than the median of data set 1?

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

2

| Day       | Number of pizzas |
|-----------|------------------|
| Sunday    | 35               |
| Monday    | 30               |
| Tuesday   | 25               |
| Wednesday | 40               |
| Thursday  | 30               |
| Friday    | 75               |
| Saturday  | 80               |

The table shows the number of pizzas sold at a store on each day for one week. Which statement best compares the mean and the median number of pizzas sold per day for that week?

- A) The mean is less than the median.
- B) The mean is greater than the median.
- C) The mean is equal to the median.
- D) There is not enough information to determine the relationship between the mean and the median.

3

| Student Attendance at an Assembly |     |
|-----------------------------------|-----|
| Freshmen                          | ?   |
| Sophomores                        | 36  |
| Juniors                           | 54  |
| Seniors                           | ?   |
| Total                             | 180 |

The partially completed table above shows the number of students, by grade, who attended an assembly. The number of freshmen who attended the assembly is 4 times the number of seniors who attended the assembly. How many freshmen attended the assembly?

- A) 18
- B) 45
- C) 72
- D) 90



4

In 2019 the Iowa state sales tax on clothing was 6.00%. A shirt cost \$15.00 before state sales tax was added. What was the cost of the shirt after state sales tax was added?

- A) \$15.06
- B) \$15.90
- C) \$21.00
- D) \$24.00

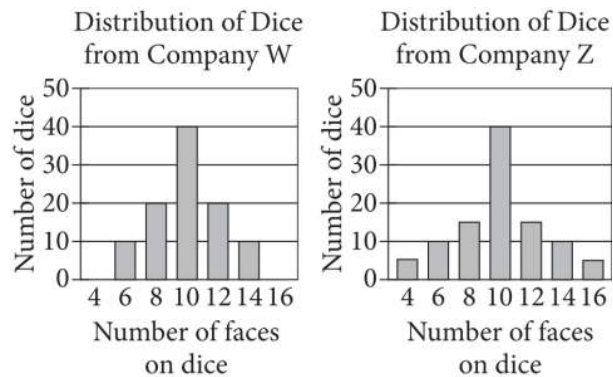
5

An object weighs 20 ounces and has a volume of 5 cubic inches. What is the density, in ounces per cubic inch, of the object?

- A) 4
- B) 15
- C) 25
- D) 100

6

Erika bought bags of polyhedral dice from companies W and Z. Each bag had 100 dice with a variety of number of faces. The bar graphs summarize the distribution of dice by their number of faces from each company.



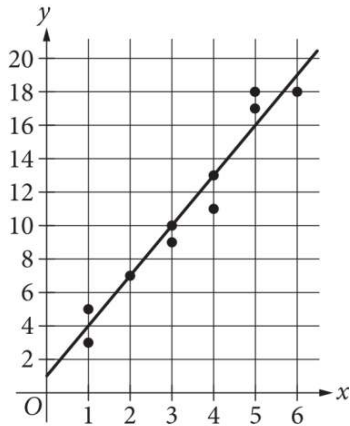
Which of the following statements best compares the medians and standard deviations of the two sets of data?

- A) The medians of the two sets of data are the same, and the standard deviations of the two sets of data are different.
- B) The medians of the two sets of data are the same, and the standard deviations of the two sets of data are the same.
- C) The medians of the two sets of data are different, and the standard deviations of the two sets of data are different.
- D) The medians of the two sets of data are different, and the standard deviations of the two sets of data are the same.



7

In the given scatterplot, a line of best fit for the data is shown.



Which of the following is closest to the slope of the line of best fit?

- A)  $\frac{1}{3}$
- B) 1
- C) 3
- D) 5

8

The table shows selected values from the function  $f$ .

| $x$ | $f(x)$ |
|-----|--------|
| -1  | 0.5    |
| 0   | 1      |
| 1   | 2      |
| 2   | 4      |

Which of the following is the best description of function  $f$ ?

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



Questions 9 and 11 refer to the following information.

$$W = 20.5 - 0.37T$$

The concrete sections of a bridge expand when the temperature increases and contract when the temperature decreases. A small expansion gap was left between the sections when the bridge was built. The given equation relates the width  $W$ , in millimeters (mm), of the expansion gap and the temperature of the concrete  $T$ , in degrees Celsius ( $^{\circ}\text{C}$ ), where  $-40 \leq T \leq 50$ .

