



# The SAT®

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# Practice

# Test #8



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# The SAT®

## GENERAL DIRECTIONS

- You may work on only one module at a time.
- If you finish a module before time is called, check your work on that module only.  
You may NOT turn to any other module.

## TIMING

Reading and Writing, Module 1: 39 minutes

Reading and Writing, Module 2: 39 minutes

*10-minute break*

Math, Module 1: 43 minutes

Math, Module 2: 43 minutes

The above are standard times. If you are approved for accommodations involving additional time, you should give yourself that time when you practice.

## MARKING YOUR ANSWERS

- Be sure to answer your questions properly in this book.
- Circle only one answer to each question. If you change your mind, completely erase the circle. You will not get credit for questions with more than one answer circled, or for questions with no answers circled.

## USING YOUR TEST BOOK

- You may use the test book for scratch work.
- You may not fold or remove pages or portions of a page from this book, or take the book from the testing room.

# Reading and Writing

## 33 QUESTIONS

**DIRECTIONS**

The questions in this section address a number of important reading and writing skills. Each question includes one or more passages, which may include a table or graph. Read each passage and question carefully, and then choose the best answer to the question based on the passage(s).

All questions in this section are multiple-choice with four answer choices. Each question has a single best answer.

1

As Mexico's first president from an Indigenous community, Benito Juarez became one of the most \_\_\_\_\_ figures in his country's history: among the many significant accomplishments of his long tenure in office (1858–1872), Juarez consolidated the authority of the national government and advanced the rights of Indigenous peoples.

Which choice completes the text with the most logical and precise word or phrase?

- A) unpredictable
- B) important
- C) secretive
- D) ordinary

2

Mônica Lopes-Ferreira and others at Brazil's Butantan Institute are studying the freshwater stingray species *Potamotrygon rex* to determine whether biological characteristics such as the rays' age and sex have \_\_\_\_\_ effect on the toxicity of their venom—that is, to see if differences in these traits are associated with considerable variations in venom potency.

Which choice completes the text with the most logical and precise word or phrase?

- A) a disconcerting
- B) an acceptable
- C) an imperceptible
- D) a substantial

3

Kelp forests grow underwater along the eastern Pacific Coast. These underwater forests are important to fish and other marine animals. Ocean currents can be powerful and rough, making it difficult for animals to find safe places to hide from predators. The underwater forests slow down the currents. This creates a more \_\_\_\_\_ environment with calmer waters where animals can take shelter.

Which choice completes the text with the most logical and precise word or phrase?

- A) tranquil
- B) dangerous
- C) imaginative
- D) surprising

4

*The Mule Bone*, a 1930 play written by Zora Neale Hurston and Langston Hughes, is perhaps the best-known of the few examples of \_\_\_\_\_ in literature. Most writers prefer working alone, and given that working together cost Hurston and Hughes their friendship, it is not hard to see why.

Which choice completes the text with the most logical and precise word or phrase?

- A) characterization
- B) interpretation
- C) collaboration
- D) commercialization

5

Ofelia Zepeda's contributions to the field of linguistics are \_\_\_\_\_: her many accomplishments include working as a linguistics professor and bilingual poet, authoring the first Tohono O'odham grammar book, and co-founding the American Indian Language Development Institute.

Which choice completes the text with the most logical and precise word or phrase?

- A) pragmatic
- B) controversial
- C) extensive
- D) universal

6

Archaeologists studying the ancient city of Pompeii in Italy recently discovered a well-preserved food shop known as a *thermopolium*. The site contains food remains, artworks, and decorations. These items give researchers a better understanding of what daily life in Pompeii may have been like. For example, the archaeologists found a ceramic jar that they believe likely contained a meat and seafood stew.

Which choice best states the main purpose of the text?

- A) To compare ancient artworks with modern ones
- B) To discuss the political system of Italy
- C) To present a recent archaeological discovery
- D) To describe a region's climate

7

The following text is from Sarah Orne Jewett's 1899 short story "Martha's Lady." Martha is employed by Miss Pyne as a maid.

Miss Pyne sat by the window watching, in her best dress, looking stately and calm; she seldom went out now, and it was almost time for the carriage. Martha was just coming in from the garden with the strawberries, and with more flowers in her apron. It was a bright cool evening in June, the golden robins sang in the elms, and the sun was going down behind the apple-trees at the foot of the garden. The beautiful old house stood wide open to the long-expected guest.

Which choice best states the main purpose of the text?

- A) To convey the worries brought about by a new guest
- B) To describe how the characters have changed over time
- C) To contrast the activity indoors with the stillness outside
- D) To depict the setting as the characters await a visitor's arrival

8

The following text is adapted from Aphra Behn's 1689 novel *The Lucky Mistake*. Atlante and Rinaldo are neighbors who have been secretly exchanging letters through Charlot, Atlante's sister.

[Atlante] gave this letter to Charlot; who immediately ran into the balcony with it, where she still found Rinaldo in a melancholy posture, leaning his head on his hand: She showed him the letter, but was afraid to toss it to him, for fear it might fall to the ground; so he ran and fetched a long cane, which he cleft at one end, and held it while she put the letter into the cleft, and stayed not to hear what he said to it. But never was man so transported with joy, as he was at the reading of this letter; it gives him new wounds; for to the generous, nothing obliges love so much as love.

Which choice best describes the overall structure of the text?

- A) It describes the delivery of a letter, and then portrays a character's happiness at reading that letter.
- B) It establishes that a character is desperate to receive a letter, and then explains why another character has not yet written that letter.
- C) It presents a character's concerns about delivering a letter, and then details the contents of that letter.
- D) It reveals the inspiration behind a character's letter, and then emphasizes the excitement that another character feels upon receiving that letter.

9

According to historian Vicki L. Ruiz, Mexican American women made crucial contributions to the labor movement during World War II. At the time, food processing companies entered into contracts to supply United States armed forces with canned goods. Increased production quotas conferred greater bargaining power on the companies' employees, many of whom were Mexican American women: employees insisted on more favorable benefits, and employers, who were anxious to fulfill the contracts, complied. Thus, labor activism became a platform for Mexican American women to assert their agency.

Which choice best describes the function of the underlined portion in the text as a whole?

- A) It elaborates on a claim about labor relations in a particular industry made earlier in the text.
- B) It offers an example of a trend in the World War II-era economy discussed earlier in the text.
- C) It notes a possible exception to the historical narrative of labor activism sketched earlier in the text.
- D) It provides further details about the identities of the workers discussed earlier in the text.

10

For many years, the only existing fossil evidence of mixopterid eurypterids—an extinct family of large aquatic arthropods known as sea scorpions and related to modern arachnids and horseshoe crabs—came from four species living on the paleocontinent of Laurussia. In a discovery that expands our understanding of the geographical distribution of mixopterids, paleontologist Bo Wang and others have identified fossilized remains of a new mixopterid species, *Terropterus xiushanensis*, that lived over 400 million years ago on the paleocontinent of Gondwana.

According to the text, why was Wang and his team's discovery of the *Terropterus xiushanensis* fossil significant?

- A) The fossil constitutes the first evidence found by scientists that mixopterids lived more than 400 million years ago.
- B) The fossil helps establish that mixopterids are more closely related to modern arachnids and horseshoe crabs than previously thought.
- C) The fossil helps establish a more accurate timeline of the evolution of mixopterids on the paleocontinents of Laurussia and Gondwana.
- D) The fossil constitutes the first evidence found by scientists that mixopterids existed outside the paleocontinent of Laurussia.

11

## Video Game Availability by Initial Release Years

Initial release years	Percentage of games still available
1975–1979	0.89
1980–1984	3.65
1985–1989	15.38
1990–1994	19.33
1995–1999	14.22

In a recent study, researchers found that relatively few video games released over the decades remain available today. For example, only 14.22 percent of games are still available that were initially released in \_\_\_\_\_.

Which choice most effectively uses data from the table to complete the statement?

- A) 2000–2004.
- B) 1995–1999.
- C) 1970–1974.
- D) 1985–1989.

12

## Depths at Which Four Deep-Sea Fish Species Live

Species	Depth below the ocean surface
Footballfish	200–1,000 meters
Southern stoplight loosejaw	500–2,000 meters
Black seadevil	250–2,000 meters
Bollons' rattail	300–800 meters

Some oceanic fish species live very deep underwater. Researchers collected data about the depths at which various species live.

Based on the information in the table, at what depth does the southern stoplight loosejaw live?

- A) More than 2,000 meters below the surface
- B) 150 to 400 meters below the surface
- C) 500 to 2,000 meters below the surface
- D) 250 to 500 meters below the surface

13

## Housing Starts in the US, January–April 2022

(in thousands)

Month	Housing starts
January	1,669
February	1,771
March	1,713
April	1,803

When construction of a single-family house begins, it is called a housing start. In the first four months of 2022, the highest number of housing starts in the United States was in \_\_\_\_\_.

Which choice most effectively uses data from the table to complete the statement?

- A) April.
- B) March.
- C) January.
- D) February.

14

Born in 1891 to a Quechua-speaking family in the Andes Mountains of Peru, Martín Chambi is today considered to be one of the most renowned figures of Latin American photography. In a paper for an art history class, a student claims that Chambi's photographs have considerable ethnographic value—in his work, Chambi was able to capture diverse elements of Peruvian society, representing his subjects with both dignity and authenticity.

Which finding, if true, would most directly support the student's claim?

- A) Chambi took many commissioned portraits of wealthy Peruvians, but he also produced hundreds of images carefully documenting the peoples, sites, and customs of Indigenous communities of the Andes.
- B) Chambi's photographs demonstrate a high level of technical skill, as seen in his strategic use of illumination to create dramatic light and shadow contrasts.
- C) During his lifetime, Chambi was known and celebrated both within and outside his native Peru, as his work was published in places like Argentina, Spain, and Mexico.
- D) Some of the peoples and places Chambi photographed had long been popular subjects for Peruvian photographers.

15

Researchers hypothesized that a decline in the population of dusky sharks near the mid-Atlantic coast of North America led to a decline in the population of eastern oysters in the region. Dusky sharks do not typically consume eastern oysters but do consume cownose rays, which are the main predators of the oysters.

Which finding, if true, would most directly support the researchers' hypothesis?

- A) Declines in the regional abundance of dusky sharks' prey other than cownose rays are associated with regional declines in dusky shark abundance.
- B) Eastern oyster abundance tends to be greater in areas with both dusky sharks and cownose rays than in areas with only dusky sharks.
- C) Consumption of eastern oysters by cownose rays in the region substantially increased before the regional decline in dusky shark abundance began.
- D) Cownose rays have increased in regional abundance as dusky sharks have decreased in regional abundance.

16

In the mountains of Brazil, *Barbacenia tomentosa* and *Barbacenia macrantha*—two plants in the Velloziaceae family—establish themselves on soilless, nutrient-poor patches of quartzite rock. Plant ecologists Anna Abrahão and Patricia de Britto Costa used microscopic analysis to determine that the roots of *B. tomentosa* and *B. macrantha*, which grow directly into the quartzite, have clusters of fine hairs near the root tip; further analysis indicated that these hairs secrete both malic and citric acids. The researchers hypothesize that the plants depend on dissolving underlying rock with these acids, as the process not only creates channels for continued growth but also releases phosphates that provide the vital nutrient phosphorus.

Which finding, if true, would most directly support the researchers' hypothesis?

- A) Other species in the Velloziaceae family are found in terrains with more soil but have root structures similar to those of *B. tomentosa* and *B. macrantha*.
- B) Though *B. tomentosa* and *B. macrantha* both secrete citric and malic acids, each species produces the acids in different proportions.
- C) The roots of *B. tomentosa* and *B. macrantha* carve new entry points into rocks even when cracks in the surface are readily available.
- D) *B. tomentosa* and *B. macrantha* thrive even when transferred to the surfaces of rocks that do not contain phosphates.

17

Many mosquito repellents contain natural components that work by activating multiple odor receptors on mosquitoes' antennae. As the insects develop resistance, new repellents are needed. Ke Dong and her team found that EBF, a molecular component of a chrysanthemum-flower extract, can repel mosquitoes by activating just one odor receptor—and this receptor, Or31, is present in all mosquito species known to carry diseases. Therefore, the researchers suggest that in developing new repellents, it would be most useful to \_\_\_\_\_.

Which choice most logically completes the text?

- A) identify molecular components similar to EBF that target the activation of Or31 receptors.
- B) investigate alternative methods for extracting EBF molecules from chrysanthemums.
- C) verify the precise locations of Or31 and other odor receptors on mosquitoes' antennae.
- D) determine the maximum number of different odor receptors that can be activated by a single molecule.

18

Birds of many species ingest foods containing carotenoids, pigmented molecules that are converted into feather coloration. Coloration tends to be especially saturated in male birds' feathers, and because carotenoids also confer health benefits, the deeply saturated colors generally serve to communicate what is known as an honest signal of a bird's overall fitness to potential mates. However, ornithologist Allison J. Shultz and others have found that males in several species of the tanager genus *Ramphocelus* use microstructures in their feathers to manipulate light, creating the appearance of deeper saturation without the birds necessarily having to maintain a carotenoid-rich diet. These findings suggest that \_\_\_\_\_.

Which choice most logically completes the text?

- A) individual male tanagers can engage in honest signaling without relying on carotenoid consumption.
- B) feather microstructures may be less effective than deeply saturated feathers for signaling overall fitness.
- C) scientists have yet to determine why tanagers have a preference for mates with colorful appearances.
- D) a male tanager's appearance may function as a dishonest signal of the individual's overall fitness.

19

When writing *The Other Black Girl* (2021), novelist Zakiya Dalila Harris drew on her own experiences working at a publishing office. The award-winning book is Harris's first novel, but her writing \_\_\_\_\_ honored before. At the age of twelve, she entered a contest to have a story published in *American Girl* magazine—and won.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) were
- B) have been
- C) has been
- D) are

20

In order to prevent nonnative fish species from moving freely between the Mediterranean and Red Seas, marine biologist Bella Galil has proposed that a saline lock system be installed along the Suez Canal in Egypt's Great Bitter Lakes. The lock would increase the salinity of the lakes and \_\_\_\_\_ a natural barrier of water most marine creatures would be unable to cross.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) creates
- B) create
- C) creating
- D) created

21

Paintings by the renowned twentieth-century US \_\_\_\_\_ were featured in *Artist to Artist*, an exhibition at the Smithsonian Art Museum that paired the works of artists whose career trajectories intersected in meaningful ways.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) artists: Thomas Hart Benton and Jackson Pollock,
- B) artists Thomas Hart Benton and Jackson Pollock
- C) artists Thomas Hart Benton, and Jackson Pollock,
- D) artists, Thomas Hart Benton and Jackson Pollock

22

In 1943, in the midst of World War II, mathematics professor Grace Hopper was recruited by the US military to help the war effort by solving complex equations. Hopper’s subsequent career would involve more than just \_\_\_\_\_ as a pioneering computer programmer, Hopper would help usher in the digital age.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) equations, though:
- B) equations, though,
- C) equations. Though,
- D) equations though

23

Increased gender diversity is revitalizing the field of economics, according to Harvard’s Claudia Goldin. The trailblazing accomplishments of Goldin, winner of the 2023 Nobel Prize in Economics for her work on women in the labor force, \_\_\_\_\_ to the value of scholars of diverse backgrounds in spurring research into previously unexplored, but vitally important, topics.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) attests
- B) has attested
- C) is attesting
- D) attest

24

During the English neoclassical period (1660–1789), many writers imitated the epic poetry and satires of ancient Greece and Rome. They were not the first in England to adopt the literary modes of classical \_\_\_\_\_ some of the most prominent figures of the earlier Renaissance period were also influenced by ancient Greek and Roman literature.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) antiquity, however
- B) antiquity, however,
- C) antiquity, however;
- D) antiquity; however,

25

English poet and Shakespeare contemporary John Donne's \_\_\_\_\_ much admired during his lifetime (1572–1631) and in the decades that followed, had, at the time of their enthusiastic rediscovery by the early twentieth-century modernists, been essentially gathering dust for the intervening 250 years.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) works were
- B) works, were
- C) works,
- D) works had been

26

Compared to that of alumina glass, \_\_\_\_\_ silica glass atoms are so far apart that they are unable to re-form bonds after being separated.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) silica glass is at a significant disadvantage due to its more dispersed atomic arrangement:
- B) silica glass has a more dispersed atomic arrangement, resulting in a significant disadvantage:
- C) a significant disadvantage of silica glass is that its atomic arrangement is more dispersed:
- D) silica glass's atomic arrangement is more dispersed, resulting in a significant disadvantage:

27

In November 1934, Amrita Sher-Gil was living in what must have seemed like the ideal city for a young artist: Paris. She was studying firsthand the color-saturated style of France's modernist masters and beginning to make a name for herself as a painter. \_\_\_\_\_ Sher-Gil longed to return to her childhood home of India; only there, she believed, could her art truly flourish.

Which choice completes the text with the most logical transition?

- A) Still,
- B) Therefore,
- C) Indeed,
- D) Furthermore,

28

In 1974, Mexican chemist Mario Molina and US chemist F. Sherwood Rowland discovered that chemicals called CFCs were harmful to the ozone layer. Their research was extremely influential in the fight against CFCs. \_\_\_\_\_ it laid the foundation for a 1987 treaty that phased out the use of CFCs across the globe.

Which choice completes the text with the most logical transition?

- A) Regardless,
- B) Specifically,
- C) However,
- D) Earlier,

29

With his room-sized installation *Unicorn/My Private Sky*, Norwegian artist Børre Sæthre succeeds in creating a whimsical yet perplexing experience.

\_\_\_\_\_ when visitors set foot inside the fantastically blue room and encounter the life-sized stuffed unicorn preening at the far end of it, they are both dazzled and confused—as if stepping into a strange and enchanting new world.

Which choice completes the text with the most logical transition?

- A) Second,
- B) Instead,
- C) Indeed,
- D) Nevertheless,

30

While researching a topic, a student has taken the following notes:

- The Philadelphia and Lancaster Turnpike was a road built between 1792 and 1794.
- It was the first private turnpike in the United States.
- It connected the cities of Philadelphia and Lancaster in the state of Pennsylvania.
- It was sixty-two miles long.

The student wants to emphasize the distance covered by the Philadelphia and Lancaster Turnpike. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) The sixty-two-mile-long Philadelphia and Lancaster Turnpike connected the Pennsylvania cities of Philadelphia and Lancaster.
- B) The Philadelphia and Lancaster Turnpike was the first private turnpike in the United States.
- C) The Philadelphia and Lancaster Turnpike, which connected two Pennsylvania cities, was built between 1792 and 1794.
- D) A historic Pennsylvania road, the Philadelphia and Lancaster Turnpike was completed in 1794.

31

While researching a topic, a student has taken the following notes:

- Most, but not all, of the Moon's oxygen comes from the Sun, via solar wind.
- Cosmochemist Kentaro Terada from Osaka University wondered if some of the unaccounted-for oxygen could be coming from Earth.
- In 2008, he analyzed data from the Japanese satellite Kaguya.
- Kaguya gathered data about gases and particles it encountered while orbiting the Moon.
- Based on the Kaguya data, Terada confirmed his suspicion that Earth is sending oxygen to the Moon.

The student wants to emphasize the aim of the research study. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) As it orbited the Moon, the Kaguya satellite collected data that was later analyzed by cosmochemist Kentaro Terada.
- B) Before 2008, Kentaro Terada wondered if the Moon was receiving some of its oxygen from Earth.
- C) Cosmochemist Kentaro Terada set out to determine whether some of the Moon's oxygen was coming from Earth.
- D) Kentaro Terada's study determined that Earth is sending a small amount of oxygen to the Moon.

32

While researching a topic, a student has taken the following notes:

- The factors that affect clutch size (the number of eggs laid at one time) have been well studied in birds but not in lizards.
- A team led by Shai Meiri of Tel Aviv University investigated which factors influence lizard clutch size.
- Meiri's team obtained clutch-size and habitat data for over 3,900 lizard species and analyzed the data with statistical models.
- Larger clutch size was associated with environments in higher latitudes that have more seasonal change.
- Lizards in higher-latitude environments may lay larger clutches to take advantage of shorter windows of favorable conditions.

The student wants to emphasize the aim of the research study. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) Researchers wanted to know which factors influence lizard egg clutch size because such factors have been well studied in birds but not in lizards.
- B) After they obtained data for over 3,900 lizard species, researchers determined that larger clutch size was associated with environments in higher latitudes that have more seasonal change.
- C) We now know that lizards in higher-latitude environments may lay larger clutches to take advantage of shorter windows of favorable conditions.
- D) Researchers obtained clutch-size and habitat data for over 3,900 lizard species and analyzed the data with statistical models.

33

While researching a topic, a student has taken the following notes:

- British musicians John Lennon and Paul McCartney shared writing credit for numerous Beatles songs.
- Many Lennon-McCartney songs were actually written by either Lennon or McCartney, not by both.
- The exact authorship of specific parts of many Beatles songs, such as the verse for “In My Life,” is disputed.
- Mark Glickman, Jason Brown, and Ryan Song used statistical methods to analyze the musical content of Beatles songs.
- They concluded that there is 18.9% probability that McCartney wrote the verse for “In My Life,” stating that the verse is “consistent with Lennon’s songwriting style.”

The student wants to make a generalization about the kind of study conducted by Glickman, Brown, and Song. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) Based on statistical analysis, Glickman, Brown, and Song claim that John Lennon wrote the verse of “In My Life.”
- B) There is only an 18.9% probability that Paul McCartney wrote the verse for “In My Life”; John Lennon is the more likely author.
- C) It is likely that John Lennon, not Paul McCartney, wrote the verse for “In My Life.”
- D) Researchers have used statistical methods to address questions of authorship within the field of music.

