# 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 Akhil Sharma, *Family Life*. ©2014 by Akhil Sharma.

I was always lost in a book, whether I was actually reading or imagining myself as a character. If bad things happened, like my brother Birju developing pneumonia and having to wear an oxygen mask, I would think that soon I would be able to go back to my reading and then time would vanish and when I reentered the world, the difficult thing would be gone or changed.

I often lied about my reading. The books I liked were science fiction and fantasy, books where things were not as complicated and unsatisfying as real life. I claimed to have read more famous books, though—the ones our teachers told us were for older students or the ones that had been made into movies. One winter morning in ninth grade, while it was still dark outside, I sat at our kitchen table and began reading a biography of Ernest Hemingway called *The Young Hemingway*, hoping that if I read the biography, I could then more effectively pretend to have read him. All I knew about Hemingway was that he was famous and that he was a writer.

The biography opens with Hemingway on a boat that is entering New York Harbor. The day is gray, and seagulls are soaring above him. He is returning to America from Paris and World War I. As I read about Hemingway having been to Spain and France, I was amazed. I couldn't believe that an actual person had gotten to go to Spain and France. What was even more amazing was that this man had done it without being a doctor or an engineer. Till then I had thought that the only way to have a good life was to have one of these two professions. As I sat there reading, I got happier and happier. To have a life where one traveled, where one did what one wanted, seemed like being rich.

The light outside the window turned blue. Trees and nearby houses grew visible as if they were emerging out of water. The happiness was so intense it was as if my chest were being stretched.

It took several days to finish the biography. I read it mostly at the kitchen table. As I read, I began wanting to be a writer. I had written short stories in class before. Now, I thought about how wonderful it would be to be a writer and get attention and get to travel and not have to be a doctor or an engineer. As I sat there reading, my mother came in and out of the kitchen. She opened and closed the refrigerator. She prepared meals. Fantasizing about a life which was far away from her and Birju, I felt like I was doing something dishonest.

The same day that I finished the biography, I went to the library. I asked the librarian if there were more books on Hemingway. The woman, young, pregnant, asked if I wanted books about Hemingway or by him. I felt embarrassed saying that I did not want to read his works, that I only wanted to learn how to be a writer and get famous. "About him," I murmured. She smiled and appeared pleased. I think she mistook my interest as me being scholarly. She led me to an aisle and showed me the library's ten or twelve hardbacks on Hemingway. The biographer had mentioned that Hemingway's style was very simple. I

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understood this to mean that if I became a writer, I wouldn't have to be very good, that being merely
65 acceptable would be sufficient for me to have a good life. I checked out all the books.

1

Throughout the passage, the narrator portrays his younger self as someone who was

A) eager to acquire diverse forms of knowledge.
B) concerned about how he was perceived by others.
C) obsessed with becoming a successful writer.
D) overly anxious about family obligations.

2

As used in line 1, "lost" most nearly means

A) absorbed.
B) misplaced.
C) bewildered.
D) vanished.

3

According to the passage, one reason the narrator liked to read was that reading

A) made him seem intelligent to his teachers and his older friends.
B) allowed him an escape from unpleasant situations.
C) helped him reflect on his family life.
D) informed him about the lives of great people.

4

The imagery in lines 36-38 ("The light . . . water") mainly serves to

A) suggest that the narrator was attempting to retreat into his imagination.
B) suggest a similarity between the narrator and the author he was reading about.
C) convey a sense of the change the narrator was experiencing.
D) indicate the sense of unease caused by a disruption in the narrator's life.

5

As used in line 39, "intense" most nearly means

A) profound.
B) sensitive.
C) strenuous.
D) attentive.

6

Which statement about the narrator's reasons for wanting to become a writer can most reasonably be inferred from the passage?

A) He was motivated mostly by a desire to exercise his creativity.
B) He was motivated primarily by the desire to be a member of a prestigious profession.
C) He was motivated less by a love of writing than by the freedom he imagined a writer would have.
D) He was motivated more by the financial security he imagined a writer had than by a desire for fame.

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7

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

A) Lines 25-27 ("As I . . . amazed")

B) Lines 28-32 ("What . . . professions")

C) Lines 38-39 ("The happiness . . . stretched")

D) Lines 41-45 ("As I read . . . engineer")

8

The narrator most strongly suggests that reading the Hemingway biography led him to feel a conflict between his

A) impulse to give up as soon as something became difficult and his desire to become more disciplined.

B) desire for freedom from his current circumstances and his sense of family obligation.

C) interest in popular fantasy writing and his perceived need to study more serious writing.

D) attempt to impress his teachers and his inclination to avoid difficult intellectual activity.

9

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

A) Lines 15-20 ("One . . . him")

B) Lines 32-35 ("As I . . . rich")

C) Lines 48-50 ("Fantasizing . . . dishonest")

D) Lines 61-66 ("The biographer . . . life")

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

Passage 1 is adapted from George III, "Address of the King to Both Houses of Parliament, 31 October 1776." Passage 2 is adapted from Richard Price, *Observations on the Nature of Civil Liberty, the Principles of Government, and the Justice and Policy of the War with America.* Originally published in 1776. George III was the British king when thirteen British colonies in North America declared their independence and formed the United States; Richard Price was a British political philosopher.

**Passage 1**

*My Lords and Gentlemen*:

Nothing could have afforded me so much satisfaction as to have been able to inform you, at the opening of this session, that the troubles which have so long distracted my Colonies in North America were at an end; and that my unhappy people, recovered from their delusion, had delivered themselves from the oppression of their leaders, and returned to their duty. But so daring and desperate is the spirit of those leaders, whose object has always been dominion and power, that they have now openly renounced all allegiance to the Crown, and all political connection with this country: they have rejected, with circumstances of indignity and insult, the means of conciliation held out to them under the authority of our commission, and have presumed to set up their rebellious Confederacies for independent States. If their treason be suffered to take root, much mischief must grow from it, to the safety of my loyal Colonies, to the commerce of my Kingdoms, and indeed to the present system of all Europe. One great advantage, however, will be derived from the object of the Rebels being openly avowed and clearly understood: we shall have unanimity at home, founded in the general conviction of the justice and necessity of our measures. . . .

In this arduous contest, I can have no other object but to promote the true interests of all my subjects. No people ever enjoyed more happiness, or lived under a milder Government, than those now revolted Provinces. The improvements in every art of which they boast, declare it; their numbers, their wealth, their strength by sea and land, which they think sufficient to enable them to make head against the whole power of the mother country, are irrefragable proofs of it. My desire is to restore to

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them the blessings of law and liberty, equally enjoyed by every British subject, which they have fatally and desperately exchanged for all the calamities of war, and the arbitrary tyranny of their chiefs.

**Passage 2**

One cannot help indeed being astonished at the virulence with which some speak on the present occasion against the Colonies. For what have they done? Have they crossed the ocean and invaded us? Have they attempted to take from us the fruits of our labour and to overturn that form of government which we hold so sacred? This cannot be pretended. On the contrary, this is what we have done to them. We have transported ourselves to their peaceful retreats and employed our fleets and armies to stop up their ports, to destroy their commerce, to seize their effects, and to burn their towns. Would we but let them alone and suffer them to enjoy in security their property and governments, instead of disturbing us they would thank and bless us. And yet it is we who imagine ourselves ill-used. The truth is, we expected to find them a cowardly rabble who would lie quietly at our feet and they have disappointed us. They have risen in their own defence and repelled force by force. They deny the plenitude of our power over them and insist upon being treated as free communities. It is this that has provoked us and kindled our governors into rage. . . .

It has however been asserted that even their good is intended by this war. Many of us are persuaded that they will be much happier under our government than under any government of their own, and that their liberties will be safer when held for them by us than when trusted in their own hands. How kind is it thus to take upon us the trouble of judging for them what is most for their happiness? Nothing can be kinder except the resolution we have formed to exterminate them if they will not submit to our judgment. What strange language have I sometimes heard? By an armed force we are now endeavouring to destroy the laws and governments of America, and yet I have heard it said that we are endeavouring to support law and government there. We are insisting upon our right to levy contributions upon them and to maintain this right we are bringing upon them all the miseries a people can endure, and yet it is asserted that we mean nothing but their security and happiness.

**10**

George III's primary purpose in Passage 1 is to

A) inform his audience about the policies he has pursued with regard to the colonies.

B) convince his audience of the dangers of losing control of the colonies.

C) justify to his audience the need for action against the colonies.

D) notify his audience about recent developments in the colonies.

**11**

As used in lines 10, 23, and 28, "object" most nearly means

A) goal.

B) entity.

C) concern.

D) topic.

**12**

According to George III in Passage 1, what would happen if Britain failed to put down the rebellion in the colonies?

A) Britain's European rivals would attempt to seize control of the colonies.

B) The British monarchy would lose its authority and reputation both at home and abroad.

C) The liberty and prosperity of British subjects around the world would be curtailed.

D) Other British colonies would be endangered and economic activity would be disrupted.

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13

The questions that Price asks in lines 43-47 of Passage 2 primarily serve to

A) raise doubts about George III's fitness to rule the colonies.

B) emphasize that the colonies have not harmed Britain.

C) reveal inconsistencies in Britain's actions toward the colonies.

D) highlight the ambiguous nature of the colonies' intentions.

14

In context, the words "kind" (line 70) and "kinder" (line 72) help create what kind of tone in Passage 2?

A) A gentle tone that reinforces Price's sympathy for British leaders

B) A sarcastic tone that undercuts the British position toward the colonies

C) A passionate tone that exaggerates the consequences of a war between Britain and the colonies

D) An appeasing tone that encourages reconciliation between Britain and the colonies

15

Based on Passage 2, how would Price most likely have responded to George III's claim about the "calamities of war" (line 39, Passage 1)?

A) By pointing out that Britain rather than the colonies is the aggressor

B) By arguing that the colonies could not win a military struggle with Britain

C) By citing the widespread opposition to war on the part of the British public

D) By noting that the colonists are not the first British subjects to violently reject George III's rule

16

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

A) Lines 41-43 ("One . . . Colonies")

B) Lines 45-47 ("Have . . . sacred")

C) Lines 49-52 ("We have . . . towns")

D) Lines 64-65 ("It has . . . war")

17

Based on Passage 1, George III would most likely say that Price's discussion of British views in the final paragraph of Passage 2 overlooks the fact that

A) monarchy is the only legitimate form of government.