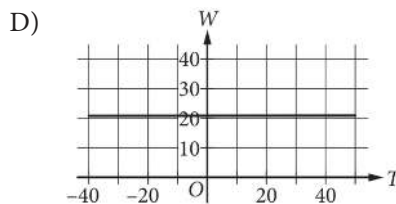
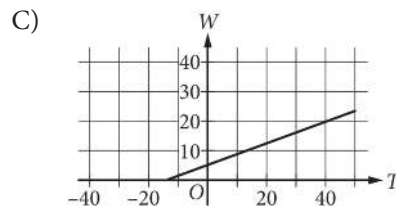
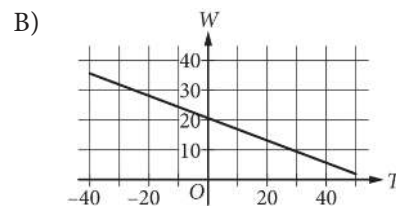
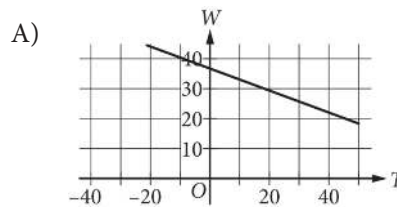
9

At what concrete temperature, in degrees Celsius, will the width of the expansion gap be 11.25 mm?

- A) 3
- B) 10
- C) 25
- D) 32

10

Which graph best represents the relationship between the expansion gap width  $W$ , in millimeters, and the temperature of the concrete  $T$ , in degrees Celsius?



11

Which inequality best describes all the concrete temperatures  $T$ , in degrees Celsius, that correspond to an expansion gap width between 13.1 mm and 16.8 mm?

- A)  $3.7 < T < 7.4$
- B)  $10.0 < T < 20.0$
- C)  $13.1 < T < 16.8$
- D)  $20.0 < T < 30.0$





12

$$p(n) = -12.7(n - 42)^2 + 57,140$$

The given function models the population of Greenland from 1960 through 2016, where  $n$  is the number of years after 1960. According to this function, how many years after 1960 was the population the greatest?

- A) 13
- B) 21
- C) 42
- D) 56

13

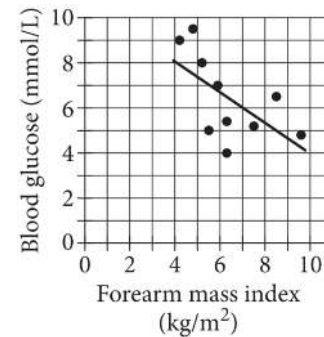
A particular waterfall erodes the land over which it flows at a rate of 11.8 inches per year. Which of the following is closest to the rate of erosion caused by this waterfall, in meters per year?

(1 foot = 12 inches, and use 1 meter = 3.28 feet.)

- A) 0.30
- B) 0.98
- C) 3.23
- D) 43.17

Questions 14 and 15 refer to the following information.

The scatterplot shows the forearm mass index, in kilograms per square meter ( $\text{kg}/\text{m}^2$ ), and the blood glucose concentration, in millimoles per liter ( $\text{mmol}/\text{L}$ ), for 10 species of bats. A line of best fit is also shown.



14

Which of the following is closest to the range of the blood glucose concentration, in  $\text{mmol}/\text{L}$ , of these 10 bat species?

- A) 4.2
- B) 5.5
- C) 7.0
- D) 9.5

15

Which of the following is closest to the forearm mass index, in grams per square centimeter, of the bat species with the lowest blood glucose concentration? (1  $\text{kg}$  = 1,000 grams, and 1  $\text{m}^2$  = 10,000 square centimeters)



16

Which expression is equivalent to  $5xy + 15x^2y + 20xy^2$ ?

- A)  $5xy(3x + 4y)$
- B)  $5xy(15x + 20y)$
- C)  $5xy(1 + 3x + 4y)$
- D)  $5xy(1 + 15x + 20y)$

17

The line with equation  $x = 0$  intersects the circle with equation  $x^2 + y^2 = 16$  at two points in the  $xy$ -plane. What is one of the points of intersection?

- A)  $(-4, 0)$
- B)  $(0, -4)$
- C)  $(0, 0)$
- D)  $(4, 0)$

18

Terrell made 48 cups of strawberry jam. He then filled  $x$  small jars and  $y$  large jars with all the jam he made. The equation  $x + 2y = 48$  represents this situation. Which is the best interpretation of  $2y$  in this context?

- A) The number of small jars Terrell filled
- B) The number of large jars Terrell filled
- C) The total number of cups of jam in the small jars
- D) The total number of cups of jam in the large jars



19

The table gives the distribution of ice cream flavor and topping option for customer orders at an ice cream shop.

| Flavor    | Topping option   |                     |
|-----------|------------------|---------------------|
|           | <i>Sprinkles</i> | <i>No sprinkles</i> |
| Chocolate | 60               | 20                  |
| Vanilla   | 30               | 10                  |
| Twist     | 90               | 10                  |

If a customer order is selected at random, what is the probability of selecting an order with sprinkles, given the flavor is vanilla?