**STOP**

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

# Reading and Writing

## 33 QUESTIONS

**DIRECTIONS**

The questions in this section address a number of important reading and writing skills. Each question includes one or more passages, which may include a table or graph. Read each passage and question carefully, and then choose the best answer to the question based on the passage(s).

All questions in this section are multiple-choice with four answer choices. Each question has a single best answer.

1

Art scholars have noted that some colors seem to be more \_\_\_\_\_ viewers than others. For example, people tend to find paintings featuring blues and greens more appealing than paintings featuring yellows and oranges.

Which choice completes the text with the most logical and precise word or phrase?

- A) confusing for
- B) attractive to
- C) corrected by
- D) similar to

2

Researchers and conservationists stress that biodiversity loss due to invasive species is \_\_\_\_\_. For example, people can take simple steps such as washing their footwear after travel to avoid introducing potentially invasive organisms into new environments.

Which choice completes the text with the most logical and precise word or phrase?

- A) preventable
- B) undeniable
- C) common
- D) concerning

3

The process of mechanically recycling plastics is often considered \_\_\_\_\_ because of the environmental impact and the loss of material quality that often occurs. But chemist Takunda Chazovachii has helped develop a cleaner process of chemical recycling that converts superabsorbent polymers from diapers into a desirable reusable adhesive.

Which choice completes the text with the most logical and precise word or phrase?

- A) resilient
- B) inadequate
- C) dynamic
- D) satisfactory

4

In the Indigenous intercropping system known as the Three Sisters, maize, squash, and beans form an \_\_\_\_\_ web of relations: maize provides the structure on which the bean vines grow; the squash vines cover the soil, discouraging competition from weeds; and the beans aid their two “sisters” by enriching the soil with essential nitrogen.

Which choice completes the text with the most logical and precise word or phrase?

- A) indecipherable
- B) ornamental
- C) obscure
- D) intricate

5

Within baleen whale species, some individuals develop an accessory spleen—a seemingly functionless formation of splenetic tissue outside the normal spleen. Given the formation’s greater prevalence among whales known to make deeper dives, some researchers hypothesize that its role isn’t \_\_\_\_\_; rather, the accessory spleen may actively support diving mechanisms.

Which choice completes the text with the most logical and precise word or phrase?

- A) replicable
- B) predetermined
- C) operative
- D) latent

6

In 2007, computer scientist Luis von Ahn was working on converting printed books into a digital format. He found that some words were distorted enough that digital scanners couldn’t recognize them, but most humans could easily read them. Based on that finding, von Ahn invented a simple security test to keep automated “bots” out of websites. The first version of the reCAPTCHA test asked users to type one known word and one of the many words scanners couldn’t recognize. Correct answers proved the users were humans and added data to the book-digitizing project.

Which choice best states the main purpose of the text?

- A) To discuss von Ahn’s invention of reCAPTCHA
- B) To explain how digital scanners work
- C) To call attention to von Ahn’s book-digitizing project
- D) To indicate how popular reCAPTCHA is

7

The following text is adapted from Gwendolyn Bennett’s 1926 poem “Street Lamps in Early Spring.”

Night wears a garment  
All velvet soft, all violet blue...  
And over her face she draws a veil  
As shimmering fine as floating dew...  
And here and there  
In the black of her hair  
The subtle hands of Night  
Move slowly with their gem-starred light.

Which choice best describes the overall structure of the text?

- A) It presents alternating descriptions of night in a rural area and in a city.
- B) It sketches an image of nightfall, then an image of sunrise.
- C) It makes an extended comparison of night to a human being.
- D) It portrays how night changes from one season of the year to the next.

8

The following text is adapted from Jane Austen's 1814 novel *Mansfield Park*. The speaker, Tom, is considering staging a play at home with a group of his friends and family.

We mean nothing but a little amusement among ourselves, just to vary the scene, and exercise our powers in something new. We want no audience, no publicity. We may be trusted, I think, in choosing some play most perfectly unexceptionable; and I can conceive no greater harm or danger to any of us in conversing in the elegant written language of some respectable author than in chattering in words of our own.

Which choice best states the main purpose of the text?

- A) To offer Tom's assurance that the play will be inoffensive and involve only a small number of people
- B) To clarify that the play will not be performed in the manner Tom had originally intended
- C) To elaborate on the idea that the people around Tom lack the skills to successfully stage a play
- D) To assert that Tom believes the group performing the play will be able to successfully promote it

9

### Text 1

Ecologists have long wondered how thousands of microscopic phytoplankton species can live together near ocean surfaces competing for the same resources. According to conventional wisdom, one species should emerge after outcompeting the rest. So why do so many species remain? Ecologists' many efforts to explain this phenomenon still haven't uncovered a satisfactory explanation.

### Text 2

Ecologist Michael Behrenfeld and colleagues have connected phytoplankton's diversity to their microscopic size. Because these organisms are so tiny, they are spaced relatively far apart from each other in ocean water and, moreover, experience that water as a relatively dense substance. This in turn makes it hard for them to move around and interact with one another. Therefore, says Behrenfeld's team, direct competition among phytoplankton probably happens much less than previously thought.

Based on the texts, how would Behrenfeld and colleagues (Text 2) most likely respond to the "conventional wisdom" discussed in Text 1?

- A) By arguing that it is based on a misconception about phytoplankton species competing with one another
- B) By asserting that it fails to recognize that routine replenishment of ocean nutrients prevents competition between phytoplankton species
- C) By suggesting that their own findings help clarify how phytoplankton species are able to compete with larger organisms
- D) By recommending that more ecologists focus their research on how competition among phytoplankton species is increased with water density

10

The following text is adapted from Sylvia Acevedo's 2018 memoir *Path to the Stars: My Journey from Girl Scout to Rocket Scientist*. The narrator is traveling by car with her family to Mexico City. Mario and Laura are her brother and sister.

Mario and I played games to see how many different license plates we could spot, and Laura liked to look for children in the back seats of the cars we passed. We were used to the forty-five-minute drive to El Paso and familiar with the six-hour ride to Chihuahua, but I wondered what the long journey to Mexico City would be like.

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According to the text, what did the narrator and Mario do while riding in the car?

- A) They read books.
- B) They sang songs.
- C) They went to sleep.
- D) They played games.

11

In the 1700s and 1800s, European composers experimented with volume in their musical works. They did so by increasing the number of musicians playing in the orchestra. For example, in some of his operas, German composer Richard Wagner added more horns, trombones, and tubas to the orchestra. With more instruments playing at the same time, the orchestra could play extremely loudly at key moments in his operas.

According to the text, how did Richard Wagner achieve moments of extremely high volume in his operas?

- A) By moving the performances of his operas from outdoor stages to indoor ones
- B) By increasing the number of musicians playing horns, trombones, and tubas in the orchestra
- C) By building a concert hall whose shape would cause sounds to echo
- D) By insisting that the singers undergo special training to sing for extended periods of time

12

Poetry in Classical Nahuatl, the language of the Aztec Empire, relies on *difrasismo*, or a parallel noun construction that conventionally operates as a single metaphor. For example, the common difrasismo *in cuauhtli in ocelotl* (literally, “the eagle, the jaguar”) signifies “warrior.” The device’s function is both formal—providing structure to lines of verse—and ritual: semantic relations among the two nouns and the concept they signify can be tenuous, as in the previous example, such that difrasismos are often only intelligible according to the conceptual associations observed in Aztec ceremonial culture.

Which statement about the difrasismo *in cuauhtli in ocelotl* is most strongly supported by the text?

- A) Its metaphorical significance derives from the semantic equivalence of the two nouns constituting the difrasismo.
- B) Its unintelligibility may cause its formal function within a line of verse to go unnoticed by present-day readers.
- C) Its apparent obscurity can be resolved when considered in the proper cultural context.
- D) Its frequency in Classical Nahuatl poetry confirms its intelligibility to the Aztec audience.

13

Eighteenth-century economist Adam Smith is famed for his metaphor of the invisible hand, which he putatively used to illustrate a robust model of how individuals produce aggregate benefits by pursuing their own economic interests. Note “putatively”: as Gavin Kennedy has shown, Smith deploys this metaphor only once in his economic writings—to make a narrow point about the then-dominant economic theory of mercantilism—and it was largely ignored until some twentieth-century economists eager to secure an intellectual pedigree for their views elevated it to a fully-fledged paradigm.

Which choice best states the main idea of the text?

- A) Although Smith is famed for his metaphor of the invisible hand, the metaphor was largely ignored until economists in the twentieth century came to realize that the metaphor was a robust model that anticipated their own views.
- B) Some twentieth-century economists gave Smith’s metaphor of the invisible hand a significance it does not have in Smith’s work, but it is nevertheless a useful model of how individuals produce aggregate benefits by pursuing their own economic interests.
- C) Smith’s metaphor of the invisible hand has been interpreted as a model of how individuals acting in their own interest produce aggregate benefits, but it was intended as a subtle critique of the economic theory of mercantilism.
- D) The reputation of Smith’s metaphor of the invisible hand is not due to the importance of the metaphor in Smith’s work but rather to the promotion of the metaphor by some later economists for their own ends.

14

Approximate Rates of Speech and Information Conveyed for Five Languages

Language	Rate of speech (syllables per second)	Rate of information conveyed (bits per second)
Serbian	7.2	39.1
Spanish	7.7	42.0
Vietnamese	5.3	42.5
Thai	4.7	33.8
Hungarian	5.9	34.6

A group of researchers working in Europe, Asia, and Oceania conducted a study to determine how quickly different Eurasian languages are typically spoken (in syllables per second) and how much information they can effectively convey (in bits per second). They found that, although languages vary widely in the speed at which they are spoken, the amount of information languages can effectively convey tends to vary much less. Thus, they claim that two languages with very different spoken rates can nonetheless convey the same amount of information in a given amount of time.

Which choice best describes data from the table that support the researchers' claim?

- A) Among the five languages in the table, Thai and Hungarian have the lowest rates of speech and the lowest rates of information conveyed.
- B) Vietnamese conveys information at approximately the same rate as Spanish despite being spoken at a slower rate.
- C) Among the five languages in the table, the language that is spoken the fastest is also the language that conveys information the fastest.
- D) Serbian and Spanish are spoken at approximately the same rate, but Serbian conveys information faster than Spanish does.

15

## Estimates of Tyrannosaurid Bite Force

Study	Year	Estimation method	Approximate bite force (newtons)
Cost et al.	2019	muscular and skeletal modeling	35,000–63,000
Gignac and Erickson	2017	tooth–bone interaction analysis	8,000–34,000
Meers	2002	body-mass scaling	183,000–235,000
Bates and Falkingham	2012	muscular and skeletal modeling	35,000–57,000

The largest tyrannosaurids—the family of carnivorous dinosaurs that includes *Tarbosaurus*, *Albertosaurus*, and, most famously, *Tyrannosaurus rex*—are thought to have had the strongest bites of any land animals in Earth’s history. Determining the bite force of extinct animals can be difficult, however, and paleontologists Paul Barrett and Emily Rayfield have suggested that an estimate of dinosaur bite force may be significantly influenced by the methodology used in generating that estimate.

Which choice best describes data from the table that support Barrett and Rayfield’s suggestion?

- A) The study by Meers used body-mass scaling and produced the lowest estimated maximum bite force, while the study by Cost et al. used muscular and skeletal modeling and produced the highest estimated maximum.
- B) In their study, Gignac and Erickson used tooth–bone interaction analysis to produce an estimated bite force range with a minimum of 8,000 newtons and a maximum of 34,000 newtons.
- C) The bite force estimates produced by Bates and Falkingham and by Cost et al. were similar to each other, while the estimates produced by Meers and by Gignac and Erickson each differed substantially from any other estimate.
- D) The estimated maximum bite force produced by Cost et al. exceeded the estimated maximum produced by Bates and Falkingham, even though both groups of researchers used the same method to generate their estimates.

16

Psychologists Dacher Keltner and Jonathan Haidt have argued that experiencing awe—a sensation of reverence and wonder typically brought on by perceiving something grand or powerful—can enable us to feel more connected to others and thereby inspire us to act more altruistically. Keltner, along with Paul K. Piff, Pia Dietze, and colleagues, claims to have found evidence for this effect in a recent study where participants were asked to either gaze up at exceptionally tall trees in a nearby grove (reported to be a universally awe-inspiring experience) or stare at the exterior of a nearby, nondescript building. After one minute, an experimenter deliberately spilled a box of pens nearby.

Which finding from the researchers' study, if true, would most strongly support their claim?

- A) Participants who had been looking at the trees helped the experimenter pick up significantly more pens than did participants who had been looking at the building.
- B) Participants who helped the experimenter pick up the pens used a greater number of positive words to describe the trees and the building in a postexperiment survey than did participants who did not help the experimenter.
- C) Participants who did not help the experimenter pick up the pens were significantly more likely to report having experienced a feeling of awe, regardless of whether they looked at the building or the trees.
- D) Participants who had been looking at the building were significantly more likely to notice that the experimenter had dropped the pens than were participants who had been looking at the trees.

17

The domestic sweet potato (*Ipomoea batatas*) descends from a wild plant native to South America. It also populates the Polynesian Islands, where evidence confirms that Native Hawaiians and other Indigenous peoples were cultivating the plant centuries before seafaring first occurred over the thousands of miles of ocean separating them from South America. To explain how the sweet potato was first introduced in Polynesia, botanist Pablo Muñoz-Rodríguez and colleagues analyzed the DNA of numerous varieties of the plant, concluding that Polynesian varieties diverged from South American ones over 100,000 years ago. Given that Polynesia was peopled only in the last three thousand years, the team concluded that \_\_\_\_\_

Which choice most logically completes the text?

- A) the cultivation of the sweet potato in Polynesia likely predates its cultivation in South America.
- B) Polynesian peoples likely acquired the sweet potato from South American peoples only within the last three thousand years.
- C) human activity likely played no role in the introduction of the sweet potato in Polynesia.
- D) Polynesian sweet potato varieties likely descend from a single South American variety that was domesticated, not wild.

18

The morphological novelty of echinoderms—marine invertebrates with radial symmetry, usually starlike, around a central point—impedes comparisons with most other animals, in which bilateral symmetry on an anterior-posterior (head to tail) axis through a trunk is typical. Particularly puzzling are sea stars, thought to have evolved a headless layout from a known bilateral origin. Applying genomic knowledge of *Saccoglossus kowalevskii* acorn worms (close relatives of sea stars, and thus expected to have similar markers for corresponding anatomical regions) to the body patterning genes of *Patiria miniata* sea stars, Laurent Formery et al. observed activity only in anterior genes across *P. miniata*'s entire body and some posterior genes limited to the edges, suggesting that \_\_\_\_\_.

Which choice most logically completes the text?

- A) despite the greater prevalence of anterior genes in sea stars' genetic makeup, posterior genes active at the body's perimeter are primarily responsible for the starlike layout that distinguishes sea stars' radial symmetry from that of other echinoderms.
- B) contrary to the belief that they evolved from early ancestors with the bilateral form typical of many other animals, sea stars instead originated with an atypical body layout that was neither bilaterally nor radially symmetrical.
- C) although the two species are closely related, there is only minimal correspondence in the genetic markers for head, tail, and trunk region development in *P. miniata* sea stars and *S. kowalevskii* acorn worms.
- D) rather than undergoing changes resulting in the eventual elimination of a head region in their radial body plan, as previously assumed, sea stars' morphology evolved to completely lack a trunk and consist primarily of a head region.

19

To survive when water is scarce, embryos inside African turquoise killifish eggs \_\_\_\_\_ a dormant state known as diapause. In this state, embryonic development is paused for as long as two years—longer than the life span of an adult killifish.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) enter
- B) to enter
- C) having entered
- D) entering

20

Formed in 1967 to foster political and economic stability within the Asia-Pacific region, the Association of Southeast Asian Nations was originally made up of five members: Thailand, the Philippines, Singapore, Malaysia, and Indonesia. By the end of the 1990s, the organization \_\_\_\_\_ its initial membership.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) has doubled
- B) had doubled
- C) doubles
- D) will double

21

After the United Kingdom began rolling out taxes equivalent to a few cents on single-use plastic grocery bags in 2011, plastic-bag consumption decreased by up to ninety \_\_\_\_\_. taxes are subject to what economists call the “rebound effect”: as the change became normalized, plastic-bag use started to creep back up.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) percent, such
- B) percent and such
- C) percent. Such
- D) percent such

22

In 1966, Emmett Ashford became the first African American to umpire a Major League Baseball game. His energetic gestures announcing when a player had struck out and his habit of barreling after a hit ball to see if it would land out of \_\_\_\_\_ transform the traditionally solemn umpire role into a dynamic one.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) bounds helped
- B) bounds, helping
- C) bounds that helped
- D) bounds to help

23

The forty-seven geothermal springs of Arkansas’ Hot Springs National Park are sourced via a process known as natural groundwater recharge, in which rainwater percolates downward through the earth—in this case, the porous rocks of the hills around Hot \_\_\_\_\_ collect in a subterranean basin.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) Springs to
- B) Springs: to
- C) Springs—to
- D) Springs, to

24

Over twenty years ago, in a landmark experiment in the psychology of choice, professor Sheena Iyengar set up a jam-tasting booth at a grocery store. The number of jams available for tasting \_\_\_\_\_ some shoppers had twenty-four different options, others only six. Interestingly, the shoppers with fewer jams to choose from purchased more jam.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) varied:
- B) varied,
- C) varied, while
- D) varied while

25

Nigerian author Buchi Emecheta's celebrated literary oeuvre includes *The Joys of Motherhood*, a novel about the changing roles of women in 1950s \_\_\_\_\_ a television play about the private struggles of a newlywed couple in Nigeria; and *Head Above Water*, her autobiography.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) Lagos, *A Kind of Marriage*,
- B) Lagos; *A Kind of Marriage*,
- C) Lagos, *A Kind of Marriage*:
- D) Lagos; *A Kind of Marriage*

26

Jetties—long, narrow structures that extend from a landmass into the water—are often constructed to protect coastlines from erosion. Jetties can sometimes have the opposite \_\_\_\_\_ obstructing the natural flow of sand along the shore can lead to increased erosion in some areas.

Which choice completes the text so that it conforms to the conventions of Standard English?

- A) effect, though;
- B) effect, though
- C) effect; though
- D) effect, though,

27

The Alaska Native Language Archive (ANLA) is known for its impressive audio collection. \_\_\_\_\_ the ANLA has more than 5,000 audio recordings of Native Alaskan languages dating as far back as 1943.

Which choice completes the text with the most logical transition?

- A) In fact,
- B) After,
- C) Regardless,
- D) Instead,

28

Etched into Peru's Nazca Desert are line drawings so large that they can only be fully seen from high above. Archaeologists have known of the lines since the 1920s, when a researcher spotted some from a nearby foothill, and they have been studying the markings ever since. \_\_\_\_\_ archaeologists' efforts are aided by drones that capture high-resolution aerial photographs of the lines.

Which choice completes the text with the most logical transition?

- A) Currently,
- B) In comparison,
- C) Still,
- D) However,

29

At two weeks old, the time their critical socialization period begins, wolves can smell but cannot yet see or hear. Domesticated dogs, \_\_\_\_\_ can see, hear, and smell by the end of two weeks. This relative lack of sensory input may help explain why wolves behave so differently around humans than dogs do: from a very young age, wolves are more wary and less exploratory.

Which choice completes the text with the most logical transition?

- A) in other words,
- B) for instance,
- C) by contrast,
- D) accordingly,

30

Upon first approaching artist Kurt Wenner's *Dies Irae*, a colorful scene painted on the surface of a cobblestone street in Mantua, Italy, one might assume a deep hole filled with life-sized, classically styled sculptures had opened up in the street.

\_\_\_\_\_ by expertly applying the principles of perspective, Wenner created merely the illusion of depth.

Which choice completes the text with the most logical transition?

- A) Additionally,
- B) On the contrary,
- C) As a result,
- D) Next,

31

Economist Elinor Ostrom's studies of communities around the world have empirically demonstrated that common pool resources, such as grazing lands, can be sustainably managed by the people who use them (rather than through private entities or centralized governments). \_\_\_\_\_ Ostrom's work is a repudiation of the "tragedy of the commons," the view that individuals will inevitably overexploit a finite shared resource if given unfettered access to it.

Which choice completes the text with the most logical transition?

- A) By contrast,
- B) For example,
- C) That said,
- D) As such,

32

While researching a topic, a student has taken the following notes:

- Some sandstone arches in Utah's Arches National Park have been defaced by tourists' carvings.
- Park rangers can smooth away some carvings using power grinders.
- For deep carvings, power grinding is not always feasible because it can greatly alter or damage the rock.
- Park rangers can use an infilling technique, which involves filling in carvings with ground sandstone and a bonding agent.
- This technique is minimally invasive.

The student wants to explain an advantage of the infilling technique. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) To remove carvings from sandstone arches in Utah's Arches National Park, power grinding is not always feasible.
- B) Filling in carvings with ground sandstone and a bonding agent is less invasive than smoothing them away with a power grinder, which can greatly alter or damage the sandstone arches.
- C) Park rangers can use a power grinding technique to smooth away carvings or fill them in with ground sandstone and a bonding agent.
- D) As methods for removing carvings from sandstone, power grinding and infilling differ in their level of invasiveness.

33

While researching a topic, a student has taken the following notes:

- *Las sergas de Esplandián* was a novel popular in sixteenth-century Spain.
- The novel featured a fictional island inhabited solely by Black women and known as California.
- That same century, Spanish explorers learned of an "island" off the west coast of Mexico.
- They called it California after the island in the novel.
- The "island" was actually the peninsula now known as Baja California ("Lower California"), which lies to the south of the US state of California.