B) the colonies already have more freedom than they should.

C) Britain intends for the colonies to eventually govern themselves.

D) the leaders of the rebellion are authoritarian and power hungry.

18

Which choice provides the best evidence that George III holds the belief that Price describes in lines 65-69, Passage 2 ("Many . . . hands")?

A) Lines 9-13 ("But so . . . country")

B) Lines 13-18 ("they . . . States")

C) Lines 27-29 ("In this . . . subjects")

D) Lines 29-31 ("No people . . . Provinces")

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**Questions 19-28 are based on the following passage and supplementary material.**

This passage is adapted from Virginia Morell, "Your Dog Is a Copycat." ©2013 by American Association for the Advancement of Science.

The next time your dog digs a hole in the backyard after watching you garden, don't punish him. He's just imitating you. A new study reveals that our canine pals are capable of copying our behavior as long as 10 minutes after it's happened. The ability is considered mentally demanding and, until this discovery, something that only humans and apes were known to do.

Researchers Claudia Fugazza and Ádám Miklósi worked with eight adult pet dogs that ranged in age from 2 to 10 years old and their owners. The canines were all females of various breeds—border collies, a Yorkshire terrier, a Shetland sheepdog, a Czechoslovakian wolfdog, and one mixed breed. The owners trained their dogs using the "Do as I do" method. For instance, an owner would tell her dog to "Stay," and then command, "Do as I do," whereupon the owner might walk around a traffic cone, or put her head in a bucket placed on the ground, or ring a bell suspended from a bar. After returning to her dog, the owner would wait 5 seconds, and then command, "Do it!" The dog was expected to copy her owner's behavior.

To see how long the dogs retained the memory, the owners were then asked to add another step to the test. After demonstrating the behavior, they walked their pets behind a screen 14 meters away that hid the cone or other experimental object, so that the animals wouldn't continue to look at it. Then they waited for up to 30 seconds before returning to the starting position and saying "Do it!" "We just kept slowly increasing the time between the demonstration and the 'Do it!' command," Fugazza explains.

Once the dogs could imitate the behavior twice in a row after waiting for 30 seconds, they were ready for the testing phase. Each dog was given 19 tests in eight different conditions—including copying a familiar action, a novel action, and a distracting action. All the dogs were shown the same novel action to imitate: Each one watched her owner enter a wooden box. This time, they were expected to wait behind the screen for one full minute, before returning to the starting position and being told "Do it!" For the distracting action tests, the dogs watched the owner do something they had seen before. Again, they were led behind the screen, but this time commanded to lie down or fetch a ball. The waiting periods during these sessions lasted from 30 seconds to 4 minutes.

The dogs endured their longest breaks after watching a familiar action—with times varying from 24 seconds to 10 minutes. "They can wait even longer," Fugazza says, "but we really don't expect the owners to stay behind the screen for an hour!" The dogs also showed their smarts by repeating the action that they'd witnessed, even when a person other than the demonstrator and who did not know which action the dog was expected to copy gave the "Do it!" command. All the dogs completed 18 trials, scoring almost perfect marks; six dogs made one error each, one dog made two, and another made six mistakes. "The statistical results are very robust," Fugazza says, "and they show the dogs can do deferred imitation." This suggests, she adds, that dogs have declarative memory—long-term memory about facts and events that can be consciously recalled. Until now, only humans have been shown to have this type of memory.

"It is a very nice demonstration of deferred imitation in dogs," says Frans de Waal, a primatologist at Emory University in Atlanta, who suggests that now that this ability has been found in our canid pals, it's likely to be found in many other animals. Still, the discovery will likely be a surprise to even the most experienced dog trainers, says Brian Hare, a comparative psychologist at Duke University in Durham, North Carolina. "I doubt that they would have predicted that dogs can learn new actions by observing what a human does, remembering the actions, and then repeating those actions, after translating them to their own doggy body plan." And while de Waal agrees with the researchers that the dogs must be using declarative memory to do this type of imitation, Hare and others are less certain. "That's the weakest part of the study," says Jonathon Crystal, a comparative psychologist at Indiana University, Bloomington. "But the evidence for delayed imitation is solid and impressive."

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**Figure 1**

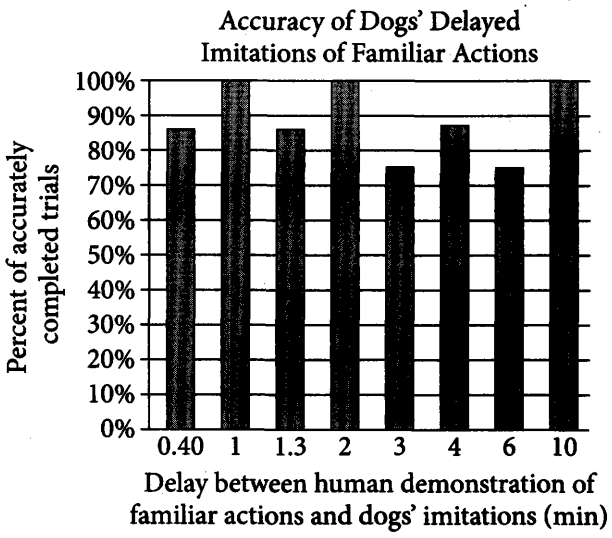
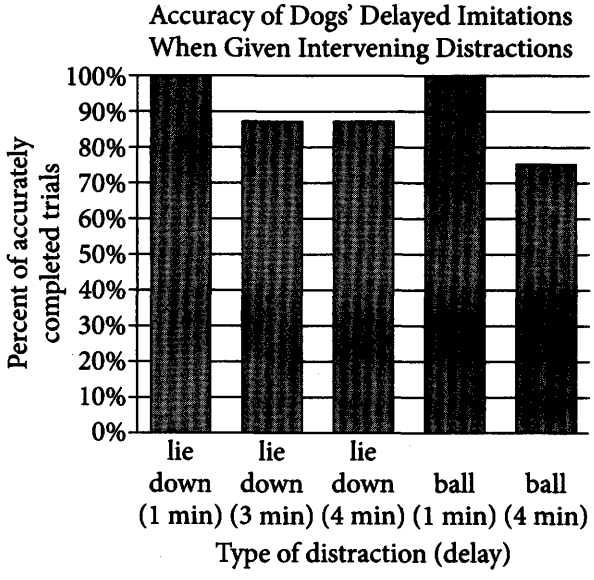



**Figure 2**




Figures adapted from Claudia Fugazza and Ádám Miklósi, "Deferred Imitation and Declarative Memory in Domestic Dogs." ©2013 by Springer-Verlag.

**19**

The main purpose of lines 1-5 ("The next . . . happened") is to

A) suggest that a study provides a way to correct an unwanted behavior.

B) illustrate the main finding of a study by means of a familiar image.

C) offer an amusing anecdote that exemplifies the problem a study was designed to solve.

D) introduce a study of a phenomenon by describing the common view of that phenomenon.

**20**

According to the author, imitating a behavior witnessed in the past is a skill that

A) serves a practical purpose for many species.

B) has been observed in only a few species.

C) must be practiced extensively to be retained.

D) has only recently been studied scientifically.

**21**

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

A) Line 3 ("He's just . . . you")

B) Lines 3-5 ("A new . . . happened")

C) Lines 5-8 ("The ability . . . do")

D) Lines 9-11 ("Researchers . . . owners")

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22

The second, third, and fourth paragraphs (lines 9-50) primarily serve to

A) summarize the results of Fugazza and Miklósi's study.

B) describe the hypotheses that Fugazza and Miklósi tried to evaluate in their study.

C) provide an overview of the assumptions that Fugazza and Miklósi made during their study.

D) explain the design and procedures of Fugazza and Miklósi's study.

23

As used in line 38, "conditions" most nearly means

A) influences.

B) situations.

C) requirements.

D) limitations.

24

According to the passage, one finding of Fugazza and Miklósi's research is that a dog can imitate an action it has seen a person perform even if the dog

A) sees a distracting action performed at the same time as it sees the action to be imitated.

B) has seen the action performed only by someone other than its owner.

C) must wait more than one hour between imitating one action and imitating a second action.

D) is directed to do so by someone other than the person who performed the action.

25

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

A) Lines 42-45 ("This . . . Do it!")

B) Lines 45-46 ("For the . . . before")

C) Lines 53-55 ("They . . . hour")

D) Lines 56-60 ("The dogs . . . command")

26

As used in line 68, "recalled" most nearly means

A) beckoned.

B) recollected.

C) withdrawn.

D) repealed.

27

The data presented in figure 1 best support which conclusion?

A) In general, the longer it took humans to perform the demonstrations, the less willing the dogs were to perform their imitations.

B) Dogs' imitations were most likely to be accurate if they were performed immediately following the humans' demonstrations.

C) Increasing the delay between humans' demonstrations and dogs' imitations did not necessarily decrease the dogs' accuracy.

D) Dogs typically performed their imitations in less time than it took humans to perform their demonstrations.

28

Taken together, figure 1 and figure 2 show that dogs' imitations after a 3-minute delay were

A) more accurate after the dogs were distracted than after they were not distracted.

B) less accurate than they were at any other point during the trials.

C) made more accurate if the dogs were given a ball than if they were not.

D) unchanged in their accuracy when a distraction was introduced.

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**Questions 29-38 are based on the following passage and supplementary material.**

This passage is adapted from Leonard Mlodinow, *The Drunkard's Walk: How Randomness Rules Our Lives.* ©2008 by Leonard Mlodinow.

The conventional marketing wisdom in what sociologists call the cultural industries—books, film, art, music—is that success is achieved by anticipating consumer preference. In this view the most productive way for executives to spend their time is to study what it is about the likes of Stephen King, Madonna, or Bruce Willis that appeals to so many fans. They study the past and have no trouble extracting reasons for whatever success they are attempting to explain. They then try to replicate it.

That is the deterministic view of the marketplace, a view in which it is mainly the intrinsic qualities of the person or the product that governs success. But there is another way to look at it, a nondeterministic view. In this view there are many high-quality but unknown books, singers, actors, and what makes one or another come to stand out is largely a conspiracy of random and minor factors—that is, luck. In this view the traditional executives are just spinning their wheels.