- A) 0.17
- B) 0.33
- C) 0.75
- D) 0.82

20

What is the  $y$ -intercept of the graph of

$$y = 6\left(\frac{1}{2}\right)^x - 3 \text{ in the } xy\text{-plane?}$$

- A) (0, -3)
- B) (0, -1)
- C) (0, 1)
- D) (0, 3)

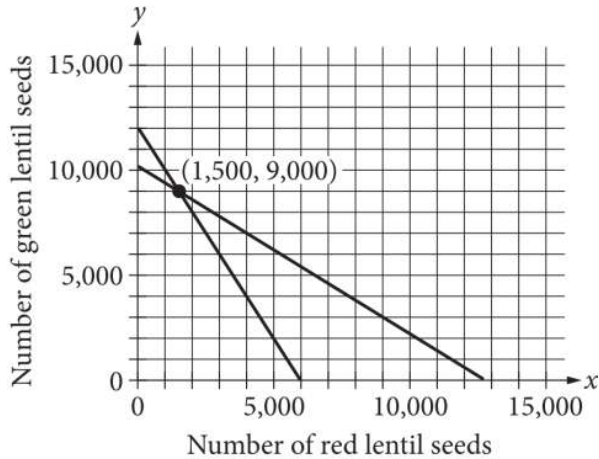
21

The ratio of a rectangle's width to its length is 4 to 9. If the width of the rectangle is  $w$ , which expression represents the length of the rectangle?

- A)  $\frac{4}{9}w$
- B)  $\frac{9}{4}w$
- C)  $11w$
- D)  $36w$



22



A system of equations is represented in the graph. One part of the system represents the number of red lentil seeds and green lentil seeds William can plot in 100 square meters if he plants a fixed number of each type of seed in each square meter. The other part of the system represents the number of each type of seed he can purchase with \$510. Which of the following systems represents this system?

- A)  $\frac{x}{60} + \frac{y}{120} = 100$   
 $0.04x + 0.05y = 510$
- B)  $\frac{x}{60} + \frac{y}{120} = 510$   
 $0.04x + 0.05y = 100$
- C)  $60x + 120y = 100$   
 $\frac{x}{0.04} + \frac{y}{0.05} = 510$
- D)  $60x + 120y = 510$   
 $\frac{x}{0.04} + \frac{y}{0.05} = 100$

23

Cone T is a right circular cone with a radius of  $r$  and height of  $h$ , as shown. The volume of cone W (not shown) is  $\frac{1}{27}$  times the volume of cone T. Which of the following could be the dimensions of cone W?

- A) height =  $\frac{1}{27}h$
- B) height =  $\frac{1}{9}h$
- C) radius =  $\frac{1}{3}r$
- D) radius =  $3r$

24

If  $x > 0$  and  $x$  is 160% of  $y$ , which expression represents  $y$  in terms of  $x$ ?

- A)  $0.160x$
- B)  $0.625x$
- C)  $1.600x$
- D)  $6.250x$



25

$$|x + 11| = 24$$

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

- A) -22
- B) 0
- C) 13
- D) 48

26

$$2x - 12y = 8$$

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

- A)  $x - 6y = 4$
- B)  $x - 4y = 0$
- C)  $\frac{1}{2}x - 3y = 2$
- D)  $\frac{1}{2}x - 3y = 0$


27

The value of a house increased by 8% from January 1, 2016, to January 1, 2017. Then, the value of the house decreased by 3% from January 1, 2017, to January 1, 2018. What was the net percentage increase in the value of the house from January 1, 2016, to January 1, 2018?

- A) 4.76%
- B) 4.85%
- C) 5.00%
- D) 5.24%

**DIRECTIONS**

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

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

Write answer in boxes. →

Grid in result. →

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

|   |   |   |   |   |
|---|---|---|---|---|
|   | 7 | / | 1 | 2 |
| . | . | . | . | . |
|   | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 | 9 |

← Fraction line

Answer: 2.5

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

← Decimal point

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

|   |   |   |   |
|---|---|---|---|
|   | 2 | / | 3 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |

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

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

Answer: 201 – either position is correct

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

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

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



28

If  $\frac{2x+3}{5} + 1 = \frac{4}{5} + 1$ , what is the value of  $2x + 3$ ?

29

A quadratic function can be used to model the height, in feet, of an object above the ground in terms of the time, in seconds, after the object was launched. According to the model, an object was launched into the air from a height of 0 feet and reached its maximum height of 3136 feet 14 seconds after it was launched. Based on the model, what was the height, in feet, of the object 1 second after it was launched?