The student wants to emphasize the role a misconception played in the naming of a place. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) The novel *Las sergas de Esplandián* featured a fictional island known as California.
- B) To the south of the US state of California lies Baja California ("Lower California"), originally called California after a fictional place.
- C) In the sixteenth century, Spanish explorers learned of a peninsula off the west coast of Mexico and called it California.
- D) Thinking it was an island, Spanish explorers called a peninsula California after an island in a popular novel.

**STOP**

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

# Math

## 27 QUESTIONS

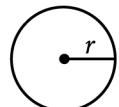
**DIRECTIONS**

The questions in this section address a number of important math skills.  
Use of a calculator is permitted for all questions.

**NOTES**

Unless otherwise indicated:

- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

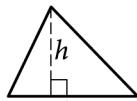
**REFERENCE**


$$A = \pi r^2$$

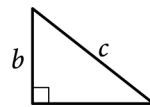
$$C = 2\pi r$$



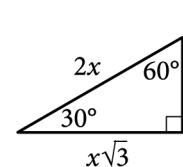
$$A = lw$$



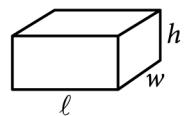
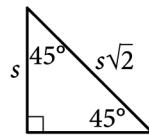
$$A = \frac{1}{2}bh$$



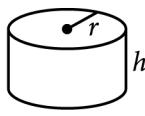
$$c^2 = a^2 + b^2$$



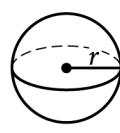
Special Right Triangles



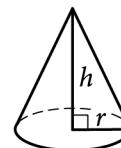
$$V = lwh$$



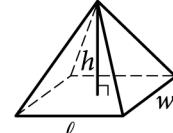
$$V = \pi r^2 h$$



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



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



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

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

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

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

**For multiple-choice questions,** solve each problem, choose the correct answer from the choices provided, and then circle your answer in this book. Circle only one answer for each question. If you change your mind, completely erase the circle. You will not get credit for questions with more than one answer circled, or for questions with no answers circled.

**For student-produced response questions,** solve each problem and write your answer next to or under the question in the test book as described below.

- Once you've written your answer, circle it clearly. You will not receive credit for anything written outside the circle, or for any questions with more than one circled answer.
- If you find **more than one correct answer**, write and circle only one answer.
- Your answer can be up to 5 characters for a **positive** answer and up to 6 characters (including the negative sign) for a **negative** answer, but no more.
- If your answer is a **fraction** that is too long (over 5 characters for positive, 6 characters for negative), write the decimal equivalent.
- If your answer is a **decimal** that is too long (over 5 characters for positive, 6 characters for negative), truncate it or round at the fourth digit.
- If your answer is a **mixed number** (such as  $3\frac{1}{2}$ ), write it as an improper fraction ( $\frac{7}{2}$ ) or its decimal equivalent (3.5).
- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

1

A bus is traveling at a constant speed along a straight portion of road. The equation  $d = 30t$  gives the distance  $d$ , in feet from a road marker, that the bus will be  $t$  seconds after passing the marker. How many feet from the marker will the bus be 2 seconds after passing the marker?

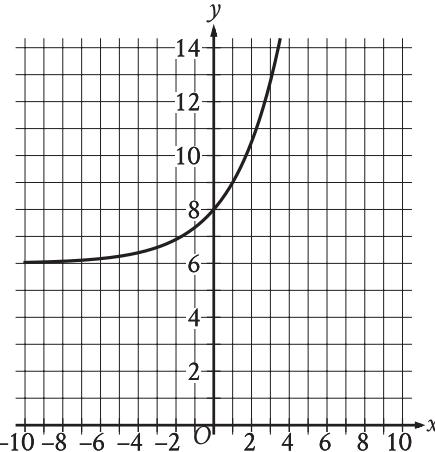
- A) 30
- B) 32
- C) 60
- D) 90

2

For a particular machine that produces beads, 29 out of every 100 beads it produces have a defect. A bead produced by the machine will be selected at random. What is the probability of selecting a bead that has a defect?

- A)  $\frac{1}{2,900}$
- B)  $\frac{1}{29}$
- C)  $\frac{29}{100}$
- D)  $\frac{29}{10}$

3



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

- A)  $(-8, 0)$
- B)  $(-6, 0)$
- C)  $(0, 6)$
- D)  $(0, 8)$

4

Which expression is equivalent to  $(2x^2 + x - 9) + (x^2 + 6x + 1)$ ?

- A)  $2x^2 + 7x + 10$
- B)  $2x^2 + 6x - 8$
- C)  $3x^2 + 7x - 10$
- D)  $3x^2 + 7x - 8$

5

An analyst collected data on the price of a carton of grape tomatoes at 30 locations selected at random in Utah. The mean price of a carton of grape tomatoes in Utah was estimated to be \$4.23, with an associated margin of error of \$0.08. Which of the following is a plausible statement about the mean price of a carton of grape tomatoes for all locations that sell this product in Utah?

- A) It is between \$4.15 and \$4.31.
- B) It is either less than \$4.15 or greater than \$4.31.
- C) It is less than \$4.15.
- D) It is greater than \$4.31.

6

$$2.6 + x = 2.8$$

What value of  $x$  is the solution to the given equation?

7

Out of 300 seeds that were planted, 80% sprouted. How many of these seeds sprouted?

8

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

For the linear function  $f$ ,  $b$  is a constant and  $f(7) = 28$ . What is the value of  $b$ ?

- A) 0
- B) 1
- C) 4
- D) 7

9

Right triangles  $LMN$  and  $PQR$  are similar, where  $L$  and  $M$  correspond to  $P$  and  $Q$ , respectively. Angle  $M$  has a measure of  $53^\circ$ . What is the measure of angle  $Q$ ?

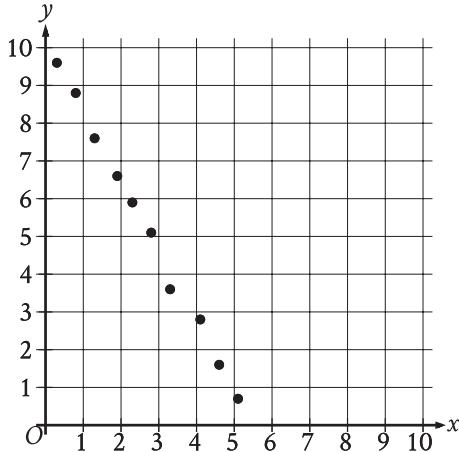
- A)  $37^\circ$
- B)  $53^\circ$
- C)  $127^\circ$
- D)  $143^\circ$

10

What is the equation of the line that passes through the point  $(0, 5)$  and is parallel to the graph of  $y = 7x + 4$  in the  $xy$ -plane?

- A)  $y = 5x$
- B)  $y = 7x + 5$
- C)  $y = 7x$
- D)  $y = 5x + 7$

11



Which of the following equations is the most appropriate linear model for the data shown in the scatterplot?

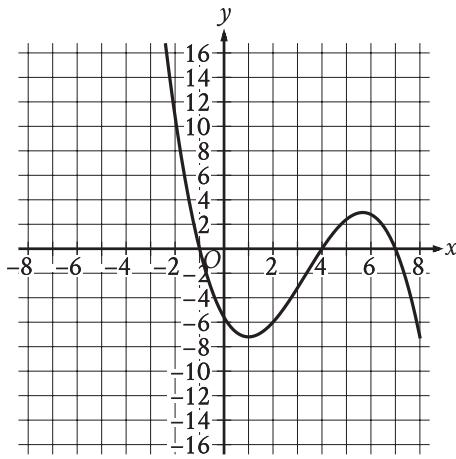
- A)  $y = -1.9x - 10.1$
- B)  $y = -1.9x + 10.1$
- C)  $y = 1.9x - 10.1$
- D)  $y = 1.9x + 10.1$

12

A model predicts that the population of Bergen was 15,000 in 2005. The model also predicts that each year for the next 5 years, the population  $p$  increased by 4% of the previous year's population. Which equation best represents this model, where  $x$  is the number of years after 2005, for  $x \leq 5$ ?

- A)  $p = 0.96(15,000)^x$
- B)  $p = 1.04(15,000)^x$
- C)  $p = 15,000(0.96)^x$
- D)  $p = 15,000(1.04)^x$

15



The graph of  $y = f(x)$  is shown, where the function  $f$  is defined by  $f(x) = ax^3 + bx^2 + cx + d$  and  $a$ ,  $b$ ,  $c$ , and  $d$  are constants. For how many values of  $x$  does  $f(x) = 0$ ?

- A) One
- B) Two
- C) Three
- D) Four

16

The area  $A$ , in square centimeters, of a rectangular cutting board can be represented by the expression  $w(w + 9)$ , where  $w$  is the width, in centimeters, of the cutting board. Which expression represents the length, in centimeters, of the cutting board?

- A)  $w(w + 9)$
- B)  $w$
- C) 9
- D)  $(w + 9)$

17

$$p = \frac{k}{4j + 9}$$

The given equation relates the distinct positive numbers  $p$ ,  $k$ , and  $j$ . Which equation correctly expresses  $4j + 9$  in terms of  $p$  and  $k$ ?

- A)  $4j + 9 = \frac{k}{p}$
- B)  $4j + 9 = kp$
- C)  $4j + 9 = k - p$
- D)  $4j + 9 = \frac{p}{k}$

18

Circle  $A$  has a radius of  $3n$  and circle  $B$  has a radius of  $129n$ , where  $n$  is a positive constant. The area of circle  $B$  is how many times the area of circle  $A$ ?

- A) 43
- B) 86
- C) 129
- D) 1,849

19

The measure of angle  $R$  is  $\frac{2\pi}{3}$  radians. The measure of angle  $T$  is  $\frac{5\pi}{12}$  radians greater than the measure of angle  $R$ . What is the measure of angle  $T$ , in degrees?

- A) 75
- B) 120
- C) 195
- D) 390

20

$$y = x^2 - 14x + 22$$

The given equation relates the variables  $x$  and  $y$ . For what value of  $x$  does the value of  $y$  reach its minimum?

21

A small business owner budgets \$2,200 to purchase candles. The owner must purchase a minimum of 200 candles to maintain the discounted pricing. If the owner pays \$4.90 per candle to purchase small candles and \$11.60 per candle to purchase large candles, what is the maximum number of large candles the owner can purchase to stay within the budget and maintain the discounted pricing?

22

$$\begin{aligned}y &\leq x + 7 \\y &\geq -2x - 1\end{aligned}$$

Which point  $(x, y)$  is a solution to the given system of inequalities in the  $xy$ -plane?

- A)  $(-14, 0)$
- B)  $(0, -14)$
- C)  $(0, 14)$
- D)  $(14, 0)$

23

Weight (pounds)	Frequency
13	12
14	8
15	5
16	7
17	9
18	10
19	13
20	7

The frequency table summarizes a data set of the weights, rounded to the nearest pound, of 71 tortoises. A weight of 39 pounds is added to the original data set, creating a new data set of the weights, rounded to the nearest pound, of 72 tortoises. Which statement best compares the mean and median of the new data set to the mean and median of the original data set?

- A) The mean of the new data set is greater than the mean of the original data set, and the median of the new data set is greater than the median of the original data set.
- B) The mean of the new data set is greater than the mean of the original data set, and the medians of the two data sets are equal.
- C) The mean of the new data set is less than the mean of the original data set, and the median of the new data set is less than the median of the original data set.
- D) The mean of the new data set is less than the mean of the original data set, and the medians of the two data sets are equal.

24

$$x - 29 = (x - a)(x - 29)$$

Which of the following are solutions to the given equation, where  $a$  is a constant and  $a > 30$ ?

- I.  $a$
  - II.  $a + 1$
  - III. 29
- A) I and II only
  - B) I and III only
  - C) II and III only
  - D) I, II, and III

25

In the  $xy$ -plane, the graph of the equation  $y = -x^2 + 9x - 100$  intersects the line  $y = c$  at exactly one point. What is the value of  $c$ ?

- A)  $-\frac{481}{4}$
- B) -100
- C)  $-\frac{319}{4}$
- D)  $-\frac{9}{2}$

26

The functions  $f$  and  $g$  are defined by the given equations, where  $x \geq 0$ . Which of the following equations displays, as a constant or coefficient, the maximum value of the function it defines, where  $x \geq 0$ ?

- I.  $f(x) = 18(1.25)^x + 41$
  - II.  $g(x) = 9(0.73)^x$
- A) I only  
B) II only  
C) I and II  
D) Neither I nor II

27

The perimeter of an equilateral triangle is 852 centimeters. The three vertices of the triangle lie on a circle. The radius of the circle is  $w\sqrt{3}$  centimeters. What is the value of  $w$ ?

**STOP**

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

# Math

## 27 QUESTIONS

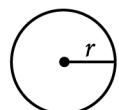
**DIRECTIONS**

The questions in this section address a number of important math skills.  
Use of a calculator is permitted for all questions.

**NOTES**

Unless otherwise indicated:

- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

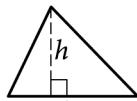
**REFERENCE**


$$A = \pi r^2$$

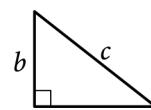
$$C = 2\pi r$$



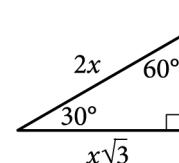
$$A = lw$$



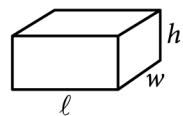
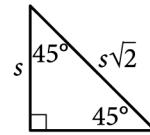
$$A = \frac{1}{2}bh$$



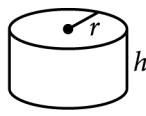
$$c^2 = a^2 + b^2$$



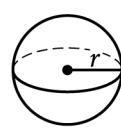
Special Right Triangles



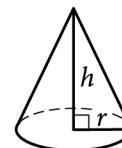
$$V = lwh$$



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



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



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



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

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

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

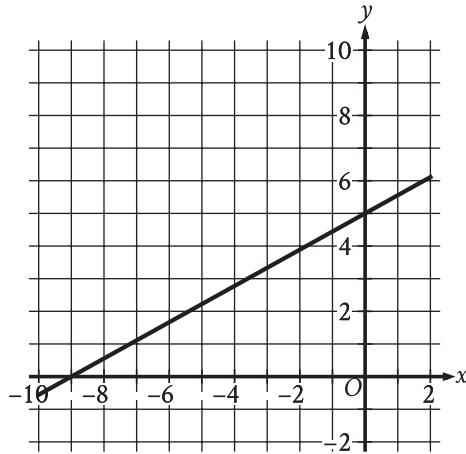
The sum of the measures in degrees of the angles of a triangle is 180.

**For multiple-choice questions,** solve each problem, choose the correct answer from the choices provided, and then circle your answer in this book. Circle only one answer for each question. If you change your mind, completely erase the circle. You will not get credit for questions with more than one answer circled, or for questions with no answers circled.

**For student-produced response questions,** solve each problem and write your answer next to or under the question in the test book as described below.

- Once you've written your answer, circle it clearly. You will not receive credit for anything written outside the circle, or for any questions with more than one circled answer.
- If you find **more than one correct answer**, write and circle only one answer.
- Your answer can be up to 5 characters for a **positive** answer and up to 6 characters (including the negative sign) for a **negative** answer, but no more.
- If your answer is a **fraction** that is too long (over 5 characters for positive, 6 characters for negative), write the decimal equivalent.
- If your answer is a **decimal** that is too long (over 5 characters for positive, 6 characters for negative), truncate it or round at the fourth digit.
- If your answer is a **mixed number** (such as  $3\frac{1}{2}$ ), write it as an improper fraction (7/2) or its decimal equivalent (3.5).
- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

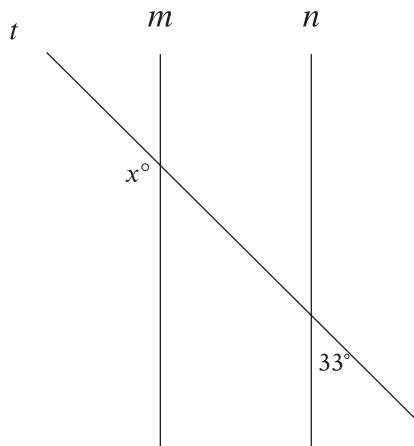
1



What is the  $y$ -intercept of the line graphed?

- A)  $(-5, 0)$
- B)  $(0, 0)$
- C)  $(0, 5)$
- D)  $(0, 9)$

3



Note: Figure not drawn to scale.

In the figure, line  $m$  is parallel to line  $n$ , and line  $t$  intersects both lines. What is the value of  $x$ ?

- A) 33
- B) 57
- C) 123
- D) 147

2

Type of store	Average number of employees
Warehouse store	365
Department store	213
Supermarket	130

For a certain region, the table shows the average number of store employees in 2016 by type of store. Based on the table, how much greater was the average number of store employees in warehouse stores than in supermarkets?

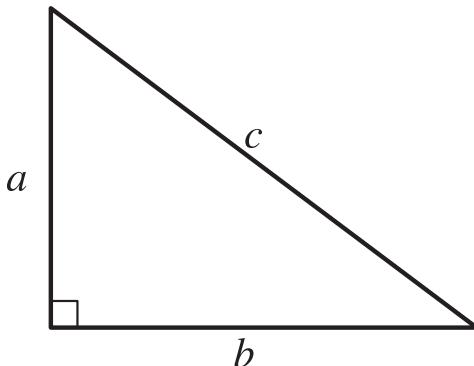
- A) 83
- B) 152
- C) 235
- D) 495

4

Sean rents a tent at a cost of \$11 per day plus a onetime insurance fee of \$10. Which equation represents the total cost  $c$ , in dollars, to rent the tent with insurance for  $d$  days?

- A)  $c = 11(d + 10)$
- B)  $c = 10(d + 11)$
- C)  $c = 11d + 10$
- D)  $c = 10d + 11$

5



Note: Figure not drawn to scale.

For the right triangle shown,  $a = 4$  and  $b = 5$ . Which expression represents the value of  $c$ ?

- A)  $4 + 5$
- B)  $\sqrt{(4)(5)}$
- C)  $\sqrt{4 + 5}$
- D)  $\sqrt{4^2 + 5^2}$

6

The function  $g$  is defined by  $g(x) = 6x$ . For what value of  $x$  is  $g(x) = 54$ ?

7

The function  $f$  is defined by  $f(x) = 8x^3 + 4$ . What is the value of  $f(2)$ ?

8

The function  $f$  is defined by  $f(x) = \frac{1}{10}x - 2$ . What is the  $y$ -intercept of the graph of  $y = f(x)$  in the  $xy$ -plane?

- A)  $(-2, 0)$
- B)  $(0, -2)$
- C)  $\left(0, \frac{1}{10}\right)$
- D)  $\left(\frac{1}{10}, 0\right)$

9

A producer is creating a video with a length of 70 minutes. The video will consist of segments that are 1 minute long and segments that are 3 minutes long. Which equation represents this situation, where  $x$  represents the number of 1-minute segments and  $y$  represents the number of 3-minute segments?

- A)  $4xy = 70$
- B)  $4(x + y) = 70$
- C)  $3x + y = 70$
- D)  $x + 3y = 70$

10

The function  $f$  is defined by  $f(x) = 7x^3$ . In the  $xy$ -plane, the graph of  $y = g(x)$  is the result of shifting the graph of  $y = f(x)$  down 2 units. Which equation defines function  $g$ ?

- A)  $g(x) = \frac{7}{2}x^3$
- B)  $g(x) = 7x^{\frac{3}{2}}$
- C)  $g(x) = 7x^3 + 2$
- D)  $g(x) = 7x^3 - 2$

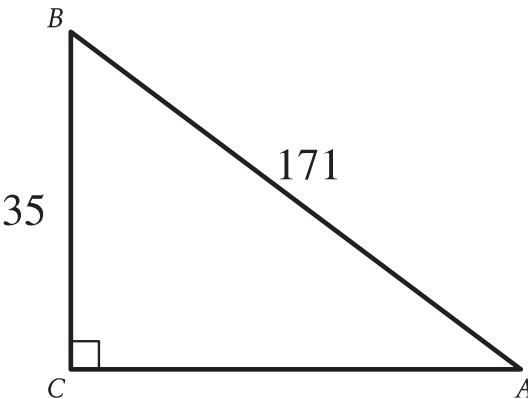
11

$$\begin{aligned}y &= -3x \\4x + y &= 15\end{aligned}$$

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

- A) 1
- B) 5
- C) 15
- D) 45

12



Note: Figure not drawn to scale.

In the right triangle shown, what is the value of  $\sin A$ ?

- A)  $\frac{1}{171}$
- B)  $\frac{35}{171}$
- C)  $\frac{171}{35}$
- D) 171

13

What is the area, in square centimeters, of a rectangle with a length of 34 centimeters (cm) and a width of 29 cm?

14

If  $\frac{x}{y} = 4$  and  $\frac{24x}{ny} = 4$ , what is the value of  $n$ ?

15

A bowl contains 20 ounces of water. When the bowl is uncovered, the amount of water in the bowl decreases by 1 ounce every 4 days. If 9 ounces of water remain in this bowl, for how many days has it been uncovered?

- A) 3
- B) 7
- C) 36
- D) 44

16

If  $9(4 - 3x) + 2 = 8(4 - 3x) + 18$ , what is the value of  $4 - 3x$ ?

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

17

A certain township consists of a 5-hectare industrial park and a 24-hectare neighborhood. The total number of trees in the township is 4,529. The equation  $5x + 24y = 4,529$  represents this situation. Which of the following is the best interpretation of  $x$  in this context?