Thanks to the Internet, this idea has been tested. The researchers who tested it focused on the music market, in which Internet sales are coming to dominate. For their study they recruited 14,341 participants who were asked to listen to, rate, and if they desired, download 48 songs by bands they had not heard of. Some of the participants were also allowed to view data on the popularity of each song—that is, on how many fellow participants had downloaded it. These participants were divided into eight separate "worlds" and could only see the data on downloads of people in their own world. All the artists in all the worlds began with zero downloads, after which each world evolved independently. There was also a ninth group of participants, who were not shown any data. The researchers employed the popularity of the songs in this latter group of insulated listeners to define the "intrinsic quality" of each song—that is, its appeal in the absence of external influence.

If the deterministic view of the world were true, the same songs ought to have dominated in each of the eight worlds, and the popularity rankings in those worlds ought to have agreed with the intrinsic quality as determined by isolated individuals. But the researchers found exactly the opposite: the popularity of individual songs varied widely among the different worlds, and different songs of similar intrinsic quality also varied widely in their popularity. For example, a song called "Lockdown" by a band called 52metro ranked twenty-six out of forty-eight in intrinsic quality but was the number-1 song in one world and the number-40 song in another. In this experiment, as one song or another by chance got an early edge in downloads, its seeming popularity influenced future shoppers. It's a phenomenon that is well-known in the movie industry: moviegoers will report liking a movie more when they hear beforehand how good it is. In this example, small chance influences created a snowball effect and made a huge difference in the future of the song.

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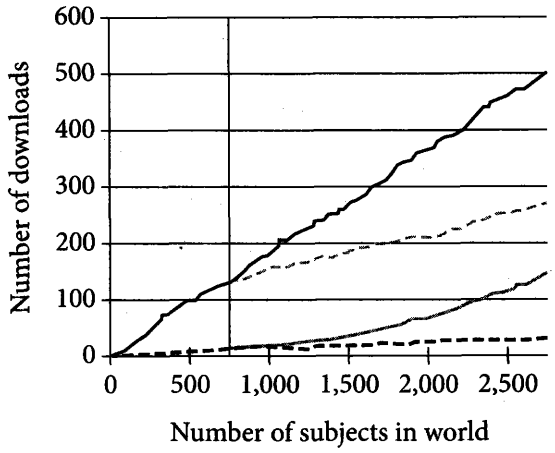
Number of Downloads of Most and Least Popular Songs When Participants Saw Actual versus Reversed Popularity of Songs




| | |
|---|---|
| ——— | Song A (song #1 in true popularity world) |
| - - - - - | Song A (song #48 in reversed popularity world) |
| - - - - - | Song B (song #48 in true popularity world) |
| ——— | Song B (song #1 in reversed popularity world) |

Adapted from David Vandivier, "Rock and Roll, Economics, and Rebuilding the Middle Class." Originally published in 2013.

In this portion of the experiment, all of the first 750 participants saw the true popularity rankings of songs. But after these initial participants had joined the world (at the point indicated by the vertical line), half of all new participants saw a true ranking of the songs' popularity, while the other half of new participants saw a reversed ranking, in which the song that was most popular among the initial participants (Song A) was ranked #48 and the song that was least popular among the initial participants (Song B) was ranked #1.

29

The author most strongly suggests that the analyses of popularity that executives in cultural industries typically offer are

A) inconsistent and developed without concern for practical application.

B) subjective and reliant on self-serving interpretations.

C) unvarying and not based on any historical data.

D) superficial and impossible to evaluate experimentally.

30

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

A) Lines 1-4 ("The conventional . . . preference")

B) Lines 4-8 ("In this . . . fans")

C) Lines 8-10 ("They . . . explain")

D) Lines 11-13 ("That . . . success")

31

As used in line 13, "governs" most nearly means

A) determines.

B) administers.

C) imposes.

D) legislates.

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CONTINUE

32

Based on the passage, proponents of the nondeterministic view of the cultural marketplace would most likely agree with which statement about commercially successful cultural products?

A) They share few characteristics with unsuccessful cultural products.

B) They better reflect the tastes and interests of the public than do unsuccessful cultural products.

C) They are marketed more enthusiastically than are unsuccessful cultural products.

D) They may not be of greater quality than are unsuccessful cultural products.

33

Information provided in lines 24-27 ("For their . . . heard of") helps to defend the researchers' work from which potential criticism?

A) The data reveal how people behave in an artificial world but not necessarily how people behave in the real world.

B) The results are influenced by participants' prior attitudes toward the bands rather than by popularity rankings or intrinsic quality.

C) The musical tastes of the participants in the intrinsic quality world may not be reflective of the musical tastes of the participants in the other worlds.

D) The fact that participants favored songs that were already popular does not mean that those participants' true preferences were for other, less popular songs.

34

As used in line 44, "agreed with" most nearly means

A) shared the view of.

B) compromised with.

C) been suitable for.

D) coincided with.

35

It can most reasonably be inferred that in the eight worlds where the number of downloads was visible, songs that became popular near the beginning of the experiment tended to

A) remain popular for the duration of the experiment.

B) be popular in a majority of those eight worlds.

C) drop in popularity near the end of the experiment.

D) have lower intrinsic quality ratings than songs that were not popular.

36

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

A) Lines 32-34 ("All the . . . independently")

B) Lines 45-50 ("But the . . . their popularity")

C) Lines 50-54 ("For example . . . another")

D) Lines 54-56 ("In this . . . shoppers")

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37

According to the graph, what happened after Song B was presented to half the new participants as the most downloaded song?

A) Song A and Song B underwent a drop in the rate at which they were downloaded.

B) Participants stopped downloading Song A for most of the remainder of the experiment.

C) There was an evident increase in the number of times Song B was downloaded.

D) Participants who saw the true popularity rankings nevertheless began to favor Song B over Song A.

38

The marketing executives described in the passage would most likely attribute the difference seen in the graph in the number of downloads of Songs A and B when 500 subjects had joined the world to

A) the effect of chance influences on the reception of both songs.

B) the ease with which participants could categorize both songs.

C) Song B's similarity to other popular songs.

D) the higher intrinsic quality of Song A.

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**Questions 39-47 are based on the following passage.**

This passage is adapted from Amina Khan, "Hot Jupiters Hold Surprisingly Little Water, Study Finds." ©2014 by Los Angeles Times.

Planetary scientists searching for water on three distant gas giants that resemble Jupiter have come up dry. Scientists who trained NASA's Hubble Space Telescope on these three "hot Jupiters" have discovered that they have far less water vapor than previously thought.

The findings, published in the Astrophysical Journal Letters, show that current theories on how such planets form and migrate may not hold much water—much like the planets themselves.

"This is just a baby step in measuring the composition of other planets outside the solar system," said study co-author Peter McCullough, a planetary scientist at the Space Telescope Science Institute in Baltimore. "We don't even really understand the Earth—and we live on it."

Using the Hubble Space Telescope, the scientists examined the atmospheres of three gas-giant planets orbiting searingly close to their respective home stars: HD 189733b, HD 209458b and WASP-12b, which sit between 60 and 900 light-years from Earth.

Even though hot Jupiters don't host life-friendly environments, they're great for searching for water. With surface temperatures between 1,500 and 4,000 degrees Fahrenheit, the planet's water ends up in the atmosphere as vapor, making it easier for space telescopes to observe. (Ironically, we still don't know how much water is in our own nearby gas giant, Jupiter, McCullough said—it's so cold that all the water sinks down into the planet, far out of sight.)

To study the planets' water content, the researchers observed each planet while it passed in front of its star, blocking some of its star's light. Some starlight also passes through the planet's atmosphere, where water molecules absorb certain wavelengths.

In wavelengths of light where water leaves its fingerprint, the star looks dimmer. In wavelengths where water molecules don't absorb light, the star shouldn't look as dim.

Sure enough, the star was indeed dimmer in the water-absorbing wavelengths than it was in other parts of the light spectrum—but it wasn't nearly as dim as they had suspected. The planet had a little water, but not enough to significantly lower the star's light.

The water abundance was on the order of a tenth to a thousandth of the level they had expected, given current models of planet formation.

"The very low water vapor levels we measure challenge our understanding of the chemistry involved in planet formation," study co-author Nicolas Crouzet of the University of Toronto said in an email.

So does this mean there's less water in alien planets all around? Probably not, McCullough said—the abundance on hot gas giants doesn't necessarily have much to do with the water abundance on small rocky planets. It's an apples-to-oranges comparison.

Björn Benneke, a Caltech planetary scientist who did not work on the paper, said it's also possible that the water content was obscured by haze or clouds on the hot Jupiters' surfaces.

But Benneke is working with McCullough and others to use the same technique on super-Earths, to learn more about the atmospheres of this strange class of planets, which have no analogy in our own solar system.

"I think the super-Earths will be more exciting because they are [among] the most frequent planets in the galaxy but we have no examples in the solar system," Benneke said. Studying these planets will be more difficult, because they're not as big as the gas giants, he said. But further study could help reveal whether these strange, massive planets are more like the gas giants, or more like smaller, rocky planets—the kind that could potentially host life as we know it.

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CONTINUE

9

The passage indicates that which statement about the hot Jupiters is FALSE?

A) They have atmospheres that contain water vapor.
B) They are relatively close to their home stars.
C) They are gas planets outside of the solar system.
D) They have environments that can potentially support life.

10

Which choice best supports the claim that many questions about planets outside of our solar system still remain unanswered?

A) Lines 1-3 ("Planetary . . . dry")
B) Lines 3-6 ("Scientists . . . thought")
C) Lines 7-10 ("The findings . . . themselves")
D) Lines 22-23 ("Even . . . water")

11

The author includes the parenthetical remark in lines 27-31 most likely to

A) describe a circumstance that will be corrected in the future.
B) call attention to a fact that might seem incongruous.
C) give an example of a question that scientists still struggle to answer.
D) contrast the differences in the results of several scientific studies.

12

As used in line 32, "content" most nearly means

A) form.
B) information.
C) significance.
D) amount.

13

According to the passage, McCullough and Crouzet's assumption about the water present on hot Jupiters was contradicted by which evidence?