Questions 30 and 31 refer to the following information.

$$\frac{3550}{3550 + 2500 + c}$$

| Students and Lecturers at Medical Schools in 2006 |          |           |
|---|----------|-----------|
| Country   | Students | Lecturers |
| Germany   | 79,866   | 3550      |
| Spain   | 36,049   | 2500      |
| Turkey  | 32,985   | 9020      |

The table shows the number of students and the number of lecturers at medical schools for three countries. No student can be a lecturer.

30

A person who in 2006 was a lecturer at a medical school in Germany, Spain, or Turkey will be selected at random. The expression shown, where  $c$  is a constant, represents the probability that the person selected will be a lecturer at a medical school in Germany. What is the value of  $c$ ?

31

At medical schools in Spain in 2006, the ratio of the number of students to the number of lecturers was  $k:1$ . What is the value of  $k$ , rounded to the nearest tenth?

# STOP

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



**No Test Material On This Page**

## QUESTIONS OVERVIEW

### READING

**47**  
Total Questions      Correct Answers

Incorrect Answers      Omitted Answers

### WRITING AND LANGUAGE

**44**  
Total Questions      Correct Answers

Incorrect Answers      Omitted Answers

### MATH – CALCULATOR

**31**  
Total Questions      Correct Answers

Incorrect Answers      Omitted Answers

### MATH – NO CALCULATOR

**17**  
Total Questions      Correct Answers

Incorrect Answers      Omitted Answers

### KEY

- Easy Question
- Medium Question
- Hard Question

### READING

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

### WRITING AND LANGUAGE

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

### MATH – CALCULATOR

| Question # | Correct | Your Answer | Difficulty |
|------------|---------|-------------|------------|
| 1          | C       |             | ■ ■ ■      |
| 2          | B       |             | ■ ■ ■      |
| 3          | C       |             | ■ ■ ■      |
| 4          | B       |             | ■ ■ ■      |
| 5          | A       |             | ■ ■ ■      |
| 6          | A       |             | ■ ■ ■      |
| 7          | C       |             | ■ ■ ■      |
| 8          | D       |             | ■ ■ ■      |
| 9          | C       |             | ■ ■ ■      |
| 10         | B       |             | ■ ■ ■      |
| 11         | B       |             | ■ ■ ■      |
| 12         | C       |             | ■ ■ ■      |
| 13         | A       |             | ■ ■ ■      |
| 14         | B       |             | ■ ■ ■      |

| Question # | Correct    | Your Answer | Difficulty |
|------------|------------|-------------|------------|
| 28         | 4          |             | ■ ■ ■      |
| 29         | 432        |             | ■ ■ ■      |
| 30         | 9020       |             | ■ ■ ■      |
| 31         | 14.4, 72/5 |             | ■ ■ ■      |

### MATH – NO CALCULATOR

| Question # | Correct | Your Answer | Difficulty |
|------------|---------|-------------|------------|
| 1          | C       |             | ■ ■ ■      |
| 2          | C       |             | ■ ■ ■      |
| 3          | B       |             | ■ ■ ■      |
| 4          | D       |             | ■ ■ ■      |
| 5          | A       |             | ■ ■ ■      |
| 6          | A       |             | ■ ■ ■      |
| 7          | D       |             | ■ ■ ■      |

| Question # | Correct | Your Answer | Difficulty |
|------------|---------|-------------|------------|
| 14         | 9       |             | ■ ■ ■      |
| 15         | 11      |             | ■ ■ ■      |
| 16         | 5400    |             | ■ ■ ■      |
| 17         | 10      |             | ■ ■ ■      |

| Question # | Correct | Your Answer | Difficulty |
|------------|---------|-------------|------------|
| 15         | C       |             | ■ ■ ■      |
| 16         | C       |             | ■ ■ ■      |
| 17         | B       |             | ■ ■ ■      |
| 18         | D       |             | ■ ■ ■      |
| 19         | C       |             | ■ ■ ■      |
| 20         | D       |             | ■ ■ ■      |
| 21         | B       |             | ■ ■ ■      |
| 22         | A       |             | ■ ■ ■      |
| 23         | C       |             | ■ ■ ■      |
| 24         | B       |             | ■ ■ ■      |
| 25         | A       |             | ■ ■ ■      |
| 26         | D       |             | ■ ■ ■      |
| 27         | A       |             | ■ ■ ■      |

| Question # | Correct | Your Answer | Difficulty |
|------------|---------|-------------|------------|
| 8          | D       |             | ■ ■ ■      |
| 9          | C       |             | ■ ■ ■      |
| 10         | A       |             | ■ ■ ■      |
| 11         | D       |             | ■ ■ ■      |
| 12         | B       |             | ■ ■ ■      |
| 13         | B       |             | ■ ■ ■      |