- A) The average number of trees per hectare in the industrial park
- B) The average number of trees per hectare in the neighborhood
- C) The total number of trees in the industrial park
- D) The total number of trees in the neighborhood

18

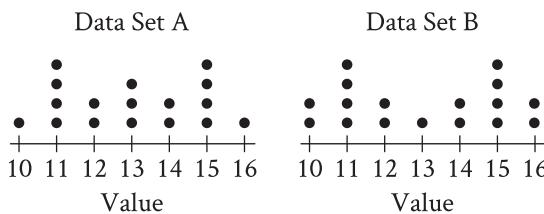
Which expression is equivalent to  $a^{\frac{11}{12}}$ ,

where  $a > 0$ ?

- A)  $\sqrt[12]{a^{132}}$
- B)  $\sqrt[144]{a^{132}}$
- C)  $\sqrt[121]{a^{132}}$
- D)  $\sqrt[11]{a^{132}}$

19

The dot plots represent the distributions of values in data sets A and B.



Which of the following statements must be true?

- I. The median of data set A is equal to the median of data set B.
  - II. The standard deviation of data set A is equal to the standard deviation of data set B.
- A) I only  
 B) II only  
 C) I and II  
 D) Neither I nor II

21

The regular price of a shirt at a store is \$11.70. The sale price of the shirt is 80% less than the regular price, and the sale price is 30% greater than the store's cost for the shirt. What was the store's cost, in dollars, for the shirt? (Disregard the \$ sign when entering your answer. For example, if your answer is \$4.97, enter 4.97)

22

A cube has an edge length of 68 inches. A solid sphere with a radius of 34 inches is inside the cube, such that the sphere touches the center of each face of the cube. To the nearest cubic inch, what is the volume of the space in the cube not taken up by the sphere?

- A) 149,796  
 B) 164,500  
 C) 190,955  
 D) 310,800

20

A circle has center  $O$ , and points  $R$  and  $S$  lie on the circle. In triangle  $ORS$ , the measure of  $\angle ROS$  is  $88^\circ$ . What is the measure of  $\angle RSO$ , in degrees?  
 (Disregard the degree symbol when entering your answer.)

23

$$y = 6x + 18$$

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

- A)  $-6x + y = 18$
- B)  $-6x + y = 22$
- C)  $-12x + y = 36$
- D)  $-12x + y = 18$

24

Triangles  $PQR$  and  $LMN$  are graphed in the  $xy$ -plane. Triangle  $PQR$  has vertices  $P$ ,  $Q$ , and  $R$  at  $(4, 5)$ ,  $(4, 7)$ , and  $(6, 5)$ , respectively. Triangle  $LMN$  has vertices  $L$ ,  $M$ , and  $N$  at  $(4, 5)$ ,  $(4, 7 + k)$ , and  $(6 + k, 5)$ , respectively, where  $k$  is a positive constant. If the measure of  $\angle Q$  is  $t^\circ$ , what is the measure of  $\angle N$ ?

- A)  $(90 - (t - k))^\circ$
- B)  $(90 - (t + k))^\circ$
- C)  $(90 - t)^\circ$
- D)  $(90 + k)^\circ$

25

$$2x + 3y = 7$$

$$10x + 15y = 35$$

For each real number  $r$ , which of the following points lies on the graph of each equation in the  $xy$ -plane for the given system?

- A)  $\left(\frac{r}{5} + 7, -\frac{r}{5} + 35\right)$
- B)  $\left(-\frac{3r}{2} + \frac{7}{2}, r\right)$
- C)  $\left(r, \frac{2r}{3} + \frac{7}{3}\right)$
- D)  $\left(r, -\frac{3r}{2} + \frac{7}{2}\right)$

26

$$\frac{x^2}{\sqrt{x^2 - c^2}} = \frac{c^2}{\sqrt{x^2 - c^2}} + 39$$

In the given equation,  $c$  is a positive constant. Which of the following is one of the solutions to the given equation?

- A)  $-c$
- B)  $-c^2 - 39^2$
- C)  $-\sqrt{39^2 - c^2}$
- D)  $-\sqrt{c^2 + 39^2}$

27

The quadratic function  $g$  models the depth, in meters, below the surface of the water of a seal  $t$  minutes after the seal entered the water during a dive. The function estimates that the seal reached its maximum depth of 302.4 meters 6 minutes after it entered the water and then reached the surface of the water 12 minutes after it entered the water. Based on the function, what was the estimated depth, to the nearest meter, of the seal 10 minutes after it entered the water?

**STOP**

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

# The SAT®

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# Practice

# Test #8



## ANSWER EXPLANATIONS

These answer explanations are for students taking the digital SAT in nondigital format.



# Reading and Writing

## Module 1

(33 questions)

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### QUESTION 1

**Choice B** is the best answer because it most logically completes the text's discussion of Juarez. In this context, "important" means marked by significant work or consequence. The text indicates that Juarez, who was the first president of Mexico from an Indigenous community, became a certain kind of figure in Mexico's history. It then supports that claim by describing some of the "many significant accomplishments" from Juarez's long tenure in office. This context conveys that Juarez is a significant and consequential figure in Mexico's history.

*Choice A* is incorrect because the text focuses on Juarez's role as the first president of Mexico from an Indigenous community and on his many major accomplishments during his lengthy time in office; nothing in the text suggests that Juarez was "unpredictable," or tended to behave in ways that couldn't be predicted. *Choice C* is incorrect because nothing in the text suggests that Juarez was a particularly "secretive" figure, or that he tended to keep things private or hidden from others. Instead, the text focuses on things that are known about Juarez: that he was the first president of Mexico from an Indigenous community, that he had a lengthy tenure, and that his many major accomplishments included consolidating the national government's authority and advancing Indigenous rights. *Choice D* is incorrect because the text focuses on the idea that Juarez, who was the first president of Mexico from an Indigenous community, had many major accomplishments during his lengthy time in office. Rather than suggesting that Juarez was an "ordinary," or common and typical, figure in Mexico's history, this context conveys that Juarez was instead a notable figure.

### QUESTION 2

**Choice D** is the best answer because it most logically completes the text's discussion of the research that Lopes-Ferreira and her colleagues are conducting on the stingray species *Potamotrygon rex*. As used in this context, "a substantial" effect means an effect that is sizable or noteworthy. The text indicates that the

researchers are seeking to determine whether there are "considerable variations" in the potency of stingray venom that are associated with variation in the stingrays' age and sex. This context suggests that the researchers want to find out whether stingray age and sex have a substantial effect on venom toxicity.

*Choice A* is incorrect because there's nothing in the text that suggests that the researchers have been studying whether the stingrays' age and sex have "a disconcerting," or an unsettling and disturbing, effect on the stingrays' venom. The text indicates that the researchers wish to determine if stingray age and sex cause large variations in the toxicity of stingray venom, not if the effect of age and sex is disconcerting. *Choice B* is incorrect because the text indicates that researchers want to find out whether differences in stingray age and sex produce differences in stingray venom, not that the researchers want to find out whether age and sex have "an acceptable," or a satisfactory, effect on venom. The text makes no mention of what would make an effect on venom toxicity acceptable and gives no indication that the researchers are interested in that question. *Choice C* is incorrect because it wouldn't make sense in context for the researchers to be looking for "an imperceptible," or an unnoticeable, effect of age and sex on stingray venom. The text says that the researchers are trying to determine if there are "considerable variations" in venom toxicity linked to age and sex, not that the researchers are trying to find effects that they can't perceive.

### QUESTION 3

**Choice A** is the best answer because it most logically completes the text's discussion of how kelp forests help marine animals. In this context, "tranquil" means free from disturbance, or calm. The text indicates that ocean currents are powerful and make it difficult for marine animals to hide from predators and that kelp forests slow currents down to create calmer areas. In other words, kelp forests create a more tranquil environment.

*Choice B* is incorrect because the text indicates that kelp forests provide shelter for marine animals, meaning they create environments that are safer, not more "dangerous." *Choice C* is incorrect because the text discusses how kelp forests affect currents in the ocean, and it isn't clear how an ocean environment could be "imaginative," or full of imagination. *Choice D* is incorrect because the text indicates that kelp forests create a calm and safe environment, and an environment that is "surprising" would be characterized by unexpected occurrences, not calmness.

### QUESTION 4

**Choice C** is the best answer because it logically and precisely completes the text's discussion of *The Mule Bone*, a play that Zora Neale Hurston and Langston Hughes wrote together. In this context, "collaboration" means working together with someone to write a literary work. The text indicates that most writers prefer to work alone and that working together destroyed the friendship between Hurston and Hughes. This establishes that *The Mule Bone* is a relatively rare example of collaboration in literature.

*Choice A* is incorrect because in this context, “characterization” would mean a literary work’s portrayal of characters’ psychological experiences and motivations, but the text doesn’t discuss characterization in *The Mule Bone* specifically or in collaborative works more generally. *Choice B* is incorrect because in this context, “interpretation” would mean the explanation of a literary work’s meaning or significance, but the text doesn’t discuss how readers or critics have interpreted *The Mule Bone*; instead, the text discusses how the play was written collaboratively and how the writing process affected the two authors. *Choice D* is incorrect because in this context, “commercialization” would mean writing a literary work in such a way as to ensure its commercial appeal, but the text never discusses commercial appeal as a factor in the writing of *The Mule Bone* specifically or the writing of collaborative works more generally.

## QUESTION 5

**Choice C** is the best answer because it most logically completes the text’s discussion of how Ofelia Zepeda has contributed to the field of linguistics. As used in this context, “extensive” means having a wide or considerable extent. The text indicates that Zepeda’s many accomplishments in linguistics are varied, including teaching linguistics, writing poetry in more than one language, creating a grammar book, and co-founding a language institute. This context supports the idea that Zepeda’s contributions to the field are extensive.

*Choice A* is incorrect because the sentence presents Zepeda’s accomplishments as examples to support the claim made in the first part of the sentence. It wouldn’t make sense to say that achievements as a professor, poet and author, and co-founder of a language institute demonstrate that Zepeda’s contributions in her field are “pragmatic,” or related to practical matters and not involving intellectual or artistic matters. *Choice B* is incorrect because the sentence presents Zepeda’s accomplishments as a professor, poet and author, and co-founder of a language institute as examples to support the claim made in the first part of the sentence. There’s no reason to believe that the positive achievements listed demonstrate that Zepeda’s contributions in her field are “controversial,” or have caused disputes and opposing viewpoints. *Choice D* is incorrect because in this context, “universal” would mean including or covering everything in a group. The sentence presents Zepeda’s accomplishments as examples to support the claim made in the first part of the sentence, and it wouldn’t make sense to say that these specific achievements—particularly as the author of a grammar book specific to the Tohono O’odham language—demonstrate that Zepeda’s contributions relate to everything in the field of linguistics.

## QUESTION 6

**Choice C** is the best answer because it most accurately describes the main purpose of the text. The text states that archaeologists recently discovered a well-preserved food shop, or *thermopolium*, in Pompeii, Italy. The text then further describes the contents of the discovery and provides an example of what was found. Thus, the overall purpose of the text is to present a recent archaeological discovery.

*Choice A* is incorrect. Although the text states that archaeologists found ancient artworks, it doesn't compare these artworks to modern ones or to any other artworks. *Choice B* is incorrect. Although the archaeological discovery discussed in the text was made in Italy, the text doesn't provide any information about politics or government in Italy. *Choice D* is incorrect because the text doesn't discuss the climate where the archaeological discovery was made or in any other region.

## QUESTION 7

**Choice D** is the best answer because it most accurately reflects the main purpose of the text. The text portrays Miss Pyne as awaiting the arrival of a carriage while Martha brings strawberries and flowers from the garden into the house. The text also describes the surroundings of the scene, stating that Miss Pyne looks "stately and calm," the evening is bright and cool, and birds are singing in the garden as the sun sets. Then the last sentence states that the house was "wide open to the long-expected guest," which strongly suggests that Miss Pyne's anticipation and Martha's activities were in preparation for the guest who is expected to arrive in the carriage. Thus, the text depicts the setting and conveys what these characters are doing as they await the arrival of their visitor.

*Choice A* is incorrect because there is nothing in the text to indicate that the characters feel any worry about the guest's arrival. The text indicates that the guest was "long-expected," but characterizing Miss Pyne as "stately and calm" conflicts with the idea that the characters are worried about the guest. *Choice B* is incorrect because the text describes a moment in time when two characters are awaiting the arrival of a visitor rather than an extended period over which characters could be seen changing. *Choice C* is incorrect. Although the text describes the activity indoors (Miss Pyne sitting calmly), it describes a higher level of activity, not stillness, outside (Martha bringing fruit and flowers and birds singing).

## QUESTION 8

**Choice A** is the best answer because it most accurately describes the overall structure of the text. The narrator begins by explaining how Charlot carefully delivers Atlante's letter to Rinaldo, and then relates that Rinaldo feels "transported with joy" after reading the letter. Therefore, the overall structure of the text is best described as a description of the delivery of a letter followed by the portrayal of a character's happiness after reading the letter.

*Choice B* is incorrect because the text indicates that the letter has been written; there's no explanation why another character hasn't written one. In addition, the text's description of Rinaldo "in a melancholy posture" suggests that he's sad and thoughtful, not that he's desperate to receive the letter. *Choice C* is incorrect. Although the text states that Charlot won't toss the letter to Rinaldo because she doesn't want it to fall, the text doesn't refer to the contents of the letter. Instead, the text describes how happy Rinaldo feels after reading it. *Choice D* is incorrect. Although the text does describe Rinaldo's reaction to the letter, the text doesn't begin by discussing Atlante's inspiration for writing the letter. Instead, the text begins by discussing the delivery of the letter.

## QUESTION 9

**Choice A** is the best answer because it best describes how the underlined portion functions in the text as a whole. The text says that the increased production quotas of food processing companies during World War II enabled employees to make better bargains in exchange for their labor. The underlined portion presents an example of this increased bargaining power: employees requested more favorable benefits, and employers complied because they were under pressure to fulfill the demanding terms of their contracts. Thus, the underlined portion of the text elaborates on a claim about labor relations in a particular industry (food processing) made earlier in the text.

*Choice B* is incorrect because there is no indication in the text that the economic factors that influenced food processing also influenced other parts of the economy; thus, the bargaining described in the underlined portion of the text cannot be called an example of a trend. *Choice C* is incorrect because the underlined portion supports the historical narrative of labor activism in food processing that is sketched in the text, instead of noting an exception to that narrative. *Choice D* is incorrect because while the underlined portion does discuss the demands that workers made in exchange for their labor, it does not discuss the identities of the workers.

## QUESTION 10

**Choice D** is the best answer because it states why Wang and his team's discovery of the *Terropterus xiushanensis* fossil was significant. The text explains that up until Wang and his team's discovery, the only fossil evidence of mixopterids came from the paleocontinent of Laurussia. Wang and his team, however, identified fossil remains of a mixopterid species from the paleocontinent Gondwana. Therefore, the team's discovery was significant because the fossil remains of a mixopterid species were outside of the paleocontinent Laurussia.

*Choice A* is incorrect. Although the text states that Wang and his team identified fossilized remains of a mixopterid species that lived more than 400 million years ago, it doesn't indicate that mixopterid fossils previously found by scientists dated to a more recent period than that. *Choice B* is incorrect. Although the text states that mixopterids are related to modern arachnids and horseshoe crabs, it doesn't suggest that the fossil discovered by Wang and his team confirmed that this relationship is closer than scientists had previously thought. *Choice C* is incorrect because the team's fossil established the presence of mixopterids on Gondwana, not on Laurussia. Moreover, the text only discusses the fossil in relation to the geographical distribution of mixopterids, not in relation to their evolution.

## QUESTION 11

**Choice B** is the best answer because it most effectively uses data from the table to complete the statement about video game availability. The text states that just a few games released in the past are available today and then indicates that there is a period of years from which only 14.22 percent of the games released are available. The table shows that 14.22 percent of games are still available from the years 1995–1999.

*Choice A* is incorrect because the years 2000–2004 are not represented in the table. *Choice C* is incorrect because the years 1970–1974 are not represented in the table. *Choice D* is incorrect because the years 1985–1989 correspond to a percentage of games still available of 15.38 percent, not 14.22 percent.

## QUESTION 12

**Choice C** is the best answer. The table shows the depths below the ocean surface at which four species of deep-sea fish live. According to the table, the range of depths at which the southern stoplight loosejaw lives is 500–2,000 meters below the surface.

*Choice A* is incorrect because the table indicates that the southern stoplight loosejaw lives 500–2,000 meters below the ocean surface, not at depths more than 2,000 meters below the surface. *Choice B* is incorrect because the table indicates that the southern stoplight loosejaw lives 500–2,000 meters below the ocean surface, not 150–400 meters below the surface. *Choice D* is incorrect because the table indicates that the southern stoplight loosejaw lives 500–2,000 meters below the ocean surface, not 250–500 meters below the surface.

## QUESTION 13

**Choice A** is the best answer because it effectively uses data from the table to complete the statement, identifying the month in which the United States had the highest number of housing starts in 2022. According to the table, which shows the number of US housing starts from January to April 2022, the highest number of housing starts was 1,803 thousand, which occurred in April.

*Choice B* is incorrect because March had 1,713 thousand housing starts, which is lower than the number of starts in April and in February. *Choice C* is incorrect because January had 1,669 thousand housing starts, which is the lowest of all the months listed in the table. *Choice D* is incorrect because February had 1,771 thousand housing starts, which is lower than the number of starts in April.

## QUESTION 14

**Choice A** is the best answer because it presents a finding that, if true, would support the claim about Chambi's photographs. The text describes a student advancing the claim that Chambi's photographs "have considerable ethnographic value"—meaning that they are valuable as records of cultures—and that they "capture diverse elements of Peruvian society" in a respectful way. If it's true that Chambi carefully photographed people from a range of different communities in Peru as well as photographed the customs and sites of different communities, that would lend support to the claim that the photographs have ethnographic value as depictions of diverse elements of society in Peru.

*Choice B* is incorrect because the student's claim is that Chambi's photographs have considerable ethnographic value because they depict diverse elements of Peruvian society; the student doesn't claim anything about the technical skill demonstrated in the photographs. *Choice C* is incorrect because neither Chambi's reputation nor the locations where his photographs may have been

published would be relevant to the student's claim that his photographs are valuable as an ethnographic record of Peru's diverse society. *Choice D* is incorrect because the popularity among other photographers of the people and places that Chambi photographed would be irrelevant to the student's claim that Chambi's photographs are valuable as an ethnographic record of Peru's diverse society.

## QUESTION 15

**Choice D** is the best answer because it presents a finding that, if true, would most directly support the researchers' hypothesis about the connection between the dusky shark population decline and the eastern oyster population decline. The text indicates that although dusky sharks don't usually eat eastern oysters, they do consume cownose rays, which are the main predators of eastern oysters. An increase in the abundance of cownose rays in the region in response to a decline in the abundance of dusky sharks would directly support the researchers' hypothesis: a higher number of cownose rays would consume more eastern oysters, driving down the oyster population.

*Choice A* is incorrect because a finding that there's an association between a decline in the regional abundance of some of dusky sharks' prey and the regional abundance of dusky sharks wouldn't directly support the researchers' hypothesis that a decline in dusky sharks has led to a decline in eastern oysters in the region. Although such a finding might help explain why shark abundance has declined, it would reveal nothing about whether the shark decline is related to the oyster decline. *Choice B* is incorrect because a finding that eastern oyster abundance tends to be greater when dusky sharks and cownose rays are present than when only dusky sharks are present wouldn't support the researchers' hypothesis that a decline in dusky sharks has led to a decline in eastern oysters in the region. The text indicates that the sharks prey on the rays, which are the main predators of the oysters; if oyster abundance is found to be greater when rays are present than when rays are absent, that would suggest that rays aren't keeping oyster abundance down, and thus that a decline in rays' predators, which would be expected to lead to an increase in the abundance of rays, wouldn't bring about a decline in oyster abundance as the researchers hypothesize. *Choice C* is incorrect because a finding that consumption of eastern oysters by cownose rays increased substantially before dusky sharks declined in regional abundance wouldn't support the researchers' hypothesis that the decline in dusky sharks has led to a decline in eastern oysters in the region. Such a finding would suggest that some factor other than shark abundance led to an increase in rays' consumption of oysters and thus to a decrease in oyster abundance, thereby weakening the researchers' hypothesis.

## QUESTION 16

**Choice C** is the best answer because it presents a finding that, if true, would support the researchers' hypothesis about the plants' dependence on dissolving rock. The text indicates that the roots of the two plant species grow directly into quartzite rock, where hairs on the roots secrete acids that dissolve the rock. The researchers hypothesize that the plants depend on this process because

dissolving rock opens spaces for the roots to grow and releases phosphates that provide the plants with phosphorus, a vital nutrient. If the plants carry out this process of dissolving rock even when the rock already has spaces into which the roots could grow, that would support the researchers' hypothesis because it suggests that the plants are getting some advantage—such as access to phosphorus—from the action of dissolving rock. If the plants don't benefit from dissolving rock, they would be expected to grow in the cracks that already exist, as doing so would mean that the plants don't have to spend energy creating and secreting acids; if, however, the plants create new entry points by dissolving rock even when cracks already exist, that would support the hypothesis that they depend on dissolving rock for some benefit.