A) In the water-absorbing wavelengths, the gas giants' home stars appeared brighter than expected.
B) In the water-absorbing wavelengths, light from the home stars was not sufficiently visible.
C) In the water-absorbing wavelengths, the difference in the brightness of the three home stars was greater than expected.
D) The water molecules in the gas giants' atmospheres absorbed more light than expected.

14

As used in line 51, "low" most nearly means

A) slight.
B) soft.
C) deep.
D) crude.

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CONTINUE

45

Based on the passage, which choice best describes the probable significance of McCullough and Crouzet's findings with respect to the water content on hot Jupiters?

A) Their findings suggest that alien planets contain less water vapor than scientists had expected.

B) Their findings suggest that Jupiter contains a fraction of the amount of water that scientists had calculated.

C) Their findings suggest that scientists' working models of planet formation may need to be revised.

D) Their findings suggest that hot Jupiters are losing water content more rapidly than scientists had predicted.

46

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

A) Lines 11-15 ("This . . . Baltimore")

B) Lines 45-47 ("The planet . . . light")

C) Lines 51-55 ("The very . . . email")

D) Lines 56-60 ("So does . . . planets")

47

The passage best supports which statement about super-Earths?

A) Super-Earths are larger than Earth and smaller than hot Jupiters.

B) Super-Earths are more similar to gas giants than they are to small rocky planets.

C) Super-Earths are rarely found in the galaxy.

D) Super-Earths are difficult to identify because they are not present in our solar system.

# STOP

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

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**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.**

### Broadway Sings a New Tune

In the early 1940s, the plots of Broadway musicals were often frivolous and extravagant, little **1** more than excuses for song-and-dance numbers. Serious plots were reserved for dramatic **2** productions, these always

**1**

A) NO CHANGE
B) more than, excuses
C) more, than excuses,
D) more then excuses

**2**

A) NO CHANGE
B) productions, which
C) productions; that
D) productions of which

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CONTINUE

lacked music. A turning point in the musical 3 genre; however, came with Richard Rodgers and Oscar Hammerstein II's 4 *Oklahoma!* Fusing high operatic style and a folksy tone, 5 Oklahoma Territory, which provided the early twentieth-century setting for the show about farmers and cowherds, would find wild success in theaters around the world and also pave the way for this

3

A) NO CHANGE
B) genre, however;
C) genre—however—
D) genre, however,

4

The writer is considering revising the underlined portion to the following.

> *Oklahoma!*—the first musical to feature a sophisticated story served by music and dance elements.

Should the writer make this revision?

A) Yes, because it adds information to support the claim made earlier in the sentence.
B) Yes, because it offers an example of the idea expressed in the first sentence of the paragraph.
C) No, because it blurs the focus of the paragraph by introducing irrelevant information.
D) No, because it makes assertions that are repeated in the next sentence.

5

A) NO CHANGE
B) the show about farmers and cowherds in early twentieth-century Oklahoma Territory
C) early twentieth-century Oklahoma Territory, where the show about farmers and cowherds was set,
D) the show's farmers and cowherds, set in early twentieth-century Oklahoma Territory,

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CONTINUE

new kind of musical to become a permanent fixture 6 on American theater.

Traditionally, the melodies for Broadway songs had been written before the lyrics. This approach reflected the importance of creating memorable tunes and the relative insignificance of plot and characterization. Successful songs in this conventional style featured witty lyrics that bore the lyricist's 7 stamp. It didn't matter which character sang them. Rodgers and Hammerstein had each worked on such shows before, but they felt that their new musical, based on Lynn Riggs's play *Green Grow the Lilacs*, required a different approach.

6

A) NO CHANGE
B) to
C) in
D) with

7

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

A) stamp, but which character sang them did not matter.
B) stamp, and this allowed for any character being able to sing them.
C) stamp no matter which character sang them.
D) stamp, this meaning that any character could sing them.

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CONTINUE

Although *Oklahoma!* tells a simple story with many lighthearted moments, there are also serious conflicts, 8 such as a joyous celebration in song and dance of the urban life of Kansas City. To do the plot justice, Rodgers and Hammerstein discussed the psychology and motivations of the characters. They decided that this time, the song lyrics would be the most important element, witty enough to be entertaining but profound enough to tell an emotional story. The songs they wrote were expressions of the characters' feelings and personalities. 9 For example, in listening to the song "People Will Say We're in Love," audiences were captivated not by the lyrics' cleverness but by the heartfelt romance between the two main characters.

8

The writer wants to make sure that the underlined portion offers the most relevant example. Which choice most effectively accomplishes this goal?

A) NO CHANGE
B) including a fight between the protagonist Curly and his nemesis.
C) most notably a ballet sequence in which the heroine, Laurey, dreams of romance.
D) in particular, a dance number that features farmers and cowherds mingling without tension.

9

A) NO CHANGE
B) However,
C) On the other hand,
D) Fortunately,

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CONTINUE

[1] When it premiered in March 1943, *Oklahoma!* was expected to be a flop. [2] It featured no famous actors; it also lacked the slapstick and escapist elements found in other musicals. [3] However, it **10** snatched something more profound with its story of romance in the American West. [4] The musical was a success from opening night: it ran on Broadway for five years, and a company toured the country with the show for another ten. [5] Through its innovative integration of plot, music, and dance, *Oklahoma!* had pioneered a new form of art: the modern Broadway musical. [6] It also found success in England, South Africa, and Australia. **11**

**10**

A) NO CHANGE
B) captured
C) apprehended
D) seized

**11**

To make this paragraph most logical, sentence 6 should be placed

A) where it is now.
B) after sentence 2.
C) after sentence 3.
D) after sentence 4.

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CONTINUE

**Questions 12-22 are based on the following passage.**

**Stray Sled Dogs**

In 2005 Danny Melville, owner of a company that offers adventure packages to tourists visiting his home country of Jamaica, wanted to add dune buggy tours to the horseback-riding adventures he already offered. During a trip to Canada to buy dune buggies, he stumbled—literally—into something completely different. Melville tripped over what looked to him like a simple metal frame with wheels. When he learned that the frame was actually a cart used to train sled 12 dogs; Melville had a stroke of inspiration: 13 he could rescue stray dogs in Jamaica and train them to pull carts like the one he had just tripped over.

12

A) NO CHANGE
B) dogs,
C) dogs.
D) dogs, then

13

The writer wants to complete the sentence with a statement of the main idea of the passage. Which choice best accomplishes this goal?

A) NO CHANGE
B) the world of competitive dogsled racing might be appealing to people on his staff, especially Newton Marshall.
C) dogsleds can be used on dry land, not just on snow.
D) dune buggies might not be the best fit for his tourism business.

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CONTINUE

Melville had always been an animal lover and was aware of the serious problems Jamaica was **14** facing. These problems were with stray dog populations. Tourists and residents alike had long complained about the stray **15** dogs. Melville believed the publicity that could be generated by training a team of strays to pull a dogsled cart would help call attention to the problem. His efforts, **16** they hoped, would simultaneously help raise money for the Jamaica Society for the Prevention of Cruelty to Animals and **17** grow his tourism business at the same time.

**14**

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

A) facing and the problems
B) facing that included ones
C) facing
D) facing, and those were

**15**

The writer is considering revising the underlined portion to the following.

> dogs, which were both a nuisance and a public health hazard.

Should the writer make this revision?

A) Yes, because it refutes a possible objection to Melville's plan.
B) Yes, because it provides details that explain a claim made in the sentence.
C) No, because it contradicts facts presented later in the passage.
D) No, because it distracts from the paragraph's discussion of Melville's plan.

**16**

A) NO CHANGE
B) one
C) he
D) we

**17**

A) NO CHANGE
B) in the same moment grow his tourism business.
C) also grow his tourism business as well.
D) grow his tourism business.

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CONTINUE

With this inspiration, Melville returned to Jamaica and went to animal rescue organizations to look for dogs that could be trained for mushing (pulling dogsleds). He selected dogs for a team and brought them to his **18** companies headquarter's on the north coast of the island. The dogs **19** had had little or no exposure to people. Many had never heard a kind word, and none had trained to work as part of a team with other dogs and a musher (the person who drives the dogsled). **20** Likewise, offered this unlikely chance, the dogs responded eagerly. With a lot of patience, a little discipline, and more than a few ear rubs, Melville and his staff turned the strays into a happy, cohesive unit. Soon the team of dogs was pulling sleds of tourists through the Jamaican terrain.

**18**

A) NO CHANGE
B) company's headquarters
C) company's headquarters'
D) companies headquarters

**19**

A) NO CHANGE
B) have had
C) will have had
D) have

**20**

A) NO CHANGE
B) Otherwise,
C) Instead,
D) However,

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CONTINUE

Simply having these "sun dogs," as they became known, as part of a tourist attraction, however, was not enough for Melville. He wanted to get involved in dogsled competitions around the world. The culmination of Melville's project came in 2010, when Newton 21 Marshall—a musher who worked for Melville, became the first Jamaican to complete the 1,100-mile Iditarod sled dog race in Alaska. Although Marshall raced with a borrowed team of dogs and placed only forty-seventh out of seventy-one mushers, he was able to generate a lot of publicity. 22

21

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

22

The writer would like to add a conclusion that shows an important outcome of the "sun dogs" project. Which choice best accomplishes that objective?

A) Marshall returned to the Iditarod in subsequent years, but he did not manage to complete the grueling course again until 2014.
B) Marshall's love of animals had taken him from his humble beginnings as a groom working with horses to the heights of international sports.
C) Melville, in turn, was able to redirect some of that attention and publicity to meet his personal goals of increasing awareness of and raising money for the care of Jamaica's stray dogs.
D) Despite the efforts of men like Marshall and Melville, Jamaica still suffers from problems stemming from the overpopulation of stray dogs.

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

**Booking It: Travel Agencies in the Digital Economy**

The rise of online travel agencies (OTAs) such as Expedia, Orbitz, and Kayak 23 have been seen by many as an indication that the traditional travel agency is a relic of the past. Traditional travel agencies—retail locations that customers can visit or call to have trips booked for 24 them, have indeed struggled in the Internet era. Whereas there were 34,000 retail travel agencies operating in the United States in the mid-1990s, when OTAs first 25 emerged, there were only 13,000 such businesses in October 2013.

23

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

24

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

25

A) NO CHANGE
B) occurred,
C) commenced,
D) transpired,

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CONTINUE

26 As a consequence, travel agencies are still major players in the US travel market, reporting $95 billion in sales in 2011. What accounts for this continuing flow of money to traditional travel agencies? Competition from OTAs, 27 sights that allow consumers direct access to information that used to be available only to professionals, has led to an important shift in the industry. The traditional travel agencies that have managed to 28 survive, thrive, and prosper are those that provide specialized travel experiences rather than simply booking routine trips for their busy clients.

A) NO CHANGE
B) Subsequently,
C) Nevertheless,
D) Rather,

A) NO CHANGE
B) sites
C) cites'
D) cites

A) NO CHANGE
B) survive, prosper, and succeed
C) survive and thrive
D) prosper and succeed

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CONTINUE

29 The impact of the Internet on the travel industry is one that can hardly be overstated. For example, one agency in California drastically increased its revenue by focusing primarily on cruises. By establishing contacts with particular cruise and tour operators, this agency 30 is capable to offer its customers special rates and package combinations. Another approach some agencies take is to cater to specific kinds of customers, such as sports fans hoping to get flights, hotels, and tickets to the big game from a single vendor.

29

The writer wants to begin the paragraph with a sentence that introduces the paragraph's main focus. Which choice most effectively accomplishes this goal?

A) NO CHANGE
B) Some travelers enjoy using Internet resources to design their own itineraries.
C) The new formula for success usually involves exploiting a niche market in some fashion.
D) Most travelers still tend to make their own travel arrangements online.

30

A) NO CHANGE
B) has the capacity of offering
C) has capability for offering
D) is able to offer

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CONTINUE

With the spread of these new approaches, the industry appears to be making a comeback. Data from a number of studies indicate that people are beginning to use traditional travel agencies more frequently. In 2012, more than 20 percent of people responding to a survey said that they were more likely than in previous years to call a travel agency when booking a trip. A study published in the *Journal of Travel Research* highlights this shift, **31** it shows that between 2007 and 2012, while the use of the Internet as a source of information for booking travel remained generally constant, the use of traditional travel agencies **32** decreased by more than 25 percent.

Percent of People Surveyed Using Different Sources of Information for Booking Travel

| | Internet | Traditional travel agencies |
|---|---|---|
| 2007 | 85.3% | 23.2% |
| 2008 | 85.2% | 23.1% |
| 2009 | 85.1% | 20.9% |
| 2010 | 86.2% | 29.8% |
| 2011 | 87.7% | 32.3% |
| 2012 | 85.5% | 29.3% |
| Percent change (2007–2012) | 0.2% increase | 26.3% increase |

Adapted from Zheng Xiang et al., "Adapting to the Internet: Trends in Travelers' Use of the Web for Trip Planning." ©2014 by Sage Publications.

A) NO CHANGE
B) this shows
C) shows
D) showing

Which choice most accurately reflects the information found in the table?

A) NO CHANGE
B) increased by more than
C) decreased by less than
D) never exceeded

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CONTINUE

In order to be successful today, traditional travel agencies must consider what they can offer customers that an OTA cannot. It is those agencies that have specialized in booking the kinds of travel experiences that are not easily purchased on a popular OTA that 33 have the most to fear from the rise of the OTA.

33

The writer wants a conclusion that accurately reflects the discussion of travel agencies in the passage. Which choice best accomplishes this goal?

A) NO CHANGE
B) should consider placing their services online.
C) continue to provide value to customers today.
D) are most likely to become obsolete in the near future.

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CONTINUE

**Questions 34-44 are based on the following passage.**

**Trackers Are for the Birds**

After miniature satellite transmitters were developed in the 1990s, ornithologists made significant strides in researching the migratory paths of some species of birds. However, the **34** transmitters weighed about 15 grams. They were too heavy for many migrating birds, such as songbirds. **35** Nonetheless, ornithologists were unable to collect detailed data on the migratory paths of these small birds. **36** The inability of the small birds to carry the transmitters hampered the ornithologists. Much of their research was based on imprecise measurements and, consequently, **37** leaving many questions unanswered.

**34**

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

A) transmitters weighed about 15 grams, that being
B) transmitters—their weight being about 15 grams—were
C) transmitters, weighing in at about 15 grams in weight, were
D) transmitters, which weighed about 15 grams, were

**35**

A) NO CHANGE
B) Along those lines,
C) As a result,
D) On the other hand,

**36**

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

A) Kept, because it provides an essential explanation.
B) Kept, because it sets up the main topic of the passage.
C) Deleted, because it undermines the main discussion of the paragraph.
D) Deleted, because it unnecessarily restates information already provided.

**37**

A) NO CHANGE
B) left
C) having left
D) which left

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CONTINUE

This problem was solved in 2006, when researchers at British Antarctic Survey, the environmental research center leading the United Kingdom's scientific activities in the Antarctic, announced a major innovation in 38 ornithology: geolocators small enough to be used for tracking the travel paths of small migratory birds. These tracking devices, when attached to the birds, record changing levels of light as the birds travel. With the data collected from the geolocators, researchers are now able to closely trace migratory 39 patterns.

38

A) NO CHANGE
B) ornithology, geolocators:
C) ornithology, geolocators—
D) ornithology; geolocators

39

The writer is considering revising the underlined portion to the following.

> patterns, mapping the precise routes the birds follow and pinpointing the exact duration of the migration.

Should the writer make this revision?

A) Yes, because it reveals the information that researchers gain from tracking bird migrations.
B) Yes, because it gives technical information explaining exactly how the new geolocators work.
C) No, because it introduces information about migration routes that is unrelated to the passage.
D) No, because it does not explain why researchers need to know precise migration routes.

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CONTINUE

Weighing less than a gram each—as light as two grains of rice—the trackers are placed on the backs of birds. Geolocators can be this small because they simply need to record information rather than communicate with satellites in real time. The devices use photoreceptors to measure light levels with reference to an inbuilt clock. Scientists later recapture the birds carrying the geolocators, download the light-level data, 40 in addition to using a computer program to convert the figures to latitudes and longitudes.

40

A) NO CHANGE
B) as well as using
C) and they use
D) and use

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CONTINUE

[1] Knowledge of these coordinates 41 allow scientists to map a bird's precise speed and flight path. [2] Geolocators have for the first time enabled scientists to see just how fast some birds travel. [3] One purple martin, for example, flew over 4,650 miles from Brazil to Pennsylvania in just 13 days. [4] Data collected from the geolocators can also help scientists learn about environmental conditions of the places birds visit. [5] In one case, researchers observed that a wood thrush did not attempt 42 its usual 12-hour nonstop northbound crossing of the Gulf of Mexico, taking twice as long to fly over land instead. [6] Tracking such 43 disaccord in migration behaviors is an important part of research on environmental change and habitat loss. 44

Bridget Stutchbury, a professor of biology at York University, said the ability to know where birds go has changed scientists' research dramatically. "They would just disappear and then come back in the spring," she said of the migrating songbirds. "It's wonderful to now have a window into their journey."

41

A) NO CHANGE
B) have allowed
C) allows
D) are allowing

42

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

43

A) NO CHANGE
B) clashes
C) dissent
D) anomalies

44

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

A) where it is now.
B) before sentence 1.
C) after sentence 4.
D) after sentence 5.

# STOP

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

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# Math Test – No Calculator

## 25 MINUTES, 17 QUESTIONS

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

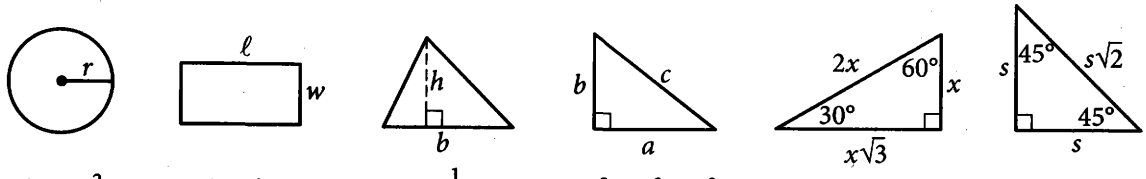
DIRECTIONS

**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

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

REFERENCE



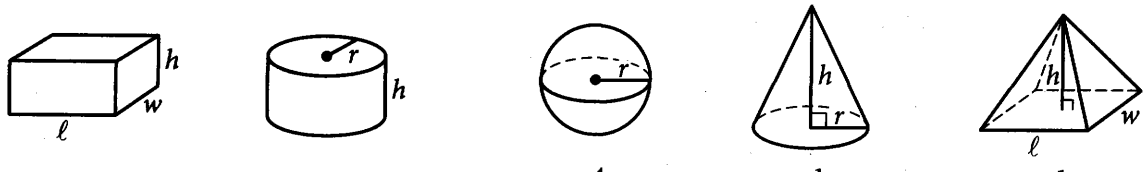

$A = \pi r^2$
$C = 2\pi r$

$A = \ell w$

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

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

Special Right Triangles




$V = \ell wh$

$V = \pi r^2 h$

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

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

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

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

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CONTINUE

1

Valentina bought two containers of beads. In the first container 30% of the beads are red, and in the second container 70% of the beads are red. Together, the containers have at least 400 red beads. Which inequality shows this relationship, where $x$ is the total number of beads in the first container and $y$ is the total number of beads in the second container?

A) $0.3x + 0.7y \geq 400$

B) $0.7x + 0.3y \leq 400$

C) $\frac{x}{3} + \frac{y}{7} \leq 400$

D) $30x + 70y \geq 400$

2

$$y = x^2 - 1$$
$$y = 3$$

When the equations above are graphed in the $xy$-plane, what are the coordinates $(x, y)$ of the points of intersection of the two graphs?

A) $(2, 3)$ and $(-2, 3)$

B) $(2, 4)$ and $(-2, 4)$

C) $(3, 8)$ and $(-3, 8)$

D) $(\sqrt{2}, 3)$ and $(-\sqrt{2}, 3)$

3

What is a solution of $16x - 4x + 18 = 12x + 6$ ?

A) $-12$

B) $1$

C) $12$

D) There are no solutions.

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CONTINUE

4

The speed of sound in dry air, $v$, can be modeled by the formula $v = 331.3 + 0.606T$, where $T$ is the temperature in degrees Celsius and $v$ is measured in meters per second. Which of the following correctly expresses $T$ in terms of $v$ ?