*Choice A* is incorrect because the existence of soil-inhabiting members of the Velloziaceae family with similar root structures to those of the two species discussed in the text wouldn't support the researchers' hypothesis that the species discussed in the text depend on dissolving rock. If other such members exist, that might suggest that the root structures can serve more functions than secreting acids to dissolve rock (since dissolving rock may not be necessary for plants living in soil), but that wouldn't suggest anything about whether the species discussed in the text benefit from dissolving rock. *Choice B* is incorrect because differences in the proportions of citric and malic acid secreted by the two species would be irrelevant to the hypothesis that the plants depend on dissolving rock. There's no information in the text to suggest that the proportion of each acid has any bearing on the process of dissolving rock or on any benefits the plants might receive from that process. *Choice D* is incorrect because if the two species thrive on rocks without phosphates, that would weaken the researchers' hypothesis that the plants depend on dissolving rock partly because dissolving rock gives them access to phosphates. If the plants can survive on rocks without getting a vital nutrient by dissolving those rocks, then either the nutrient isn't actually vital for those plants or they can get the nutrient in some way other than by dissolving rocks.

## QUESTION 17

**Choice A** is the best answer because it most logically completes the text's discussion of mosquito repellents. The text begins by explaining that many repellents work by using natural components to activate multiple odor receptors on mosquitoes' antennae, and that new repellents must be created whenever mosquitoes become resistant to older ones. The text then highlights a research team's discovery that EBF, a molecular component of a chrysanthemum-flower extract, can repel mosquitoes by activating a single odor receptor, Or31, that is shared by all species of mosquitoes known to carry diseases. The text suggests that compared to the repellents mentioned earlier, a repellent that acts on the Or31 receptor would be more effective: by noting that all mosquito species known to carry diseases share the Or31 receptor, the text suggests that the Or31 receptor may be unique in this respect, meaning that a repellent such as EBF that acts on it would be more effective since it works on a single receptor shared by all mosquito species that carry diseases, rather than a combination of receptors that is not shared by all species. Once mosquitoes become resistant to EBF, it would

therefore make sense for researchers to look for other molecular components similar to EBF that target the activation of Or31 receptors, since a single such component could also repel all disease-carrying mosquitoes.

*Choice B* is incorrect because nothing in the text suggests that EBF molecules are difficult to extract from chrysanthemums and that investigating alternative extraction methods would therefore be useful for developing efficient and effective mosquito repellents. Rather, the text suggests that researchers developing new mosquito repellents should aim to identify molecular components similar to EBF, since that component targets the Or31 odor receptor shared by all species of mosquitoes known to carry diseases. *Choice C* is incorrect because nothing in the text suggests that researchers are unaware of the precise location of Or31 and other odor receptors in mosquitoes' antennae or that knowing this information would be useful for developing efficient and effective mosquito repellents. Rather, the text suggests that researchers developing new mosquito repellents should aim to identify molecular components similar to EBF, which targets the Or31 odor receptor. *Choice D* is incorrect because it doesn't logically follow that the discovery of one odor receptor shared by all disease-bearing mosquitoes should lead to further research into which repellents might activate the greatest number of odor receptors. Rather, the text suggests that researchers developing new mosquito repellents should instead search for additional molecular components that, like EBF, activate the one odor receptor that is known to be shared by all disease-bearing mosquitoes.

## QUESTION 18

**Choice D** is the best answer because it most logically completes the text's discussion of Shultz's finding about male tanagers. The text explains that because carotenoids both contribute to deeply saturated feathers and offer health benefits, having deeply saturated feathers is usually "an honest signal" (a true indication) that a bird is generally fit. However, Shultz and others have found that certain male tanagers can appear to have deeply saturated feathers even if they haven't consumed a diet rich in carotenoids, thanks to microstructures in their feathers that manipulate light. If those birds aren't necessarily eating carotenoid-rich diets, they may actually be less fit than other birds that appear to have similarly saturated feathers; this suggests that a male tanager's appearance may function as a dishonest signal, or a false indication, of the bird's overall fitness.

*Choice A* is incorrect because Shultz's finding suggests that some tanagers can signal fitness without consuming the carotenoids that contribute to fitness, thereby making those signals dishonest, not that tanagers can give honest signals of their fitness without consuming carotenoids. *Choice B* is incorrect because Shultz's finding suggests that the microstructures in certain tanagers' feathers can give a dishonest signal of fitness, not that the microstructures are less effective than actual pigmentation for signaling fitness. Whether the signal of fitness is honest or dishonest has no bearing on how effective the signal is: a signal is effective if potential mates behave as though it's true, regardless of whether it's actually true. Since there's no information in the text about how potential mates respond to the dishonest signals of some tanagers, there's no

support for the idea that the dishonest signals are less effective than the honest signals. *Choice C* is incorrect because Shultz's finding suggests that certain male tanagers may appear to be fitter than they actually are, not that scientists haven't determined why tanagers prefer mates with colorful appearances.

## QUESTION 19

**Choice C** is the best answer. The convention being tested is subject-verb agreement. The singular verb "has been" agrees in number with the singular subject "writing."

*Choice A* is incorrect because the plural verb "were" doesn't agree in number with the singular subject "writing." *Choice B* is incorrect because the plural verb "have been" doesn't agree in number with the singular subject "writing." *Choice D* is incorrect because the plural verb "are" doesn't agree in number with the singular subject "writing."

## QUESTION 20

**Choice B** is the best answer. The convention being tested is the use of non-finite (untensed) verb forms in a sentence. The modal "would," which indicates the future from a perspective in the past, should be accompanied by a non-finite plain form verb. In this choice, the non-finite plain form verb "create" is used correctly in conjunction with the non-finite plain form verb "increase" to describe what the lock would do.

*Choice A* is incorrect because the finite present tense verb "creates" can't be used in this way with the modal "would" to describe what the lock would do.

*Choice C* is incorrect because the present participle "creating" can't be used in this way with the modal "would" to describe what the lock would do. *Choice D* is incorrect because the finite past tense verb "created" can't be used in this way with the modal "would" to describe what the lock would do.

## QUESTION 21

**Choice B** is the best answer. The convention being tested is the use of punctuation around noun phrases. No punctuation is needed because the coordinated noun phrase "Thomas Hart Benton and Jackson Pollock" is a restrictive appositive, meaning that it provides essential identifying information about the noun phrase before it, "the renowned twentieth-century US artists."

*Choice A* is incorrect because no punctuation is needed between the noun phrase "the renowned twentieth-century US artists" and the restrictive appositive "Thomas Hart Benton and Jackson Pollock." Additionally, no punctuation is needed between the sentence's subject ("paintings by the renowned twentieth-century US artists Thomas Hart Benton and Jackson Pollock") and the main verb ("were featured"). *Choice C* is incorrect because no punctuation is needed between the coordinated elements "Thomas Hart Benton" and "Jackson Pollock." Additionally, no punctuation is needed between the sentence's subject ("paintings by the renowned twentieth-century US artists Thomas Hart Benton and Jackson Pollock") and the main verb ("were featured"). *Choice D* is incorrect because no

punctuation is needed between the noun phrase “the renowned twentieth-century US artists” and the restrictive appositive “Thomas Hart Benton and Jackson Pollock.”

## QUESTION 22

**Choice A** is the best answer. The convention being tested is the use of punctuation to mark boundaries between supplements and clauses. The comma after “equations” is used to separate the independent clause (“Hopper’s... equation”) from the supplementary adverb phrase “though.” The colon after “though” is used to mark the boundary between the clause ending with “though” and the following clause (“as...age”). A colon used in this way introduces information that illustrates or explains information that has come before it. In this case, the colon after “though” introduces the following explanation of how Hopper’s subsequent career would involve more than just solving equations: she would become a pioneering computer programmer.

*Choice B* is incorrect because it results in a comma splice. A comma can’t be used in this way to join two independent clauses (“Hopper’s...though” and “as... age”) such as these. *Choice C* is incorrect because it results in an illogical sequence of sentences. Placing the period after “equations” and beginning the next sentence with “Though” illogically suggests that the following information (that Hopper would help usher in the digital age) is contrary to the information in the previous sentence (Hopper’s subsequent career would involve more than just solving equations). Instead, the information that follows supports the information from the previous sentence by explaining how her work and influence extended beyond solely solving equations. *Choice D* is incorrect because it results in a run-on sentence. The two independent clauses (“Hopper’s...though” and “as...age”) are fused without punctuation.

## QUESTION 23

**Choice D** is the best answer. The convention being tested is subject-verb agreement. The plural verb “attest” agrees in number with the plural subject “trailblazing accomplishments.”

*Choice A* is incorrect because the singular verb “attests” doesn’t agree in number with the plural subject “trailblazing accomplishments.” *Choice B* is incorrect because the singular verb “has attested” doesn’t agree in number with the plural subject “trailblazing accomplishments.” *Choice C* is incorrect because the singular verb “is attesting” doesn’t agree in number with the plural subject “trailblazing accomplishments.”

## QUESTION 24

**Choice C** is the best answer. The convention being tested is the punctuation of a supplementary phrase following a clause. This choice uses a comma to separate the supplementary adverb phrase “however” from the independent clause it modifies (“They...antiquity”) and uses a semicolon to join the first independent clause (“They...antiquity”) and the second independent clause (“some...literature”).

Further, placing the semicolon after “however” indicates that the information in the clause that this is part of (that neoclassical writers were not the first to adopt classical literary modes) is contrary to what might be assumed from the information in the previous sentence (that the neoclassical writers were unique in imitating classical epic poetry and satires).

*Choice A* is incorrect because it fails to mark the boundary after “however” between the two independent clauses with appropriate punctuation. *Choice B* is incorrect because the comma after “however” can’t be used in this way to mark the boundary between the two independent clauses. *Choice D* is incorrect because placing the semicolon after “antiquity” illogically indicates that the information in the clause that this is part of (that prominent Renaissance figures were also influenced by classical literature) is contrary to the information in the previous clause (that neoclassical writers were not the first to adopt classical literary modes).

## QUESTION 25

**Choice C** is the best answer. The convention being tested is the use of punctuation and verb forms within a sentence. This choice leaves the verb “admired” in its nonfinite past participle form to function within a supplementary element (“much...followed”). Offset by commas after “works” and “followed,” this supplementary element interrupts the main clause (“English poet and Shakespeare contemporary John Donne’s works...had...been essentially gathering dust...”) with additional information about the works’ reception during Donne’s lifetime.

*Choice A* is incorrect because it fails to offset the supplementary element (“much...followed”) with appropriate punctuation, and using the finite verb “were much admired” results in an ungrammatical sentence. *Choice B* is incorrect because using the finite verb “were much admired” results in an ungrammatical sentence. *Choice D* is incorrect because it fails to offset the supplementary element (“much...followed”) with appropriate punctuation, and using the finite verb “had been much admired” results in an ungrammatical sentence.

## QUESTION 26

**Choice D** is the best answer. The convention being tested is subject-modifier placement. This choice makes “silica glass’s atomic arrangement” the subject of the sentence and places it immediately after the modifying phrase “compared to that of alumina glass.” In doing so, this choice clearly establishes that silica glass’s atomic arrangement—and not another noun in the sentence—is being compared to the atomic arrangement (“that”) of alumina glass.

*Choice A* is incorrect because it results in a dangling modifier. The placement of the noun phrase “silica glass” immediately after the modifying phrase illogically suggests that silica glass itself (rather than its atomic arrangement) is being compared to alumina glass’s atomic arrangement. *Choice B* is incorrect because it results in a dangling modifier. The placement of the noun phrase “silica glass” immediately after the modifying phrase illogically suggests that silica glass itself (rather than its atomic arrangement) is being compared to alumina glass’s atomic

arrangement. *Choice C* is incorrect because it results in a dangling modifier. The placement of the noun phrase “a significant disadvantage” immediately after the modifying phrase illogically suggests that “a significant disadvantage” is being compared to alumina glass’s atomic arrangement.

## QUESTION 27

**Choice A** is the best answer. “Still” logically signals that the information about Sher-Gil in this sentence—that she longed to leave Paris and return to India—contrasts with what one would expect after reading about Sher-Gil’s experiences in Paris in the previous sentences.

*Choice B* is incorrect because “therefore” illogically signals that the information about Sher-Gil in this sentence is a result or consequence of the descriptions in the previous sentences. Instead, this information contrasts with what one would expect after reading about Sher-Gil’s experiences in Paris. *Choice C* is incorrect because “indeed” illogically signals that the information about Sher-Gil in this sentence offers additional emphasis in support of the descriptions in the previous sentences. Instead, this information contrasts with what one would expect after reading about Sher-Gil’s experiences in Paris. *Choice D* is incorrect because “furthermore” illogically signals that the information about Sher-Gil in this sentence offers additional support for or confirmation of the descriptions in the previous sentences. Instead, this information contrasts with what one would expect after reading about Sher-Gil’s experiences in Paris.

## QUESTION 28

**Choice B** is the best answer. “Specifically” logically signals that the information in this sentence—that Molina and Rowland’s research laid the foundation for a later treaty—provides specific, precise details elaborating on the previous sentence’s more general claim about the influence of the research.

*Choice A* is incorrect because “regardless” illogically signals that the information in this sentence is true despite the previous sentence’s claim about the influence of Molina and Rowland’s research. Instead, this information—that the research laid the foundation for a later treaty—provides specific details elaborating on the previous claim. *Choice C* is incorrect because “however” illogically signals that the information in this sentence contrasts with the previous sentence’s claim about the influence of Molina and Rowland’s research. Instead, this information—that the research laid the foundation for a later treaty—provides specific details elaborating on the previous claim. *Choice D* is incorrect because “earlier” illogically signals that the information in this sentence occurred at a time before Molina and Rowland’s research influenced the fight against CFCs. Instead, this information—that the research laid the foundation for a later treaty—provides specific details elaborating on the previous claim about the research’s influence.

## QUESTION 29

**Choice C** is the best answer. “Indeed” logically signals that the description of the art installation in this sentence—its blue room and preening unicorn that leave visitors “dazzled and confused”—offers additional emphasis in support of the previous sentence’s claim about the installation’s “whimsical yet perplexing experience.”

*Choice A* is incorrect because “second” illogically signals that the description in this sentence is a second, separate claim from the previous sentence’s claim about the installation’s “whimsical yet perplexing experience.” Instead, the specific details describing the installation emphasize and support the previous claim. *Choice B* is incorrect because “instead” illogically signals that the description in this sentence is an alternative to the previous sentence’s claim about the installation’s “whimsical yet perplexing experience.” Rather, the specific details describing the installation emphasize and support that claim. *Choice D* is incorrect because “nevertheless” illogically signals that the description in this sentence is true despite the previous sentence’s claim about the installation’s “whimsical yet perplexing experience.” Instead, the specific details describing the installation emphasize and support that claim.

## QUESTION 30

**Choice A** is the best answer. The sentence emphasizes the distance covered by the Philadelphia and Lancaster Turnpike, noting that the turnpike, which connected the two Pennsylvania cities in its name, was sixty-two miles long.

*Choice B* is incorrect. The sentence emphasizes the significance of the turnpike; it doesn’t emphasize the distance that the turnpike covered. *Choice C* is incorrect. While the sentence mentions that the turnpike connected two Pennsylvania cities, it doesn’t emphasize the specific distance covered by the turnpike. *Choice D* is incorrect. The sentence emphasizes when the turnpike was built; it doesn’t emphasize the distance that the turnpike covered.

## QUESTION 31

**Choice C** is the best answer. The sentence emphasizes the aim, or goal, of the research study, noting what Terada set out to do: determine whether some of the Moon’s oxygen was coming from Earth.

*Choice A* is incorrect. The sentence focuses on how the Kaguya satellite collected data; it doesn’t emphasize the aim of the research study. *Choice B* is incorrect. While the sentence mentions what Terada was curious about before conducting the research study, it doesn’t emphasize his study’s aim. *Choice D* is incorrect. The sentence presents the research study’s conclusion; it doesn’t emphasize the study’s aim.

## QUESTION 32

**Choice A** is the best answer. The sentence emphasizes the aim of the research study by highlighting what the researchers conducting the study wanted to know—specifically, which factors influence clutch size among lizards.

*Choice B* is incorrect because the sentence emphasizes what researchers determined at the end of the study, not what the study's aim was. *Choice C* is incorrect because the sentence emphasizes a finding from the research study, not the aim of the study. *Choice D* is incorrect because the sentence emphasizes the research study's methodology, not its aim.

## QUESTION 33

**Choice D** is the best answer. The sentence uses information from the notes to make a generalization about the kind of study Glickman, Brown, and Song conducted. Specifically, the sentence indicates that the study was of a kind that used statistical methods to address questions of authorship within the field of music.

*Choice A* is incorrect because the sentence summarizes the methodology and findings of a particular analysis of a single song; it doesn't make a generalization about the kind of study conducted. *Choice B* is incorrect because the sentence mentions the data and conclusion of a particular analysis of a single song; it doesn't make a generalization about the kind of study conducted. *Choice C* is incorrect because the sentence focuses on a specific conclusion from a particular analysis of a single song; it doesn't make a generalization about the kind of study conducted.

# Reading and Writing

## Module 2

(33 questions)

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### QUESTION 1

**Choice B** is the best answer because it best completes the text's discussion of how viewers respond to colors. The text presents something art scholars have noted and gives the example of people tending to find paintings with blues and greens more appealing than those with yellows and oranges. This context conveys that certain colors are more "attractive to" viewers than other colors are.

*Choice A* is incorrect because the text indicates only that people tend to find some colors more appealing than others and gives no indication that certain colors are ever "confusing for," or puzzling to, viewers. *Choice C* is incorrect because the text discusses the relative appeal of certain colors in paintings but gives no indication that any colors would ever be "corrected by" viewers, or somehow fixed or improved by them. *Choice D* is incorrect because it wouldn't make much sense to say that some colors are more "similar to" viewers than others, which would suggest that colors and viewers are alike to different degrees. Further, the text primarily emphasizes a difference, not a similarity, in how appealing paintings tend to be based on the colors they contain.

### QUESTION 2

**Choice A** is the best answer because it most logically completes the text's discussion of how biodiversity loss due to invasive species can be avoided. As used in this context, "preventable" means able to be stopped or kept from happening. The text indicates that "people can take simple steps" to avoid bringing possible invasive species into new environments. It presents these steps as an example of how biodiversity loss due to invasive species is preventable.

*Choice B* is incorrect because it wouldn't make sense to say that a simple step like washing your shoes after traveling is an example of biodiversity loss due to invasive species being "undeniable," or something that can't be proved to be wrong. Although the text may suggest that biodiversity loss due to invasive species is something that really happens, the word that completes the text must

make the first sentence into an assertion that is illustrated by the second sentence, and the second sentence illustrates the idea that biodiversity loss due to invasive species is preventable, not undeniable. *Choice C* is incorrect because it wouldn't make sense to say that a simple step like washing your shoes after traveling is an example of biodiversity loss due to invasive species being "common," or something that happens regularly. Additionally, the text doesn't provide any information about how frequently invasive species cause biodiversity loss. *Choice D* is incorrect because it wouldn't make sense to say that a simple step like washing your shoes after traveling is an example of biodiversity loss due to invasive species being "concerning," or something that is troubling or causes worry. Although the text implies that the phenomenon of biodiversity loss due to invasive species is itself a concerning phenomenon, the word that completes the text must make the first sentence into an assertion that is illustrated by the second sentence, and the second sentence illustrates the idea that biodiversity loss due to invasive species is preventable, not concerning.

### QUESTION 3

**Choice B** is the best answer because it most logically completes the text's discussion about recycling plastics. In this context, "inadequate" means not satisfactory. The text indicates that the mechanical plastic-recycling process affects the environment and causes "the loss of material quality." The text contrasts that with Chazovachii's chemical plastic-recycling process, which is cleaner and produces a desirable product. The text's emphasis on the negative aspects of mechanical recycling suggests that it is inadequate in terms of environmental impact and the quality of the material the process yields.

*Choice A* is incorrect because in this context "resilient" would mean able to withstand difficulty and the text does not characterize the plastic-recycling process as having this quality or describe any difficulties that these processes might need to overcome. *Choice C* is incorrect because in this context "dynamic" would mean constantly changing. Although the text suggests that there have been changes in the field of recycling, as is the case with the advent of Chazovachii's chemical recycling process, there is nothing to suggest that the mechanical process itself has changed or is prone to change. *Choice D* is incorrect because in this context "satisfactory" would mean acceptable but not perfect. The text mentions only shortcomings of the mechanical process (environmental effects and lower material quality), so the text more strongly supports a negative view of this process and provides no evidence that it would be considered satisfactory.

### QUESTION 4

**Choice D** is the best answer because it most logically completes the text's discussion of the Three Sisters intercropping system. As used in this context, "intricate" would mean made up of complexly related elements. The text indicates that in the Three Sisters system, maize, squash, and beans form a "web of relations" in which the crops interact in various ways. The text's description of these interactions—the bean vines growing on the maize stalks, the squash vines keeping weeds away, and the beans adding nutrients that the maize and squash use—provides context suggesting that this "web of relations" is intricate.

*Choice A* is incorrect because describing the relationship among the crops in the Three Sisters system as “indecipherable,” or impossible to comprehend, would not make sense in context. Although the text presents the relationship as complex, the text’s description of the role that each crop plays makes it clear that the relationship is well understood, not indecipherable. *Choice B* is incorrect because the text discusses the practical benefits that each plant in the Three Sisters system provides to other members of the system, showing that the relationship among the crops that make up the system is not “ornamental,” or mainly serving a decorative purpose. *Choice C* is incorrect because describing the relationship among the crops in the Three Sisters system as “obscure,” or unknown or poorly understood, would not make sense in context. Although the text presents the relationship as complex, the text’s description of the role that each crop plays makes it clear that the relationship is well understood, not obscure.