A) $T = \dfrac{v + 0.606}{331.3}$

B) $T = \dfrac{v - 0.606}{331.3}$

C) $T = \dfrac{v + 331.3}{0.606}$

D) $T = \dfrac{v - 331.3}{0.606}$

5

An empty shipping container is filled with boxes. The boxes are each of the same weight. The total weight $W$, in kilograms, of the shipping container after $x$ boxes have been loaded into it can be represented by the equation $W = 2{,}200 + 350x$. What does the number 2,200 represent in this context?

A) The weight, in kilograms, of a single box

B) The weight, in kilograms, of $x$ boxes

C) The weight, in kilograms, of the empty shipping container

D) The weight, in kilograms, of the full shipping container

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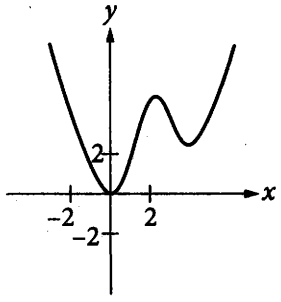
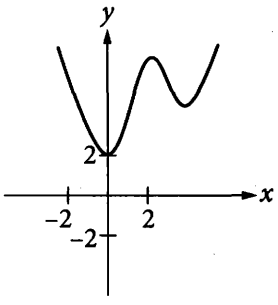
CONTINUE

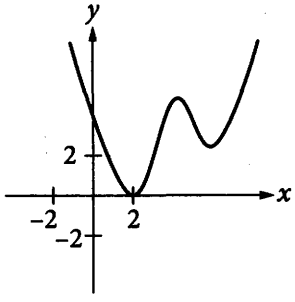



The graph of $y = f(x)$ is shown above. Which of the following could be the graph of $y = f(x) - 2$ ?

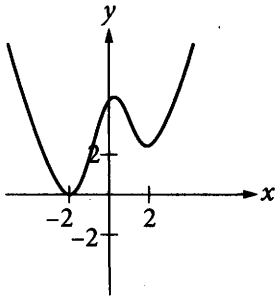
A)



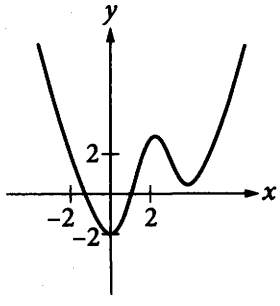

B)




C)




D)

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CONTINUE

7

Which of the following is equivalent to $a^2 + ab$ ?

A) $a^2(a+b)$

B) $a(a+b)$

C) $a^3b$

D) $ab$

8

$$3x - 9y = 18$$
$$x + 3y = 18$$

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

A) $(15, 3)$

B) $(12, 2)$ 36-14

C) $(6, 4)$ 18 - 36

D) $(0, 6)$ 3 - 56

9

$$p(t) = t^2 - 5$$
$$r(t) = 3t + 1$$
$$s(t) = 2t^2 + t - 5$$

The polynomial functions $p$, $r$, and $s$ are defined above. Which of the following is equivalent to $2p(t) + 3r(t) - 4s(t)$ ?

A) $-6t^2 + 5t + 13$

B) $-6t^2 + 10t - 9$

C) $-6t^2 + 13t - 27$

D) $-10t^2 - 13t - 33$

10

$$\sqrt[3]{x^3y^6}$$

Which of the following expressions is equivalent to the expression above?

A) $y^2$

B) $xy^2$

C) $y^3$

D) $xy^3$

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CONTINUE

11

Adam's school is a 20-minute walk or a 5-minute bus ride away from his house. The bus runs once every 30 minutes, and the number of minutes, $w$, that Adam waits for the bus varies between 0 and 30. Which of the following inequalities gives the values of $w$ for which it would be faster for Adam to walk to school?

A) $w - 5 < 20$

B) $w - 5 > 20$

C) $w + 5 < 20$

D) $w + 5 > 20$

12

$$y = ax^2 - c$$

In the equation above, $a$ and $c$ are positive constants. How many times does the graph of the equation above intersect the graph of the equation $y = a + c$ in the $xy$-plane?

A) Zero

B) One

C) Two

D) More than two

13

A science teacher is preparing the 5 stations of a science laboratory. Each station will have either Experiment A materials or Experiment B materials, but not both. Experiment A requires 6 teaspoons of salt, and Experiment B requires 4 teaspoons of salt. If $x$ is the number of stations that will be set up for Experiment A and the remaining stations will be set up for Experiment B, which of the following expressions represents the total number of teaspoons of salt required?

A) $5x$

B) $10x$

C) $2x + 20$

D) $10x + 20$

A or B

6 tsp

4.2x

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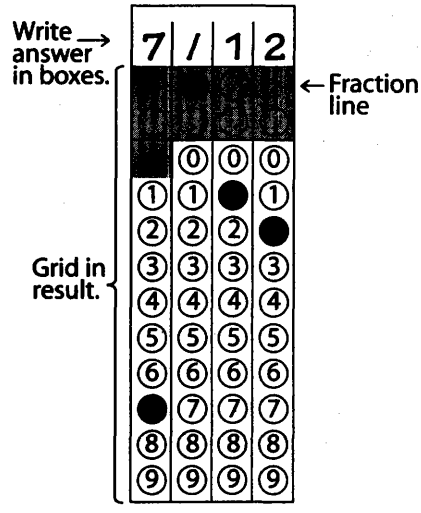
CONTINUE

DIRECTIONS

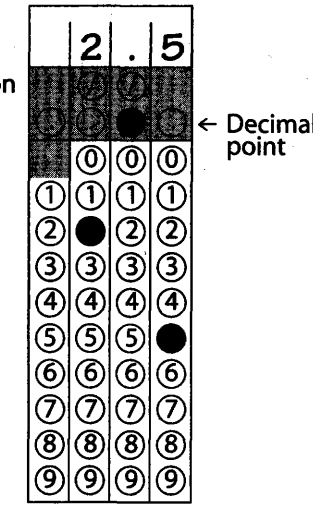
**For questions 14-17,** solve the problem and enter your answer in the grid, as described below, on the answer sheet.

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

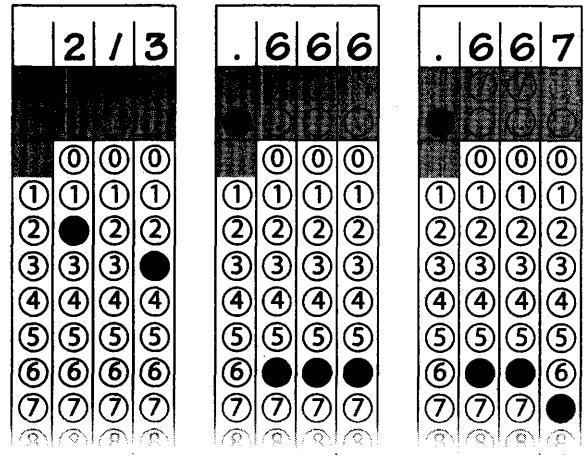
Answer: $\frac{7}{12}$



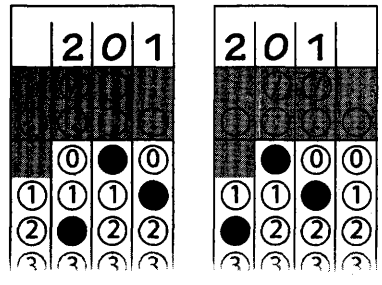

Answer: 2.5




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




Answer: 201 – either position is correct




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

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CONTINUE

**14**

At a used book sale, paperback books sell for \$3 each and hardback books sell for \$8 each. If Claude purchased 10 used books for a total cost of \$45 at the used book sale, how many hardback books did he purchase?

45

**15**

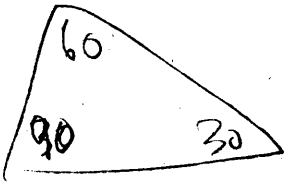
In the $xy$-plane, what is the slope of a line that is perpendicular to the line with equation $y + 2x = 3$ ?

$y = -2x + 3$

$\frac{1}{2}$

**16**

A triangle with angle measures 30°, 60°, and 90° has a perimeter of $18 + 6\sqrt{3}$. What is the length of the longest side of the triangle?




**17**

What is the positive solution of the equation $(2x + 1)^2 - (x + 13) = 3x^2 - 2x + 2$ ?

$2x^2 + 1 - x + 13 = 3x^2 - 2x + 2$

14

$x^2 - x - 12$

$6 \cdot -6$

$-4 \cdot 3$

$x^2 - 4 \quad x + 3$

$x = 4 \quad x = +3$

# STOP

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

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# Math Test – Calculator

## 45 MINUTES, 31 QUESTIONS

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

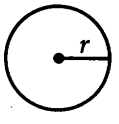
DIRECTIONS

**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.

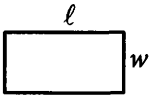
NOTES

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

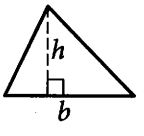
REFERENCE



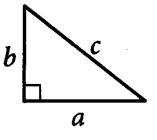

$A = \pi r^2$
$C = 2\pi r$



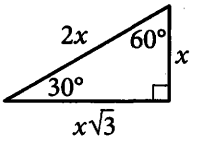

$A = \ell w$

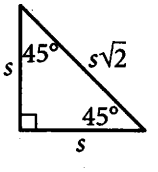



$A = \frac{1}{2}bh$

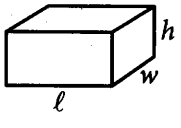



$c^2 = a^2 + b^2$

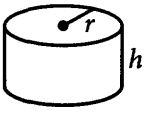


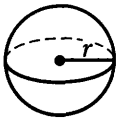

Special Right Triangles



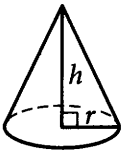

$V = \ell wh$



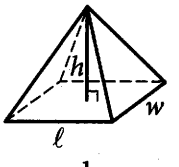

$V = \pi r^2 h$




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




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




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

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

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CONTINUE

On a certain map, 1 centimeter represents a distance of 10 kilometers. A length of 5 centimeters on the map represents how many kilometers?

A) 0.2
B) 0.5
C) 2.0
D) 50.0

$$(5x + 5y)(2x - 2y)$$

Which of the following is equivalent to the expression above?

A) $5x^2 - 2y^2$
B) $(5x - 2y)^2$
C) $10(x^2 - y^2)$
D) $10(x - y)^2$

$10x^2 - 10xy + 10xy$
$-10y^2$

| $x$ | $y$ |
|---|---|
| 1 | 15 |
| 2 | 45 |
| 3 | $a$ |

75

The table above may show linear growth or exponential growth for $y$ as a function of $x$, depending on the value of $a$. Which of the following statements best describes the increase from 45 to $a$ that would cause the table to show linear growth or exponential growth?

A) An increase of 30 would show linear growth, and an increase of 90 would show exponential growth.
B) An increase of 90 would show linear growth, and an increase of 30 would show exponential growth.
C) An increase of 75 would show linear growth, and an increase of 135 would show exponential growth.
D) An increase of 135 would show linear growth, and an increase of 75 would show exponential growth.

For what value of $w$ does $w - 10 = 2(w + 5)$ ?

A) 5
B) 0
C) −15
D) −20

$-5 = 20$
$-10 = 10$
$-25 \quad -20$
$-30$

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CONTINUE

**Questions 5-7 refer to the following information.**

A study was conducted on the production rates for a company that produces tractor wheels. The table below shows the number of wheels made during 11 consecutive one-hour production periods.

| One-hour period | Number of wheels made |
|---|---|
| A | 24 |
| B | 24 |
| C | 21 |
| D | 21 |
| E | 21 |
| F | 19 |
| G | 24 |
| H | 24 |
| I | 19 |
| J | 22 |
| K | 23 |

5

What is the range of the number of wheels made for the 11 one-hour periods?

A) 5.5
B) 5.0
C) 4.5
D) 4.0

What is the ratio of the number of one-hour periods with less than 20 wheels made to the number of one-hour periods with 22 or more wheels made?

A) 1 to 3
B) 1 to 4
C) 2 to 7
D) 3 to 7

What is the percent decrease in the number of wheels made from one-hour period B to one-hour period C ?

A) 3%
B) 12.5%
C) 14%
D) 22.5%

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CONTINUE

8

In the expression $3(2x^2 + px + 8) - 16x(p + 4)$, $p$ is a constant. This expression is equivalent to the expression $6x^2 - 155x + 24$. What is the value of $p$ ?

A) −3

B) 7

C) 13

D) 155

$54 + 6p + 24 + 48p + 192$

$220 + 42p$

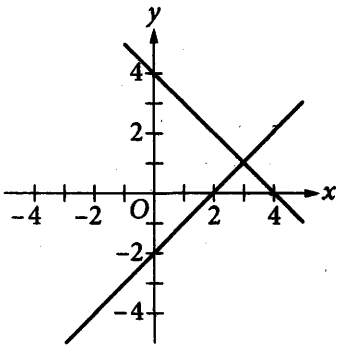
9

$x + y = 4$ $\quad y = -x + 4$

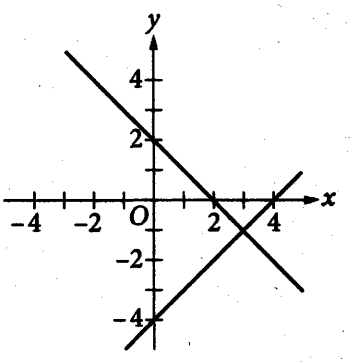
$x - y = 2$ $\quad y = x - 2$

Which of the following is the graph in the $xy$-plane of the system of equations above?

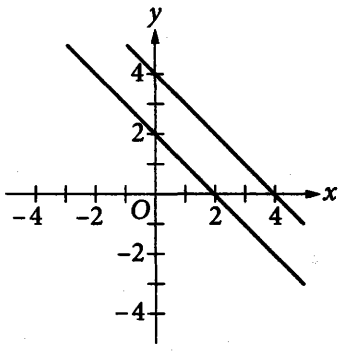
A)



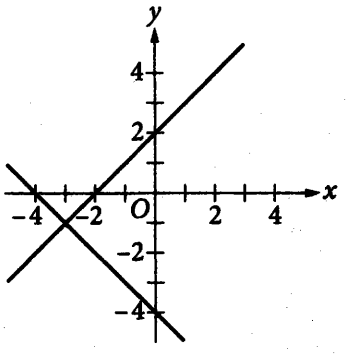

B)




C)




D)

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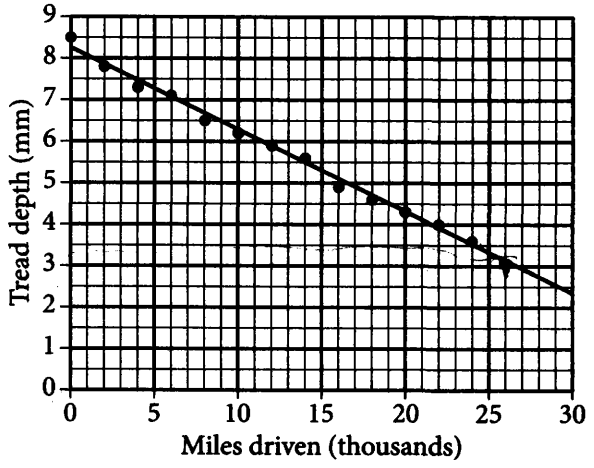
CONTINUE

10

Jenna bought a new tire for her car, and the tire is advertised to last for a minimum of 20,000 miles of driving. As the tire is used, the tire tread depth decreases. The scatterplot and line of best fit below show the relationship between the number of miles driven and the tire tread depth, in millimeters (mm), for the tire.




Jenna will replace the tire when the tire tread depth reaches 3.2 mm. According to the line of best fit, what is the number of miles driven when the estimated tire tread depth is 3.2 mm ?

A) 20,000

B) 24,000

C) 26,000

D) 30,000

11

If $a$ and $c$ are positive numbers, which of the following is equivalent to $\sqrt{(a+c)^3} \cdot \sqrt{a+c}$ ?

A) $a+c$

B) $a^2+c^2$

C) $a^2+2ac+c^2$

D) $a^2c^2$

12

For a science project, Anka recorded whether it rained each weekday and weekend day for 12 weeks. Her results are summarized in the table below.

Weekday and Weekend Day Rain for 12 Weeks

| | Rain | No rain | Total |
|---|---|---|---|
| Number of weekdays | 12 | 48 | 60 |
| Number of weekend days | 8 | 16 | 24 |
| Total | 20 | 64 | 84 |

If one of the days on which there was no rain is selected at random, what is the probability the day was a weekend day?

A) $\frac{4}{21}$

B) $\frac{1}{4}$

C) $\frac{2}{3}$

D) $\frac{3}{4}$

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CONTINUE

13

| Participates in athletic program | Type of college | |
|---|---|---|
| | 2-year | 4-year |
| Yes | 67 | 71 |
| No | 43 | 69 |

110 140 total 250

The table above summarizes the results of a survey in which 250 physical education majors were asked whether they attend a 2- or 4-year college and whether they participate in a college athletic program. If one of the 250 students is selected at random, what is the probability that the student selected would be attending a 4-year college and participating in a college athletic program?

A) 0.284

B) 0.343

C) 0.397

D) 0.507

14

Marta has 7,500 pesos she will convert to US dollars using a currency exchange service. At this time, the currency exchange rate is 1 peso = 0.075 US dollars. The exchange service will charge Marta a 2% fee on the converted US dollar amount. How many US dollars will Marta receive from the currency exchange after the 2% fee is applied?

A) $551.25

B) $562.50

C) $5,625.00

D) $98,000.00

15

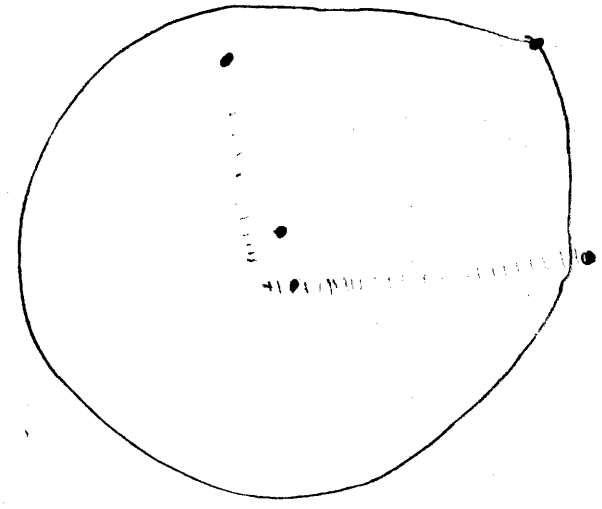
A circle in the $xy$-plane has center $(3, 4)$, and the point $(27, 14)$ is on the circle. Which of the following is an equation of the circle?

A) $(x+3)^2 + (y+4)^2 = 676$

B) $(x-3)^2 + (y-4)^2 = 676$

C) $(x-27)^2 + (y-14)^2 = 25$

D) $(x+27)^2 + (y+14)^2 = 169$



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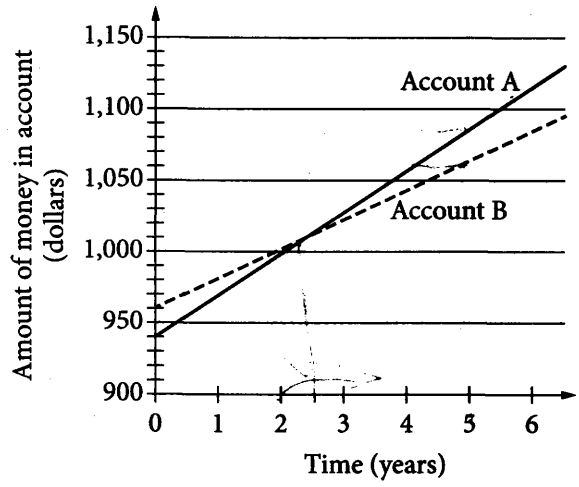
16




The graph above models the amount of money in two different bank accounts $t$ years after they were opened on the same day. The amount in each account grows at a constant rate. According to the model, which of the following statements is true?

A) Account A always has more money than Account B.

B) The growth rate for Account A is less than the growth rate for Account B.

C) At $t = 5$, there will be about \$300 more in Account A than in Account B.