## QUESTION 5

**Choice D** is the best answer because it most logically completes the text’s discussion of baleen whale accessory spleens. In this context, “latent” means dormant or functionless. The text sets up a contrast between the idea that baleen whale accessory spleens appear not to have a function and the research indicating that the accessory spleen may actually have a role in supporting the whales’ diving mechanisms. This context therefore conveys the idea that the assumption that baleen whale accessory spleens are latent may be incorrect.

*Choice A* is incorrect because it wouldn’t make sense to say that the role of the accessory spleen is “replicable,” or capable of being reproduced. The text indicates that the role of the accessory spleen seems to have no function, but some researchers think it does have a role; the text doesn’t address whether the role of the accessory spleen could or couldn’t be reproduced. *Choice B* is incorrect because suggesting that the role of the accessory spleen is “predetermined,” or decided in advance, wouldn’t make sense in context. Although the researchers may agree that the role of the accessory spleen or any other organ hasn’t been determined in advance, the text focuses on the idea that the accessory spleen was thought to have been functionless but may in fact serve an active role for baleen whales. *Choice C* is incorrect because it’s the opposite of what the context of the text is conveying. The second sentence of the text indicates that baleen whale accessory spleens may not be useless, not that they aren’t “operative,” or functional.

## QUESTION 6

**Choice A** is the best answer because it most accurately states the main purpose of the text. After providing a brief introduction to computer scientist Luis von Ahn, the text focuses on discussing how von Ahn’s digitization work led to the invention of a digital security test known as reCAPTCHA.

*Choice B* is incorrect because the text doesn’t address how digital scanners work. *Choice C* is incorrect. Although the text mentions von Ahn’s book-digitizing project, that information is provided as a detail, not as the main purpose of the text. *Choice D* is incorrect because the text doesn’t provide any indication of reCAPTCHA’s popularity; instead, it describes reCAPTCHA’s origin.

## QUESTION 7

**Choice C** is the best answer because it most accurately describes the overall structure of the text. Throughout the text, the speaker characterizes nighttime as if it were a person who wears clothing ("a garment" that is "velvet soft" and "violet blue") and a veil "over her face" and who moves her hands "slowly with their gem-starred light" through her dark hair. Thus, the text is structured as an extended comparison of night to a human being.

*Choice A* is incorrect because the text never mentions any particular location; instead, it focuses on presenting a single description of night as a person with certain clothing and features. *Choice B* is incorrect because the text doesn't make any reference to the sun or sunrise; instead, it focuses on presenting a single image of night as a person with certain clothing and features. *Choice D* is incorrect. Rather than describing how nighttime changes seasonally (or in any other way), the text presents a single image of night as a person with certain clothing and features.

## QUESTION 8

**Choice A** is the best answer because it most accurately portrays the main purpose of the text. At the beginning of the text, Tom asserts that he and the other people staging the play are doing so only for "a little amusement among ourselves" and aren't interested in attracting an audience or any attention with the production. Then, Tom promises that the play they chose is modest and appropriate, and he further reasons that using the well-written prose of "some respectable author" is better than using their own words. Overall, the main purpose of the text is to convey Tom's promise that the play will be inoffensive and involve only a few people.

*Choice B* is incorrect because the text doesn't indicate that Tom had earlier intentions for the play's performance or that anything has changed since the group first decided to stage a play. Instead, the text focuses on how harmless the entire endeavor will be. *Choice C* is incorrect. Although Tom mentions that using the words of a "respectable author" will be better than using their own words, he never addresses the idea that the people around him generally aren't skilled enough to stage a play. *Choice D* is incorrect because in the text Tom specifically says that they "want no audience, no publicity," which indicates that they don't plan on promoting the play at all.

## QUESTION 9

**Choice A** is the best answer because based on Text 2, it represents how Behrenfeld and colleagues would most likely respond to the "conventional wisdom" discussed in Text 1. The conventional wisdom cited holds the opinion that when there is species diversity within a phytoplankton population, "one species should emerge after outcompeting the rest"—that is, after being so successful in competing for resources that the other species vanish from the population. However, Text 2 explains that according to Behrenfeld and colleagues, phytoplankton are so small and spaced so far apart in the water that there is "much less" direct competition for resources within phytoplankton populations than scientists had previously thought.

*Choice B* is incorrect because Text 2 never discusses whether routine replenishment of ocean nutrients affects competition between phytoplankton species. *Choice C* is incorrect because the interspecies competition discussed in both texts is specifically between phytoplankton species, and neither text considers whether phytoplankton compete for resources with larger nonphytoplankton species. *Choice D* is incorrect because according to Text 2, Behrenfeld and colleagues argue that water density decreases, not increases, competition between phytoplankton species.

## QUESTION 10

**Choice D** is the best answer because it most accurately describes what the narrator and Mario did while riding in the car. The text describes a car trip that the narrator is taking with her family. The text states that during the car ride, the narrator and Mario “played games” to see how many different license plates they could spot.

*Choice A* is incorrect because the text doesn’t mention the narrator and Mario reading during the car ride and instead describes them playing games. *Choice B* is incorrect because the text doesn’t mention the narrator and Mario singing songs during the car ride and instead describes them playing games. *Choice C* is incorrect because the text doesn’t mention the narrator and Mario sleeping during the car ride and instead describes them playing games.

## QUESTION 11

**Choice B** is the best answer because it presents a statement about how Richard Wagner achieved moments of extremely high volume in his operas that is supported by the text. The text states that European composers experimented with volume in their works by increasing the number of musicians in the orchestra and provides the example of Wagner, who “added more horns, trombones, and tubas to the orchestra.” The text explains that by having more of these instruments playing at the same time, the overall volume of the orchestra could be dramatically increased at key moments in Wagner’s operas.

*Choice A* is incorrect because the text never indicates that Wagner moved his operas indoors to achieve moments of extremely high volume, nor does it indicate that his operas were previously performed outdoors. The only technique discussed in the text for achieving extremely high volume is Wagner’s addition of more instruments to create a bigger, louder orchestra. *Choice C* is incorrect because the text never says that Wagner built or used a specially designed concert hall to increase volume through echoes. The only technique discussed in the text is Wagner’s addition of more instruments to create a bigger, louder orchestra. *Choice D* is incorrect because the text never mentions any special training for singers related to volume or singing for extended periods. The text’s focus is entirely on the orchestra and how Wagner and other European composers used instruments to experiment with volume in their musical works.

## QUESTION 12

**Choice C** is the best answer because it presents a statement about the difrasismo *in cuauhtli in ocelotl* that is directly supported by the text. The text begins by describing difrasismo, a device used in Classical Nahuatl poetry. The text then mentions the device's two functions: a formal one (giving structure to lines of verse) and a ritualistic one. The text indicates that the relation between the words in a difrasismo may appear tenuous without the additional information supplied by Aztec ceremonial culture but that the meaning becomes intelligible in the context of that information. Therefore, the difrasismo's apparent obscurity can be resolved when considered in the proper cultural context.

**Choice A** is incorrect because the text doesn't indicate that the two nouns used in a difrasismo are semantically equivalent; instead, the text indicates that the two nouns used in a difrasismo make up a single metaphor whose meaning is often intelligible only in the context of information supplied by Aztec ceremonial culture. **Choice B** is incorrect because the text doesn't indicate that there's a relationship between the formal function of the difrasismo and the difrasismo's intelligibility. Additionally, the text suggests that present-day readers who are familiar with Aztec ceremonial culture wouldn't find the difrasismo to be unintelligible. **Choice D** is incorrect because the text doesn't indicate that the frequency of difrasismo's use in Classical Nahuatl is a necessary feature of intelligibility: the text indicates that an infrequently used difrasismo would presumably also be intelligible to members of an Aztec audience who are sufficiently familiar with Aztec ceremonial culture.

## QUESTION 13

**Choice D** is the best answer because it most accurately states the main idea of the text. The text explains that economist Adam Smith's famous metaphor of the invisible hand was putatively (that is, widely assumed but not proven) intended to illustrate a robust model (a consistently accurate generalization) of how individuals pursuing their own economic interests can create broader benefits for the population. The text then emphasizes the lack of affirmative evidence for this idea by calling out the term "putatively," and explaining that, according to Gavin Kennedy, Smith used the metaphor only once in his works, in reference to specific circumstances related to the now-outdated economic view known as mercantilism, and that the metaphor didn't garner much attention until economists in the twentieth century held it up as a paradigm (a theoretical framework in the field) and thereby implied that Smith shared some of their views on economics. By emphasizing "putatively," the text implies that there is no independent reason to believe that Smith would agree with the metaphor's use outside of the specific context for which he wrote it and that, therefore, the twentieth-century economists who used it did so to support their own views without regard for the metaphor's importance to Smith's work.

**Choice A** is incorrect. Although the text indicates that Smith's metaphor was largely ignored until some twentieth-century economists revived it and bolstered its status, the text suggests that the later economists used Smith's metaphor to self-servingly boost their own work while ignoring the original context in which

Smith wrote it. Moreover, the statement in this choice fails to reflect the text's emphasis on Smith's limited use of the metaphor in his work. *Choice B* is incorrect. Although the text indicates that some twentieth-century economists altered the significance of Smith's metaphor, the text doesn't suggest that the metaphor is a "useful model" of how aggregate benefits arise from individuals' selfish actions, let alone that this usefulness is unaffected by taking the metaphor out of its original context. *Choice C* is incorrect. Although the text indicates that Smith's metaphor was intended as a model of how individuals acting in their own interest produce aggregate benefits and it was written within the context of the now-outdated economic theory of mercantilism, these points are subordinate to the primary idea in the text, which is that Smith's use of the metaphor was tightly constrained but twentieth-century economists ignored the original context so that they could use the metaphor to suggest, without support, that Smith would agree with their economic views.

## QUESTION 14

**Choice B** is the best answer because it provides the most direct support from the table for the claim that two languages can convey similar amounts of information even if they're spoken at different rates. The table shows the approximate rates at which five languages are spoken and the rates at which those five languages convey information. Vietnamese is spoken at around 5.3 syllables per second, whereas Spanish is spoken at around 7.7 syllables per second, but the two languages convey information at very similar rates: Vietnamese at a rate of around 42.5 bits per second and Spanish at a rate of around 42.0 bits per second. Thus, the description of Vietnamese conveying information at around the same rate that Spanish does despite being spoken more slowly supports the claim in the text that languages can convey the same amount of information even if spoken at different rates.

*Choice A* is incorrect because it isn't true that Thai and Hungarian have the lowest rates of speech of the five languages shown. According to the table, Hungarian is spoken at around 5.9 syllables per second, which is faster than Vietnamese (5.3 syllables per second). Additionally, even if this statement were true, the assertion that two languages are spoken the slowest and convey information the slowest wouldn't support the claim that languages can convey the same amount of information even if they're spoken at different rates. *Choice C* is incorrect because it isn't true that the fastest-spoken language (Spanish, at 7.7 syllables per second) also conveys information the fastest: Spanish conveys information at 42.0 bits per second, which is slower than the 42.5 bits-per-second rate at which Vietnamese conveys information. Additionally, even if this statement were true, the assertion that the language spoken the fastest also conveys information the fastest has no bearing on the claim that languages can convey the same amount of information even if they're spoken at different rates. *Choice D* is incorrect because it isn't true that Serbian conveys information faster than Spanish does. According to the table, Serbian conveys information at a rate of around 39.1 bits per second, which is slower than the 42.0 bits-per-second rate at which Spanish conveys information.

## QUESTION 15

**Choice C** is the best answer because it accurately describes data from the table that support Barrett and Rayfield's suggestion about bite force estimates. According to the text, Barrett and Rayfield believe that estimates of dinosaur bite force may be strongly influenced by the methods used to produce them—that is, that different methods may produce significantly different results. The table shows that the studies by Bates and Falkingham and by Cost et al. used the same estimation method (muscular and skeletal modeling) and produced similar bite force estimates (approximately 35,000–57,000 newtons and 35,000–63,000 newtons, respectively). The study by Meers, however, used body-mass scaling and produced a much higher bite force estimate (183,000–235,000 newtons), while the study by Gignac and Erickson used tooth-bone interaction analysis and produced a much lower bite force estimate (8,000–34,000 newtons). The fact that one method produced similar estimates in two different studies and that two different methods used in other studies produced substantially different estimates supports the idea that dinosaur bite force estimates are significantly influenced by the methodology used to produce them.

*Choice A* is incorrect because it inaccurately describes data from the table. The table does show that the studies by Meers and by Cost et al. used different estimation methods and produced very different ranges of estimated dinosaur bite force, which would support Barrett and Rayfield's suggestion that different methodologies may produce significantly different estimates. However, the table doesn't show that the study by Meers produced the lowest estimated maximum bite force while the study by Cost et al. produced the highest. In fact, the study by Meers estimated a maximum bite force of approximately 235,000 newtons, which is the highest of all the estimated maximums. *Choice B* is incorrect. Although the data from Gignac and Ericson's study are accurately described, a single set of findings from one study using only one methodology can't show that different methodologies may produce significantly different dinosaur bite force estimates, as Barrett and Rayfield suggest. *Choice D* is incorrect. Although the table shows that the maximum bite force estimated by Cost et al. was higher than that estimated by Bates and Falkingham, the difference is relatively small; in fact, both teams estimated a minimum bite force of approximately 35,000 newtons and a maximum bite force close to approximately 60,000 newtons. Because these findings demonstrate that a single methodology (muscular and skeletal modeling) produced similar overall results in two studies, the findings don't support Barrett and Rayfield's suggestion that different methodologies may produce significantly different dinosaur bite force estimates.

## QUESTION 16

**Choice A** is the best answer because it presents a finding that, if true, would most strongly support the researchers' claim that they found evidence that experiencing awe can make people feel more connected to others and thus more likely to behave altruistically (with beneficial and unselfish concern for others). According to the text, the researchers tested for this effect by first having participants look at either something known to be awe-inspiring (very tall trees) or something ordinary (a plain building) and then purposely spilling pens near the

participants. The finding that participants who had looked at the trees helped pick up significantly more pens than did participants who had looked at the building would support the researchers' claim by demonstrating that the people who had experienced awe behaved more altruistically when the experimenter needed help than the other participants did.

*Choice B* is incorrect because a finding about helpful participants using positive words to describe the trees and the building after the experiment was over wouldn't have any bearing on the researchers' claim that experiencing awe increases altruistic behavior. The text doesn't address the use of positive words to describe things or suggest any connection between using such words and having experienced awe, so that behavior wouldn't serve as evidence that experiencing awe played a role in promoting helpful behavior. *Choice C* is incorrect because a finding that participants who didn't help the experimenter were significantly more likely than others to report having experienced awe whether they had looked at the building or the trees would weaken the researchers' claim that experiencing awe increases altruistic behavior by suggesting that the opposite might be true—that experiencing awe is in fact linked to choosing not to act in a way that benefits someone else. *Choice D* is incorrect because a finding about participants noticing that the experimenter had dropped the pens wouldn't have any bearing on the researchers' claim about people behaving altruistically. Being aware of a challenge or problem isn't necessarily beneficial on its own and isn't the same as offering help, so the finding wouldn't support the idea that experiencing awe increases altruistic behavior.

## QUESTION 17

**Choice C** is the best answer because it most logically completes the text's discussion of the sweet potato in Polynesia. The text indicates that the sweet potato is found in Polynesia but originated in South America, and that the sweet potato was being cultivated by Native Hawaiians and other Indigenous peoples in Polynesia long before sea voyages between South America and Polynesia began. The text goes on to note that research by Muñoz-Rodríguez and colleagues has established that the Polynesian varieties of sweet potato split from South American varieties more than 100,000 years ago, which is thousands of years before humans settled in Polynesia. If Polynesian peoples were cultivating the sweet potato before sea voyages between Polynesia and South America began, and if Polynesian varieties of sweet potato diverged from South American varieties well before people were in Polynesia, it can reasonably be concluded that humans didn't play a role in bringing the sweet potato to Polynesia.

*Choice A* is incorrect. The text doesn't provide any information about when the sweet potato began to be cultivated in South America, so there's no support for the conclusion that cultivation began in Polynesia before it began in South America. *Choice B* is incorrect because the text indicates that the sweet potato was being cultivated in Polynesia long before sea journeys between Polynesia and South America began. Therefore, it wouldn't be reasonable to conclude that Polynesian peoples acquired the sweet potato from South American peoples. Additionally, the text indicates that the Polynesian varieties of sweet potato diverged from the South American varieties thousands of years before people

settled in Polynesia, which suggests that the sweet potato was already present in Polynesia when people arrived. *Choice D* is incorrect because the text states that the domestic sweet potato, which is found in Polynesia, descends from a wild South American plant, not from a domesticated South American plant. The only people that the text describes as cultivating the sweet potato are Native Hawaiians and other Indigenous peoples of Polynesia.

## QUESTION 18

**Choice D** is the best answer because it most logically completes the text's discussion of the morphology (form and structure) of sea stars, a type of echinoderm. The text indicates that echinoderms have radially symmetrical body plans (symmetrical around a central point, usually in the form of a star), whereas most animals have bilaterally symmetrical body plans (symmetrical along an axis running from head to tail through a trunk). According to the text, sea stars are unusual echinoderms because, despite their radial body plan, they descended from known bilateral ancestors. This shift in body plan was thought to be a process of losing the genetic markers associated with the head region. The text explains that by comparing the genes of one sea star species (*P. miniata*) to those of a close relative, the acorn worm, researchers determined that instead, anterior (head) genes are active across the sea star's entire body, posterior (tail) genes are active in limited, peripheral locations of the body, and no trunk-related genes are active. This finding strongly suggests that, rather than becoming "headless" as they evolved from a bilateral ancestor, sea stars developed a body plan consisting almost entirely of a head region with a minimal tail region and no trunk region present.

*Choice A* is incorrect because the text doesn't identify how any particular region of sea stars' bodies influences the layout of sea stars' radial symmetry. Moreover, the text indicates that the radial symmetry of echinoderms is "usually starlike," not that a starlike layout distinguishes sea stars from other echinoderms. *Choice B* is incorrect because the text doesn't suggest that the idea that sea stars evolved from an ancestor with bilateral symmetry is incorrect (describing the bilateral origin as "known") and doesn't address any body plans other than those with radial or bilateral symmetry. The text strongly suggests that rather than revealing something about sea stars' origin, Formery et al.'s findings contradict the assumption that the current body plan of sea stars is "headless." *Choice C* is incorrect because the text suggests that Formery et al. were able to make determinations about *P. miniata* sea stars' body plan based on the comparability of genetic markers between *P. miniata* and *S. kowalevskii* acorn worms. The text indicates only that little or no activity was observed in certain types of genes associated with body development in *P. miniata*, not that those genes turned out to largely differ from body-development genes in *S. kowalevskii*.

## QUESTION 19

**Choice A** is the best answer. The convention being tested is finite and nonfinite verb forms within a sentence. A main clause requires a finite verb to perform the action of the subject (in this case, "embryos"), and this choice supplies the clause with the finite present tense verb "enter" to indicate how the embryos achieve diapause.

*Choice B* is incorrect because the nonfinite to-infinitive “to enter” doesn’t supply the main clause with a finite verb. *Choice C* is incorrect because the nonfinite participle “having entered” doesn’t supply the main clause with a finite verb. *Choice D* is incorrect because the nonfinite participle “entering” doesn’t supply the main clause with a finite verb.

## QUESTION 20

**Choice B** is the best answer. The convention being tested is the use of verbs to express tense. In this choice, the past perfect verb “had doubled” properly indicates that the doubling of the organization’s initial membership occurred during a specific period before the present (between the organization’s founding in 1967 and the end of the 1990s).

*Choice A* is incorrect because the present perfect verb “has doubled” doesn’t indicate that the organization’s doubling of its initial membership occurred during a specific period in the past. *Choice C* is incorrect because the present tense verb “doubles” doesn’t indicate that the organization’s doubling of its initial membership occurred during a specific period in the past. *Choice D* is incorrect because the future tense verb “will double” doesn’t indicate that the organization’s doubling of its initial membership occurred during a specific period in the past.

## QUESTION 21

**Choice C** is the best answer. The convention being tested is punctuation use between sentences. In this choice, the period after “percent” is used correctly to mark the boundary between one sentence (“After...percent”) and another (“Such...up”).

*Choice A* is incorrect because it results in a comma splice. A comma can’t be used in this way to mark the boundary between sentences. *Choice B* is incorrect. Without a comma preceding it, the conjunction “and” can’t be used in this way to join sentences. *Choice D* is incorrect because it results in a run-on sentence. The sentences (“After...percent” and “Such...up”) are fused without punctuation and/or a conjunction.

## QUESTION 22

**Choice A** is the best answer. The convention being tested is finite verb use in a main clause. A main clause requires a finite verb to perform the action of the subject (in this case, Ashford’s “gestures” and “habit”), and this choice supplies the finite past tense verb “helped” to indicate what Ashford’s gestures and habit helped accomplish.

*Choice B* is incorrect because the non-finite participle “helping” doesn’t supply the main clause with a finite verb. *Choice C* is incorrect because the relative clause “that helped” doesn’t supply the main clause with a finite verb. *Choice D* is incorrect because the non-finite to-infinitive “to help” doesn’t supply the main clause with a finite verb.

## QUESTION 23

**Choice C** is the best answer. The convention being tested is the punctuation of a supplementary element within a sentence. The dash after "Springs" pairs with the dash after "earth" to separate the supplementary element "in this case, the porous rocks of the hills around Hot Springs" from the rest of the sentence.

*Choice A* is incorrect because it fails to use appropriate punctuation to separate the supplementary element from the rest of the sentence. *Choice B* is incorrect because a colon can't be paired with a dash in this way to separate the supplementary element from the rest of the sentence. *Choice D* is incorrect because a comma can't be paired with a dash in this way to separate the supplementary element from the rest of the sentence.