D) At some time for $2 \le t \le 3$, the amount of money in both accounts will be the same.

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

$$m = 2.07v + 0.07$$

A student measured several samples of the element sulfur at a temperature of 293 kelvins (K). The equation above models the relationship between the mass $m$, in grams, and the volume $v$, in cubic centimeters, of the samples.

17

Based on the model, which of the following is closest to the predicted volume, in cubic centimeters, of a sample of sulfur that has mass of 100 grams at 293 K ?

A) 48

B) 98

C) 102

D) 207

100 = 2.07v + 0.07

18

The student also measured several samples of the element selenium at a temperature of 293 K. The data revealed that selenium has a mass that is greater than twice the mass of a sample of sulfur of the same volume. Which of the following equations could model the relationship between the mass $m$, in grams, and the volume $v$, in cubic centimeters, for the element selenium at this temperature?

A) $m = 1.04v + 0.08$

B) $m = 2.07v - 1.93$

C) $m = 4.14v - 0.24$

D) $m = 4.79v + 0.15$

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CONTINUE

19

For which of the following data sets is the mean greater than the median?

A) 5, 5, 5, 5, 5, 5, 5, 5, 5

B) 0, 10, 20, 30, 40, 50, 60, 70, 80

C) 2, 4, 8, 16, 32, 64, 128, 256, 512

D) 7, 107, 107, 207, 207, 207, 307, 307, 307

20

The height of a magnolia tree $H$, in inches, is predicted to increase according to the model below, where $n$ represents the number of growing seasons since the tree was planted.

$$H = 24n + 73, \text{ where } H \leq 600$$

What is the best interpretation of the number 24 in this context?

A) The predicted number of growing seasons for the tree to increase 24 inches in height

B) The predicted number of growing seasons for the tree to reach its maximum height

C) The predicted number of inches the height of the tree will increase each growing season

D) The initial height of the tree, in inches, when it was planted

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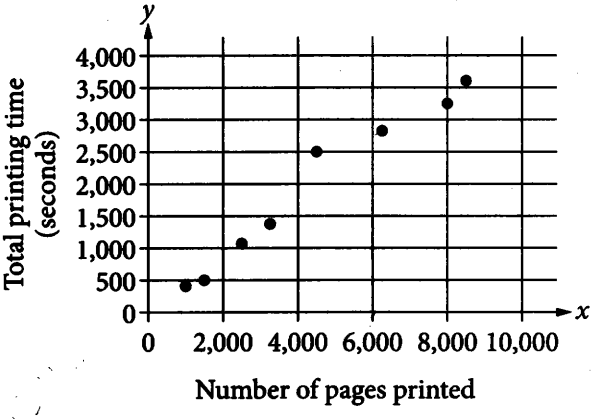
CONTINUE

**Questions 21 and 22 refer to the following information.**

The table and scatterplot below show how long a printer took to print pages for each of the 8 most recent print jobs.

| Job number | Number of pages printed | Total printing time (seconds) |
|---|---|---|
| 1 | 8,425 | 3,600 |
| 2 | 980 | 423 |
| 3 | 4,500 | 2,520 |
| 4 | 6,225 | 2,845 |
| 5 | 1,400 | 510 |
| 6 | 2,500 | 1,080 |
| 7 | 7,950 | 3,250 |
| 8 | 3,275 | 1,400 |




21

At the rate that job number 1 was completed, how long would a print job of 21,905 pages take to complete?

A) 2 hours and 6 minutes

B) 2 hours and 36 minutes

C) 6 hours and 5 minutes

D) 156 hours

Which of the following could be a line of best fit for the points shown on the scatterplot?

A) $y = 0.4x + 60$

B) $y = 0.4x + 6{,}000$

C) $y = 2.5x - 60$

D) $y = 4x + 60$

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CONTINUE

23

Let the function $p$ be defined as

$$p(x) = \frac{(x-c)^2 + 160}{2c}, \text{ where } c \text{ is a constant.}$$

If $p(c) = 10$, what is the value of $p(12)$ ?

A) 10.00
B) 10.25
C) 10.75
D) 11.00

24

A supervisor at an after-school program earns \$19.50 per hour until 6:00 p.m.; after 6:00 p.m., the supervisor earns \$1.75 per hour more than the earlier rate. If the supervisor worked 40 hours last month and $s$ of those hours were after 6:00 p.m., which of the following functions gives the total amount, in dollars, the supervisor earned last month?

A) $f(s) = 19.50(40 - s) + 1.75s$
B) $f(s) = 19.50(40 - s) + 21.25s$
C) $f(s) = 19.50(s) + 21.25(40 - s)$
D) $f(s) = 19.50(40) + 21.25s$

25

Growth of a Culture of Bacteria

| Day | Number of bacteria per milliliter at end of day |
|---|---|
| 1 | $2.5 \times 10^5$ |
| 2 | $5.0 \times 10^5$ |
| 3 | $1.0 \times 10^6$ |

A culture of bacteria is growing at an exponential rate, as shown in the table above. At this rate, on which day would the number of bacteria per milliliter reach $5.12 \times 10^8$ ?

A) Day 5
B) Day 9
C) Day 11
D) Day 12

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CONTINUE

$$-2x = 3y - 6$$
$$-9x - 5y = 7$$

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

A) $-12$

B) $-6$

C) $-3$

D) $4$

Maria cooked some food, and when she took it out of the oven, the temperature of the food was 133°C. The temperature of the room in which Maria put the food to cool down was 20°C. She measured the temperature of the food every 10 minutes and recorded her observations in the table below.

| Time (minutes) | Temperature |
|---|---|
| 0 | 133°C |
| 10 | 69°C |
| 20 | 42°C |
| 30 | 30°C |
| 40 | 24°C |
| 50 | 22°C |

Which of the following best models the relationship between the time $t$, in minutes, since the food was removed from the oven and the temperature $T$, in degrees Celsius, of the food?

A) $T = 133 - 6.4t$

B) $T = 133 - 2.22t$

C) $T = 20 + 133(0.92)^t$

D) $T = 20 + 113(0.92)^t$

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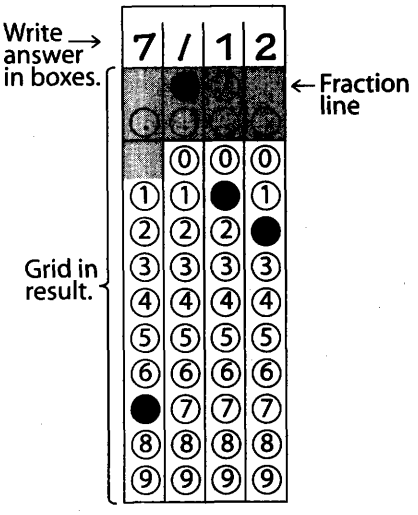
CONTINUE

**DIRECTIONS**

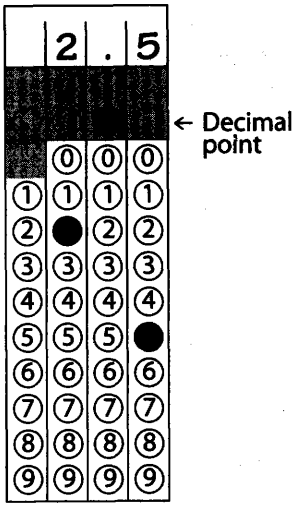
**For questions 28-31**, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

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

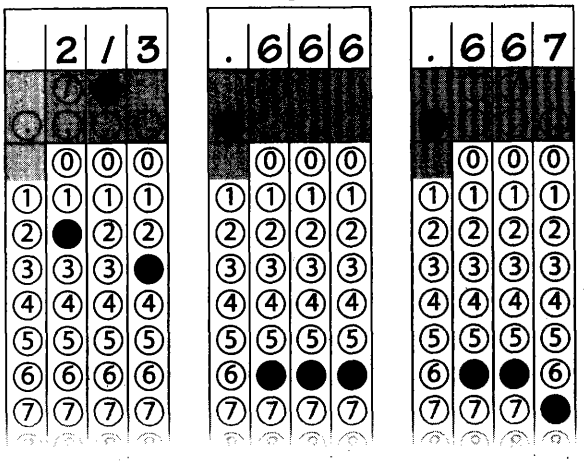
Answer: $\frac{7}{12}$



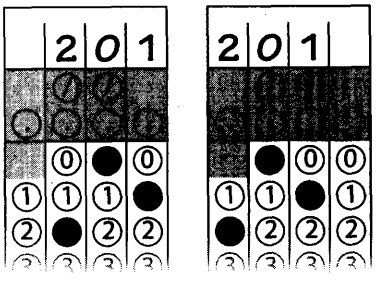

Answer: 2.5




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




Answer: 201 – either position is correct




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

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CONTINUE

28

A movie theater sells two types of tickets, adult tickets for $12 and child tickets for $8. If the theater sold 30 tickets for a total of $300, how much, in dollars, was spent on adult tickets? (Disregard the $ sign when gridding your answer.)

12 8
12 12 12

12,00

29

During a 5-second time interval, the average acceleration $a$, in meters per second squared, of an object with an initial velocity of 12 meters per second is defined by the equation $a = \frac{v_f - 12}{5}$, where $v_f$ is the final velocity of the object in meters per second. If the equation is rewritten in the form $v_f = xa + y$, where $x$ and $y$ are constants, what is the value of $x$ ?

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CONTINUE

**Questions 30 and 31 refer to the following information.**

Views on Nuclear Energy Use

| Response | Frequency |
|---|---|
| Strongly favor | 56 |
| Somewhat favor | 214 |
| Somewhat oppose | 104 |
| Strongly oppose | 37 |

A researcher interviewed 411 randomly selected US residents and asked about their views on the use of nuclear energy. The table above summarizes the responses of the interviewees.

30

According to the table, $p$ percent of the interviewees responded "somewhat oppose" when asked about their views on the use of nuclear energy. What is the value of $p$, to the nearest tenth?

31

If the population of the United States was 300 million when the survey was given, based on the sample data for the 411 US residents, what is the best estimate, in millions, of the difference between the number of US residents who somewhat favor or strongly favor the use of nuclear energy and the number of those who somewhat oppose or strongly oppose it? (Round your answer to the nearest whole number.)

# STOP

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

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