## QUESTION 24

**Choice A** is the best answer. The convention being tested is the use of a colon within a sentence. In this choice, the colon is used in a conventional way to introduce the following description of how the number of jams available varied.

*Choice B* is incorrect because it creates a comma splice. A comma can't be used in this way to join two main clauses ("the number...varied" and "some..six").

*Choice C* is incorrect because it results in an illogical and confusing sentence. Using the conjunction "while" to join the main clause ("the number...varied") with the following clause's description of the number of jams available suggests that the variation in the number of jams is in contrast to some shoppers having twenty-four options. *Choice D* is incorrect because it results in an illogical and confusing sentence. Using "while" in this way suggests that the number of jams available varied during the time in which some shoppers had twenty-four options and others had six. The sentence makes clear, however, that what follows "varied" is a description of the variation, not a separate, simultaneous occurrence.

## QUESTION 25

**Choice B** is the best answer. The convention being tested is the punctuation of items in a complex series (a series including internal punctuation). In this choice, the semicolon after "Lagos" is conventionally used to separate the first item ("The Joys...Lagos") and the second item ("A Kind...Nigeria") in the series. Further, the comma after "Marriage" correctly separates the title "A Kind of Marriage" from the supplementary phrase ("a television...Nigeria") that describes it.

*Choice A* is incorrect because the comma after "Lagos" doesn't match the semicolon used later in the series to separate the second item ("A Kind...Nigeria") from the third item ("and...autobiography"). *Choice C* is incorrect because the comma after "Lagos" doesn't match the semicolon used later in the series to separate the second item ("A Kind...Nigeria") from the third item ("and...autobiography"). Additionally, a colon can't be used in this way to separate the title "A Kind of Marriage" from the supplementary phrase ("a television...Nigeria") that describes it. *Choice D* is incorrect because it fails to use appropriate punctuation to separate the title "A Kind of Marriage" from the supplementary phrase ("a television...Nigeria") that describes it.

## QUESTION 26

**Choice A** is the best answer. The convention being tested is the use of punctuation within a sentence. This choice correctly uses a comma to separate the supplementary adverb “though” from the preceding main clause (“Jetties can sometimes have the opposite effect”) and uses a semicolon to join the next main clause (“obstructing...areas”) to the rest of the sentence. Further, placing the semicolon after “though” logically indicates that the information earlier in this sentence (that jetties can sometimes cause erosion) is contrary to what might be assumed from the information in the previous sentence (that jetties are often constructed for the purpose of protecting coastlines from erosion).

*Choice B* is incorrect because it fails to mark the boundary between the two main clauses with appropriate punctuation. With “though...areas” functioning as a subordinate clause following the comma, this choice illogically indicates that the following information (that obstructing the natural flow of sand along the shore can sometimes lead to erosion) is contrary to the information earlier in the sentence (that jetties can sometimes cause erosion). Instead, the information following “though” supports the previous claim about the erosive effects of jetties. *Choice C* is incorrect because it’s not conventional to use a semicolon in this way to separate a main clause from a dependent clause. Further, it illogically indicates that the following information (that obstructing the natural flow of sand along the shore can sometimes lead to erosion) is contrary to the information earlier in the sentence (that jetties can sometimes cause erosion). Instead, the information following “though” supports the previous claim about the erosive effects of jetties. *Choice D* is incorrect because it results in a comma splice. Commas can’t be used in this way to set off a supplementary word or phrase between two main clauses.

## QUESTION 27

**Choice A** is the best answer. “In fact” logically signals that the information in this sentence about the large number of recordings in ANLA’s collection emphasizes and supports the previous claim that ANLA is known for its impressive audio collection.

*Choice B* is incorrect because “after” illogically signals that the information in this sentence occurs later in a sequence of events than the previous claim about ANLA’s impressive audio collection. Instead, the information about the large number of recordings emphasizes and supports that claim. *Choice C* is incorrect because “regardless” illogically signals that the information in this sentence is true despite the previous claim about ANLA’s impressive audio collection. Instead, the information about the large number of recordings emphasizes and supports that claim. *Choice D* is incorrect because “instead” illogically signals that the information in this sentence presents an alternative to the previous claim about ANLA’s impressive audio collection. Rather, the information about the large number of recordings emphasizes and supports that claim.

## QUESTION 28

**Choice A** is the best answer. “Currently” logically signals that the archaeologists’ use of drones (a current technology) to photograph the lines is the present-day continuation of the ongoing archaeological research described in the previous sentence.

**Choice B** is incorrect because “in comparison” illogically signals that the action described in this sentence offers a comparison to the ongoing archaeological research described in the previous sentence. Instead, the use of drones is the present-day continuation of that research. **Choice C** is incorrect because “still” illogically signals that the action described in this sentence occurs despite the ongoing archaeological research described in the previous sentence. Instead, the use of drones is the present-day continuation of that research. **Choice D** is incorrect because “however” illogically signals that the action described in this sentence occurs either despite or in contrast to the ongoing archaeological research described in the previous sentence. Instead, the use of drones is the present-day continuation of that research.

## QUESTION 29

**Choice C** is the best answer. “By contrast” logically signals that the information in this sentence—that dogs can see, hear, and smell by the end of two weeks—contrasts with the preceding information (that wolves can smell but not see or hear at the same age).

**Choice A** is incorrect because “in other words” illogically signals that the information about domesticated dogs in this sentence paraphrases the information about wolves in the previous sentence. Instead, the information about dogs contrasts with what came before. **Choice B** is incorrect because “for instance” illogically signals that the information about domesticated dogs in this sentence exemplifies the information about wolves in the previous sentence. Instead, the information about dogs contrasts with what came before. **Choice D** is incorrect because “accordingly” illogically signals that the information about domesticated dogs in this sentence is in accordance with, or results from, the information about wolves in the previous sentence. Instead, the information about dogs contrasts with what came before.

## QUESTION 30

**Choice B** is the best answer. “On the contrary” logically signals that the information in this sentence—that *Dies Irae*’s appearance of depth is merely an illusion—contrasts with the previous statement about a viewer’s possible assumption regarding the street painting.

**Choice A** is incorrect because “additionally” illogically signals that this sentence is simply additional information about a viewer’s possible assumption regarding the street painting. Instead, the information about how Wenner achieved the illusion of depth contrasts with the previous sentence’s description of the illusion.

**Choice C** is incorrect because “as a result” illogically signals that the information in this sentence is a result of, or caused by, a viewer’s possible assumption regarding the street painting. Instead, the information about how Wenner achieved the illusion of depth contrasts with the previous sentence’s description

of the illusion. *Choice D* is incorrect because “next” illogically signals that the information in this sentence is the next step in a process. Instead, the information about how Wenner achieved the illusion of depth contrasts with the previous sentence’s description of the illusion.

## QUESTION 31

**Choice D** is the best answer. “As such” correctly signals that the claim in this sentence—that Ostrom’s work is a repudiation of the “tragedy of the commons” view—follows logically from the information about Ostrom’s studies in the previous sentence. According to that sentence, Ostrom’s studies demonstrate that common pool resources can in fact be sustainably managed by the people who use them.

*Choice A* is incorrect because “by contrast” illogically signals that the information in this sentence contrasts with the information about Ostrom’s studies in the previous sentence. Instead, the claim that Ostrom’s work repudiates the “tragedy of the commons” view follows logically from that information. *Choice B* is incorrect because “for example” illogically signals that the claim in this sentence exemplifies the information about Ostrom’s studies in the previous sentence. Instead, the claim that Ostrom’s work repudiates the “tragedy of the commons” view follows logically from that information. *Choice C* is incorrect because “that said” illogically signals that the information in this sentence is an exception or caveat to the information about Ostrom’s studies in the previous sentence. Instead, the claim that Ostrom’s work repudiates the “tragedy of the commons” view follows logically from that information.

## QUESTION 32

**Choice B** is the best answer. The sentence effectively explains an advantage of infilling: it’s less invasive than using a power grinder.

*Choice A* is incorrect. The sentence identifies a disadvantage of power grinding; it doesn’t explain an advantage of infilling. *Choice C* is incorrect. The sentence identifies the two techniques park rangers use; it doesn’t explain an advantage of infilling. *Choice D* is incorrect. The sentence indicates that power grinding and infilling are different in one aspect; it fails to explain an advantage of infilling.

## QUESTION 33

**Choice D** is the best answer. The sentence emphasizes the role a misconception played in the naming of a place, explaining that Spanish explorers mistook a peninsula for an island and, as a result, named the peninsula after a fictional island, California.

*Choice A* is incorrect. The sentence mentions a novel that featured a fictional island, California; it doesn’t emphasize the role a misconception played in the naming of a place. *Choice B* is incorrect. The sentence notes that Baja California was originally named after a fictional place; it doesn’t emphasize the role a misconception—specifically, the Spanish explorers’ mistaken belief that the peninsula was an island—played in the naming of a place. *Choice C* is incorrect. The sentence indicates when Spanish explorers learned of the peninsula they called California; it doesn’t emphasize the role a misconception played in the naming of a place.

# Math

## Module 1 (27 questions)

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### QUESTION 1

**Choice C** is correct. It's given that  $t$  represents the number of seconds after the bus passes the marker. Substituting 2 for  $t$  in the given equation  $d=30t$  yields  $d=30(2)$ , or  $d=60$ . Therefore, the bus will be 60 feet from the marker 2 seconds after passing it.

*Choice A* is incorrect. This is the distance, in feet, the bus will be from the marker 1 second, not 2 seconds, after passing it. *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect. This is the distance, in feet, the bus will be from the marker 3 seconds, not 2 seconds, after passing it.

### QUESTION 2

**Choice C** is correct. It's given that 29 out of every 100 beads that the machine produces have a defect. It follows that if the machine produces  $k$  beads, then the number of beads that have a defect is  $\frac{29}{100}k$ , for some constant  $k$ . If a bead produced by the machine will be selected at random, the probability of selecting a bead that has a defect is given by the number of beads with a defect,  $\frac{29}{100}k$ , divided by the number of beads produced by the machine,  $k$ . Therefore, the probability of selecting a bead that has a defect is  $\frac{\frac{29}{100}k}{k}$ , or  $\frac{29}{100}$ .

*Choice A* is incorrect and may result from conceptual or computational errors.

*Choice B* is incorrect and may result from conceptual or computational errors.

*Choice D* is incorrect and may result from conceptual or computational errors.

### QUESTION 3

**Choice D** is correct. The  $y$ -intercept of a graph in the  $xy$ -plane is the point at which the graph crosses the  $y$ -axis. The graph shown crosses the  $y$ -axis at the point  $(0, 8)$ . Therefore, the  $y$ -intercept of the graph shown is  $(0, 8)$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

## QUESTION 4

**Choice D** is correct. The given expression is equivalent

to  $(2x^2+x+(-9))+(x^2+6x+1)$ , which can be rewritten as

$(2x^2+x^2)+(x+6x)+(-9+1)$ . Adding like terms in this expression yields

$3x^2+7x+(-8)$ , or  $3x^2+7x-8$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

## QUESTION 5

**Choice A** is correct. It's given that the mean price of a carton of grape tomatoes in Utah was estimated to be \$4.23, with an associated margin of error of \$0.08. It follows that plausible values for this mean price are between  $\$4.23 - \$0.08$  and  $\$4.23 + \$0.08$ . Therefore, it's plausible that the mean price of a carton of grape tomatoes for all locations that sell this product in Utah is between \$4.15 and \$4.31.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 6

The correct answer is .2. Subtracting 2.6 from each side of the given equation yields  $x=0.2$ . Therefore, the value of  $x$  that's the solution to the given equation is 0.2. Note that .2 and 1/5 are examples of ways to enter a correct answer.

## QUESTION 7

The correct answer is 240. It's given that 80% of the 300 seeds sprouted.

Therefore, the number of seeds that sprouted can be calculated by multiplying the number of seeds that were planted by  $\frac{80}{100}$ , which gives  $300\left(\frac{80}{100}\right)$ , or 240.

## QUESTION 8

**Choice A** is correct. For the linear function  $f$ , it's given that  $f(7)=28$ . Substituting 7 for  $x$  and 28 for  $f(x)$  in the given function yields  $28=4(7)+b$ , or  $28=28+b$ . Subtracting 28 from each side of this equation yields  $0=b$ . Therefore, the value of  $b$  is 0.

*Choice B* is incorrect. Substituting 1 for  $b$  in the given function yields  $f(x)=4x+1$ . For this function, when the value of  $x$  is 7, the value of  $f(x)$  is 29, not 28. *Choice C* is incorrect. Substituting 4 for  $b$  in the given function yields  $f(x)=4x+4$ . For this function, when the value of  $x$  is 7, the value of  $f(x)$  is 32, not 28. *Choice D* is incorrect. Substituting 7 for  $b$  in the given function yields  $f(x)=4x+7$ . For this function, when the value of  $x$  is 7, the value of  $f(x)$  is 35, not 28.

## QUESTION 9

**Choice B** is correct. It's given that triangle  $LMN$  is similar to triangle  $PQR$ . Corresponding angles of similar triangles are congruent. Since angle  $M$  and angle  $Q$  correspond to each other, they must be congruent. Therefore, if the measure of angle  $M$  is  $53^\circ$ , then the measure of angle  $Q$  is also  $53^\circ$ .

*Choice A* is incorrect and may result from concluding that angle  $M$  and angle  $Q$  are complementary rather than congruent. *Choice C* is incorrect and may result from concluding that angle  $M$  and angle  $Q$  are supplementary rather than congruent. *Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 10

**Choice B** is correct. The equation of a line in the  $xy$ -plane can be written in slope-intercept form  $y=mx+b$ , where  $m$  is the slope of the line and  $(0, b)$  is its  $y$ -intercept. It's given that the line passes through the point  $(0, 5)$ . Therefore,  $b=5$ . It's also given that the line is parallel to the graph of  $y=7x+4$ , which means the line has the same slope as the graph of  $y=7x+4$ . The slope of the graph of  $y=7x+4$  is 7. Therefore,  $m=7$ . Substituting 7 for  $m$  and 5 for  $b$  in the equation  $y=mx+b$  yields  $y=7x+5$ .

*Choice A* is incorrect. The graph of this equation passes through the point  $(0, 0)$ , not  $(0, 5)$ , and has a slope of 5, not 7. *Choice C* is incorrect. The graph of this equation passes through the point  $(0, 0)$ , not  $(0, 5)$ . *Choice D* is incorrect. The graph of this equation passes through the point  $(0, 7)$ , not  $(0, 5)$ , and has a slope of 5, not 7.

## QUESTION 11

**Choice B** is correct. The equation representing a linear model can be written in the form  $y=a+bx$ , or  $y=bx+a$ , where  $b$  is the slope of the graph of the model and  $(0, a)$  is the  $y$ -intercept of the graph of the model. The scatterplot shows that as the  $x$ -values of the data points increase, the  $y$ -values of the data points decrease, which means the graph of an appropriate linear model has a negative slope. Therefore,  $b < 0$ . The scatterplot also shows that the data points are close to the  $y$ -axis at a positive value of  $y$ . Therefore, the  $y$ -intercept of the graph of an appropriate linear model has a positive  $y$ -coordinate, which means  $a > 0$ . Of the given choices, only choice B,  $y=-1.9x+10.1$ , has a negative value for  $b$ , the slope, and a positive value for  $a$ , the  $y$ -coordinate of the  $y$ -intercept.

*Choice A* is incorrect. The graph of this model has a  $y$ -intercept with a negative  $y$ -coordinate, not a positive  $y$ -coordinate. *Choice C* is incorrect. The graph of this model has a positive slope, not a negative slope, and a  $y$ -intercept with a negative  $y$ -coordinate, not a positive  $y$ -coordinate. *Choice D* is incorrect. The graph of this model has a positive slope, not a negative slope.

## QUESTION 12

**Choice D** is correct. It's given that a model predicts the population of Bergen in 2005 was 15,000. The model also predicts that each year for the next 5 years, the population increased by 4% of the previous year's population. The predicted population in one of these years can be found by multiplying the predicted population from the previous year by 1.04. Since the predicted population in 2005 was 15,000, the predicted population 1 year later is  $15,000(1.04)$ . The predicted population 2 years later is this value times 1.04, which is  $15,000(1.04)(1.04)$ , or  $15,000(1.04)^2$ . The predicted population 3 years later is this value times 1.04, or  $15,000(1.04)^3$ . More generally, the predicted population,  $p$ ,  $x$  years after 2005 is represented by the equation  $p=15,000(1.04)^x$ .

*Choice A* is incorrect. Substituting 0 for  $x$  in this equation indicates the predicted population in 2005 was 0.96 rather than 15,000. *Choice B* is incorrect. Substituting 0 for  $x$  in this equation indicates the predicted population in 2005 was 1.04 rather than 15,000. *Choice C* is incorrect. This equation indicates the predicted population is decreasing, rather than increasing, by 4% each year.

## QUESTION 13

The correct answer is 25. Subtracting the second equation from the first equation in the given system of equations yields  $(2a - 2a) + (8b - 4b) = 198 - 98$ , which is equivalent to  $0 + 4b = 100$ , or  $4b = 100$ . Dividing each side of this equation by 4 yields  $b = 25$ .

## QUESTION 14

The correct answer is 6. Applying the distributive property to the expression  $ry^4(15y - 9)$  yields  $15ry^5 - 9ry^4$ . Since  $90y^5 - 54y^4$  is equivalent to  $ry^4(15y - 9)$ , it follows that  $90y^5 - 54y^4$  is also equivalent to  $15ry^5 - 9ry^4$ . Since these expressions are equivalent, it follows that corresponding coefficients are equivalent. Therefore,  $90 = 15r$  and  $-54 = -9r$ . Solving either of these equations for  $r$  will yield the value of  $r$ . Dividing both sides of  $90 = 15r$  by 15 yields  $6 = r$ . Therefore, the value of  $r$  is 6.

## QUESTION 15

**Choice C** is correct. If a value of  $x$  satisfies  $f(x)=0$ , the graph of  $y=f(x)$  will contain a point  $(x, 0)$  and thus touch the  $x$ -axis. Since there are 3 points at which this graph touches the  $x$ -axis, there are 3 values of  $x$  for which  $f(x)=0$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 16

**Choice D** is correct. It's given that the expression  $w(w+9)$  represents the area, in square centimeters, of a rectangular cutting board, where  $w$  is the width, in centimeters, of the cutting board. The area of a rectangle can be calculated by multiplying its length by its width. It follows that the length, in centimeters, of the cutting board is represented by the expression  $(w+9)$ .

*Choice A* is incorrect. This expression represents the area, in square centimeters, of the cutting board, not its length, in centimeters. *Choice B* is incorrect. This expression represents the width, in centimeters, of the cutting board, not its length. *Choice C* is incorrect. This is the difference between the length, in centimeters, and the width, in centimeters, of the cutting board, not its length, in centimeters.

## QUESTION 17

**Choice A** is correct. To express  $4j+9$  in terms of  $p$  and  $k$ , the given equation must be solved for  $4j+9$ . Since it's given that  $j$  is a positive number,  $4j+9$  is not equal to zero. Therefore, multiplying both sides of the given equation by  $4j+9$  yields the equivalent equation  $p(4j+9)=k$ . Since it's given that  $p$  is a positive number,  $p$  is not equal to zero. Therefore, dividing each side of the equation  $p(4j+9)=k$  by  $p$  yields the equivalent equation  $4j+9=\frac{k}{p}$ .

*Choice B* is incorrect. This equation is equivalent to  $p=\frac{4j+9}{k}$ . *Choice C* is incorrect. This equation is equivalent to  $p=k-4j-9$ . *Choice D* is incorrect. This equation is equivalent to  $p=k(4j+9)$ .

## QUESTION 18

**Choice D** is correct. The area of a circle can be found by using the formula  $A=\pi r^2$ , where  $A$  is the area and  $r$  is the radius of the circle. It's given that the radius of circle  $A$  is  $3n$ . Substituting this value for  $r$  into the formula  $A=\pi r^2$  gives  $A=\pi(3n)^2$ , or  $9\pi n^2$ . It's also given that the radius of circle  $B$  is  $129n$ . Substituting this value for  $r$  into the formula  $A=\pi r^2$  gives  $A=\pi(129n)^2$ , or  $16,641\pi n^2$ . Dividing the area of circle  $B$  by the area of circle  $A$  gives  $\frac{16,641\pi n^2}{9\pi n^2}$ , which simplifies to 1,849. Therefore, the area of circle  $B$  is 1,849 times the area of circle  $A$ .

*Choice A* is incorrect. This is how many times greater the radius of circle  $B$  is than the radius of circle  $A$ . *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect. This is the coefficient on the term that describes the radius of circle  $B$ .

## QUESTION 19

**Choice C** is correct. It's given that the measure of angle  $R$  is  $\frac{2\pi}{3}$  radians, and the measure of angle  $T$  is  $\frac{5\pi}{12}$  radians greater than the measure of angle  $R$ . Therefore, the measure of angle  $T$  is equal to  $\frac{2\pi}{3} + \frac{5\pi}{12}$  radians. Multiplying  $\frac{2\pi}{3}$  by  $\frac{4}{4}$  to get a common denominator with  $\frac{5\pi}{12}$  yields  $\frac{8\pi}{12}$ . Therefore,  $\frac{2\pi}{3} + \frac{5\pi}{12}$  is equivalent to  $\frac{8\pi}{12} + \frac{5\pi}{12}$ , or  $\frac{13\pi}{12}$ . Therefore, the measure of angle  $T$  is  $\frac{13\pi}{12}$  radians. The measure of angle  $T$ , in degrees, can be found by multiplying its measure, in radians, by  $\frac{180}{\pi}$ . This yields  $\frac{13\pi}{12} \times \frac{180}{\pi}$ , which is equivalent to 195 degrees. Therefore, the measure of angle  $T$  is 195 degrees.

*Choice A* is incorrect. This is the number of degrees that the measure of angle  $T$  is greater than the measure of angle  $R$ . *Choice B* is incorrect. This is the measure of angle  $R$ , in degrees. *Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 20

The correct answer is 7. When an equation is of the form  $y=ax^2+bx+c$ , where  $a$ ,  $b$ , and  $c$  are constants, the value of  $y$  reaches its minimum when  $x=-\frac{b}{2a}$ . Since the given equation is of the form  $y=ax^2+bx+c$ , it follows that  $a=1$ ,  $b=-14$ , and  $c=22$ . Therefore, the value of  $y$  reaches its minimum when  $x=-\frac{(-14)}{2(1)}$ , or  $x=7$ .

## QUESTION 21

The correct answer is 182. Let  $s$  represent the number of small candles the owner can purchase, and let  $\ell$  represent the number of large candles the owner can purchase. It's given that the owner pays \$4.90 per candle to purchase small candles and \$11.60 per candle to purchase large candles. Therefore, the owner pays  $4.90s$  dollars for  $s$  small candles and  $11.60\ell$  dollars for  $\ell$  large candles, which means the owner pays a total of  $4.90s+11.60\ell$  dollars to purchase candles. It's given that the owner budgets \$2,200 to purchase candles. Therefore,  $4.90s+11.60\ell \leq 2,200$ . It's also given that the owner must purchase a minimum of 200 candles. Therefore,  $s+\ell \geq 200$ . The inequalities  $4.90s+11.60\ell \leq 2,200$  and  $s+\ell \geq 200$  can be combined into one compound inequality by rewriting the second inequality so that its left-hand side is equivalent to the left-hand side of the first inequality. Subtracting  $\ell$  from both sides of the inequality  $s+\ell \geq 200$  yields  $s \geq 200-\ell$ . Multiplying both sides of this inequality by 4.90 yields  $4.90s \geq 4.90(200-\ell)$ , or  $4.90s \geq 980 - 4.90\ell$ . Adding  $11.60\ell$  to both sides of this inequality yields  $4.90s + 11.60\ell \geq 980 - 4.90\ell + 11.60\ell$ , or  $4.90s + 11.60\ell \geq 980 + 6.70\ell$ . This inequality can be combined with the inequality  $4.90s+11.60\ell \leq 2,200$ , which yields the compound inequality  $980 + 6.70\ell \leq 4.90s + 11.60\ell \leq 2,200$ . It follows that  $980 + 6.70\ell \leq 2,200$ . Subtracting 980 from both sides of this inequality yields  $6.70\ell \leq 1,220$ . Dividing both sides of this inequality by 6.70 yields approximately  $\ell \leq 182.09$ . Since the number of large candles the owner purchases must be a whole number, the maximum number of large candles the owner can purchase is the largest whole number less than 182.09, which is 182.

## QUESTION 22

**Choice D** is correct. A point  $(x, y)$  is a solution to a system of inequalities in the  $xy$ -plane if substituting the  $x$ -coordinate and the  $y$ -coordinate of the point for  $x$  and  $y$ , respectively, in each inequality makes both of the inequalities true.

Substituting the  $x$ -coordinate and the  $y$ -coordinate of choice D, 14 and 0, for  $x$  and  $y$ , respectively, in the first inequality in the given system,  $y \leq x+7$ , yields  $0 \leq 14+7$ , or  $0 \leq 21$ , which is true. Substituting 14 for  $x$  and 0 for  $y$  in the second inequality in the given system,  $y \geq -2x-1$ , yields  $0 \geq -2(14)-1$ , or  $0 \geq -29$ , which is true. Therefore, the point  $(14, 0)$  is a solution to the given system of inequalities in the  $xy$ -plane.

*Choice A* is incorrect. Substituting  $-14$  for  $x$  and  $0$  for  $y$  in the inequality  $y \leq x + 7$  yields  $0 \leq -14 + 7$ , or  $0 \leq -7$ , which is not true. *Choice B* is incorrect. Substituting  $0$  for  $x$  and  $-14$  for  $y$  in the inequality  $y \geq -2x - 1$  yields  $-14 \geq -2(0) - 1$ , or  $-14 \geq -1$ , which is not true. *Choice C* is incorrect. Substituting  $0$  for  $x$  and  $14$  for  $y$  in the inequality  $y \leq x + 7$  yields  $14 \leq 0 + 7$ , or  $14 \leq 7$ , which is not true.

## QUESTION 23

**Choice B** is correct. The mean of a data set is the sum of the values in the data set divided by the number of values in the data set. The new data set consists of the weights of the 71 tortoises in the original data set and one additional weight, 39. Since the additional weight, 39, is greater than any of the values in the original data set, the mean of the new data set is greater than the mean of the original data set. If a data set contains an odd number of data values, the median is represented by the middle data value in the list when the data values are listed in ascending or descending order. Since the original data set consists of the weights of 71 tortoises and is in ascending order, the median of the original data set is represented by the middle value, or the 36th value. Based on the frequencies shown in the table, the 36th value in this data set is 17. If a data set contains an even number of data values, the median is between the two middle data values when the values are listed in ascending or descending order. Since the new data set consists of the weights of 72 tortoises, the median of the new data set is between the 36th and 37th data values when the values are arranged in ascending order. To keep the data in ascending order, the additional value of 39 would be placed at the bottom of the frequency table with a frequency of 1. Therefore, based on the frequencies in the table, the 36th and 37th values in the new data set are both 17. It follows that the median of the new data set is 17, which is the same as the median of the original data set. Therefore, the mean of the new data set is greater than the mean of the original data set, and the medians of the two data sets are equal.

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 24

**Choice C** is correct. Subtracting the expression  $(x - 29)$  from both sides of the given equation yields  $0 = (x - a)(x - 29) - (x - 29)$ , which can be rewritten as  $0 = (x - a)(x - 29) + (-1)(x - 29)$ . Since the two terms on the right-hand side of this equation have a common factor of  $(x - 29)$ , it can be rewritten as  $0 = (x - 29)(x - a + (-1))$ , or  $0 = (x - 29)(x - a - 1)$ . Since  $x - a - 1$  is equivalent to  $x - (a + 1)$ , the equation  $0 = (x - 29)(x - a - 1)$  can be rewritten as  $0 = (x - 29)(x - (a + 1))$ . By the zero product property, it follows that  $x - 29 = 0$  or  $x - (a + 1) = 0$ . Adding 29 to both sides of the equation  $x - 29 = 0$  yields  $x = 29$ . Adding  $a + 1$  to both sides of the equation  $x - (a + 1) = 0$  yields  $x = a + 1$ . Therefore, the two solutions to the given equation are 29 and  $a + 1$ . Thus, only  $a + 1$  and 29, not  $a$ , are solutions to the given equation.

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 25

**Choice C** is correct. In the  $xy$ -plane, the graph of the line  $y=c$  is a horizontal line that crosses the  $y$ -axis at  $y=c$  and the graph of the quadratic equation

$y=-x^2+9x-100$  is a parabola. A parabola can intersect a horizontal line at exactly one point only at its vertex. Therefore, the value of  $c$  should be equal to the  $y$ -coordinate of the vertex of the graph of the given equation. For a quadratic equation in vertex form,  $y=a(x-h)^2+k$ , the vertex of its graph in the  $xy$ -plane is  $(h, k)$ . The given quadratic equation,  $y=-x^2+9x-100$ , can be rewritten as

$y=-\left(x^2-2\left(\frac{9}{2}\right)x+\left(\frac{9}{2}\right)^2\right)+\left(\frac{9}{2}\right)^2-100$ , or  $y=-\left(x-\frac{9}{2}\right)^2+\left(-\frac{319}{4}\right)$ . Thus, the value of  $c$  is equal to  $-\frac{319}{4}$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 26

**Choice B** is correct. For the function  $f$ , since the base of the exponent, 1.25, is greater than 1, the value of  $(1.25)^x$  increases as  $x$  increases. Therefore, the value of  $18(1.25)^x$  and the value of  $18(1.25)^x + 41$  also increase as  $x$  increases. Since  $f$  is therefore an increasing function where  $x \geq 0$ , the function  $f$  has no maximum value. For the function  $g$ , since the base of the exponent, 0.73, is less than 1, the value of  $(0.73)^x$  decreases as  $x$  increases. Therefore, the value of  $9(0.73)^x$  also decreases as  $x$  increases. It follows that the maximum value of  $g(x)$  for  $x \geq 0$  occurs when  $x=0$ . Substituting 0 for  $x$  in the function  $g$  yields  $g(0)=9(0.73)^0$ , which is equivalent to  $g(0)=9(1)$ , or  $g(0)=9$ . Therefore, the maximum value of  $g(x)$  for  $x \geq 0$  is 9, which appears as a coefficient in equation II. So, of the two equations given, only II displays, as a constant or coefficient, the maximum value of the function it defines, where  $x \geq 0$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 27

The correct answer is  $\frac{284}{3}$ . Since the perimeter of a triangle is the sum of the lengths of its sides, and the given triangle is equilateral, the length of each side is  $\frac{852}{3}$ , or 284, centimeters (cm). Right triangle  $AMO$  can be formed, where  $M$  is the midpoint of one of the triangle's sides,  $A$  is one of this side's endpoints, and  $O$  is the center of the circle. It follows that  $AM$  is  $\frac{284}{2}$ , or 142, cm. Additionally, triangle  $AMO$  has angles measuring  $30^\circ$ ,  $60^\circ$ , and  $90^\circ$ , where the measure of angle  $OMA$  is  $90^\circ$  and the measure of angle  $OAM$  is  $30^\circ$ . It follows that the length

of side  $MO$  is half the length of hypotenuse  $AO$ , and the length of side  $AM$  is  $\sqrt{3}$  times the length of side  $MO$ . It's given that  $AO=w\sqrt{3}$  cm. Therefore,  $MO=\frac{w\sqrt{3}}{2}$  cm and  $AM=\frac{w\sqrt{3}\sqrt{3}}{2}$  cm, which is equivalent to  $AM=\frac{3w}{2}$  cm. Since  $AM=142$  cm, it follows that  $\frac{3w}{2}=142$ . Multiplying both sides of this equation by 2 yields  $3w=284$ . Dividing both sides of this equation by 3 yields  $w=\frac{284}{3}$ . Note that  $284/3$ ,  $94.66$ , and  $94.67$  are examples of ways to enter a correct answer.

# Math

## Module 2 (27 questions)

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### QUESTION 1

**Choice C** is correct. The  $y$ -intercept of a graph is the point where the graph intersects the  $y$ -axis. The line graphed intersects the  $y$ -axis at the point  $(0, 5)$ . Therefore, the  $y$ -intercept of the line graphed is  $(0, 5)$ .

*Choice A* is incorrect and may result from conceptual errors. *Choice B* is incorrect and may result from conceptual errors. *Choice D* is incorrect and may result from conceptual errors.

### QUESTION 2

**Choice C** is correct. The table shows that for a certain region in 2016, the average number of store employees in warehouse stores was 365 and the average number of store employees in supermarkets was 130. Subtracting 130 from 365 yields  $365 - 130$ , or 235. Therefore, the average number of store employees was 235 greater in warehouse stores than in supermarkets.

*Choice A* is incorrect. For this region in 2016, this is how much greater the average number of store employees was in department stores than in supermarkets. *Choice B* is incorrect. For this region in 2016, this is how much greater the average number of store employees was in warehouse stores than in department stores. *Choice D* is incorrect. For this region in 2016, this is the sum of the average number of store employees in warehouse stores and in supermarkets.

### QUESTION 3

**Choice D** is correct. It's given that line  $m$  is parallel to line  $n$ , and line  $t$  intersects both lines. It follows that line  $t$  is a transversal. When two lines are parallel and intersected by a transversal, exterior angles on the same side of the transversal are supplementary. Thus,  $x + 33 = 180$ . Subtracting 33 from both sides of this equation yields  $x = 147$ . Therefore, the value of  $x$  is 147.

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

## QUESTION 4

**Choice C** is correct. It's given that the cost of renting a tent is \$11 per day for  $d$  days. Multiplying the rental cost by the number of days yields  $\$11d$ , which represents the cost of renting the tent for  $d$  days before the insurance is added. Adding the onetime insurance fee of \$10 to the rental cost of  $\$11d$  gives the total cost  $c$ , in dollars, which can be represented by the equation  $c=11d+10$ .

*Choice A* is incorrect. This equation represents the total cost to rent the tent if the insurance fee was charged every day. *Choice B* is incorrect. This equation represents the total cost to rent the tent if the daily fee was  $\$(d+11)$  for 10 days.

*Choice D* is incorrect. This equation represents the total cost to rent the tent if the daily fee was \$10 and the onetime fee was \$11.

## QUESTION 5

**Choice D** is correct. By the Pythagorean theorem, if a right triangle has a hypotenuse with length  $c$  and legs with lengths  $a$  and  $b$ , then  $c^2=a^2+b^2$ . In the right triangle shown, the hypotenuse has length  $c$  and the legs have lengths  $a$  and  $b$ . It's given that  $a=4$  and  $b=5$ . Substituting 4 for  $a$  and 5 for  $b$  in the Pythagorean theorem yields  $c^2=4^2+5^2$ . Taking the square root of both sides of this equation yields  $c=\pm\sqrt{4^2+5^2}$ . Since the length of a side of a triangle must be positive, the value of  $c$  is  $\sqrt{4^2+5^2}$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

## QUESTION 6

The correct answer is 9. It's given that  $g(x)=6x$ . Substituting 54 for  $g(x)$  in the given function yields  $54=6x$ . Dividing both sides of this equation by 6 yields  $x=9$ . Therefore, the value of  $x$  when  $g(x)=54$  is 9.

## QUESTION 7

The correct answer is 68. It's given that the function  $f$  is defined by  $f(x)=8x^3+4$ . Substituting 2 for  $x$  in this equation yields  $f(2)=8(2)^3+4$ , or  $f(2)=8(8)+4$ , which is equivalent to  $f(2)=68$ . Therefore, the value of  $f(2)$  is 68.

## QUESTION 8

**Choice B** is correct. The  $y$ -intercept of the graph of a function in the  $xy$ -plane is the point on the graph where  $x=0$ . It's given that  $f(x)=\frac{1}{10}x-2$ . Substituting 0 for  $x$  in this equation yields  $f(0)=\frac{1}{10}(0)-2$ , or  $f(0)=-2$ . Since it's given that  $y=f(x)$ , it follows that  $y=-2$  when  $x=0$ . Therefore, the  $y$ -intercept of the graph of  $y=f(x)$  in the  $xy$ -plane is  $(0, -2)$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 9

**Choice D** is correct. Since  $x$  represents the number of 1-minute segments and  $y$  represents the number of 3-minute segments, the total length of the video is  $1 \cdot x + 3 \cdot y$ , or  $x + 3y$ , minutes. Since the video is 70 minutes long, the equation  $x + 3y = 70$  represents this situation.

*Choice A* is incorrect and may result from conceptual errors. *Choice B* is incorrect and may result from conceptual errors. *Choice C* is incorrect and may result from conceptual errors.

## QUESTION 10

**Choice D** is correct. If the graph of  $y = g(x)$  is the result of shifting the graph of  $y = f(x)$  down  $k$  units in the  $xy$ -plane, the function  $g$  can be defined by an equation of the form  $g(x) = f(x) - k$ . It's given that  $f(x) = 7x^3$  and the graph of  $y = g(x)$  is the result of shifting the graph of  $y = f(x)$  down 2 units. Substituting  $7x^3$  for  $f(x)$  and 2 for  $k$  in the equation  $g(x) = f(x) - k$  yields  $g(x) = 7x^3 - 2$ .

*Choice A* is incorrect and may result from conceptual errors. *Choice B* is incorrect and may result from conceptual errors. *Choice C* is incorrect. This equation defines a function  $g$  for which the graph of  $y = g(x)$  is the result of shifting the graph of  $y = f(x)$  up, not down, 2 units.

## QUESTION 11

**Choice C** is correct. The given system of linear equations can be solved by the substitution method. Substituting  $-3x$  for  $y$  from the first equation in the given system into the second equation yields  $4x + (-3x) = 15$ , or  $x = 15$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect. This is the absolute value of  $y$ , not the value of  $x$ .

## QUESTION 12

**Choice B** is correct. The sine of an acute angle in a right triangle is the ratio of the length of the side opposite that angle to the length of the hypotenuse. The hypotenuse of a right triangle is the side opposite the right angle. In right triangle  $ABC$ , side  $BC$  is the side opposite angle  $A$  and side  $AB$  is the hypotenuse. It's given that the length of side  $BC$  is 35 units and the length of side  $AB$  is 171 units. Therefore, the value of  $\sin A$  is  $\frac{35}{171}$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect. This is the ratio of the length of the hypotenuse to the length of the side opposite angle  $A$  rather than the ratio of the length of the side opposite angle  $A$  to the length of the hypotenuse. *Choice D* is incorrect. This is the length of the hypotenuse rather than  $\sin A$ .

**QUESTION 13**

The correct answer is 986. The area,  $A$ , of a rectangle is given by  $A = \ell w$ , where  $\ell$  is the length of the rectangle and  $w$  is its width. It's given that the length of the rectangle is 34 centimeters (cm) and the width is 29 cm. Substituting 34 for  $\ell$  and 29 for  $w$  in the equation  $A = \ell w$  yields  $A = (34)(29)$ , or  $A = 986$ . Therefore, the area, in square centimeters, of this rectangle is 986.

**QUESTION 14**

The correct answer is 24. The equation  $\frac{24x}{ny} = 4$  can be rewritten as  $\left(\frac{24}{n}\right)\left(\frac{x}{y}\right) = 4$ . It's given that  $\frac{x}{y} = 4$ . Substituting 4 for  $\frac{x}{y}$  in the equation  $\left(\frac{24}{n}\right)\left(\frac{x}{y}\right) = 4$  yields  $\left(\frac{24}{n}\right)(4) = 4$ . Multiplying both sides of this equation by  $n$  yields  $(24)(4) = 4n$ . Dividing both sides of this equation by 4 yields  $24 = n$ . Therefore, the value of  $n$  is 24.

**QUESTION 15**

**Choice D** is correct. It's given that the bowl starts with 20 ounces of water and has 9 ounces of water remaining after a period of time has passed. The amount of water the bowl has lost during the time period can be found by subtracting the remaining amount of water from the amount of water the bowl starts with, which yields  $20 - 9$  ounces, or 11 ounces. This means the bowl loses 11 ounces of water during that period of time. It's given that the amount of water decreases by 1 ounce every 4 days. Letting  $t$  represent the number of days the bowl has been uncovered, it follows that  $\frac{1}{4} = \frac{11}{t}$ . Multiplying both sides of this equation by 4 $t$  yields  $t = 44$ . Therefore, the bowl has been uncovered for 44 days.

**Choice A** is incorrect and may result from conceptual or calculation errors.

**Choice B** is incorrect and may result from conceptual or calculation errors.

**Choice C** is incorrect. This is the value of  $t$  for the equation  $\frac{1}{4} = \frac{9}{t}$ , not  $\frac{1}{4} = \frac{11}{t}$ .

**QUESTION 16**

**Choice D** is correct. The value of  $4 - 3x$  can be found by isolating this expression in the given equation. Subtracting 2 from both sides of the given equation yields  $9(4 - 3x) = 8(4 - 3x) + 16$ . Subtracting  $8(4 - 3x)$  from both sides of this equation yields  $9(4 - 3x) - 8(4 - 3x) = 16$ , which gives  $1(4 - 3x) = 16$ , or  $4 - 3x = 16$ . Therefore, the value of  $4 - 3x$  is 16.

**Choice A** is incorrect and may result from conceptual or calculation errors.

**Choice B** is incorrect. This is the value of  $x$ , not  $4 - 3x$ . **Choice C** is incorrect and may result from conceptual or calculation errors.

**QUESTION 17**

**Choice A** is correct. It's given that a certain township consists of a 5-hectare industrial park and a 24-hectare neighborhood and that the total number of trees in the township is 4,529. It's also given that the equation  $5x + 24y = 4,529$  represents this situation. Since the total number of trees for a given area can be

determined by taking the size of the area, in hectares, times the average number of trees per hectare, the best interpretation of  $5x$  is the number of trees in the industrial park and the best interpretation of  $24y$  is the number of trees in the neighborhood. Since 5 is the size of the industrial park, in hectares, the best interpretation of  $x$  is the average number of trees per hectare in the industrial park.

*Choice B* is incorrect and may result from conceptual errors. *Choice C* is incorrect and may result from conceptual errors. *Choice D* is incorrect and may result from conceptual errors.

## QUESTION 18

**Choice B** is correct. Since  $\frac{12}{12} = 1$ , multiplying the exponent of the given expression by  $\frac{12}{12}$  yields an equivalent expression:  $a^{\left(\frac{11}{12}/\frac{12}{12}\right)} = a^{\left(\frac{132}{144}\right)}$ . Since  $\frac{132}{144} = 132\left(\frac{1}{144}\right)$ , the expression  $a^{\frac{132}{144}}$  can be rewritten as  $a^{\left(132\left(\frac{1}{144}\right)\right)}$ . Applying properties of exponents, this expression can be rewritten as  $(a^{132})^{\frac{1}{144}}$ . An expression of the form  $(m)^{\frac{1}{k}}$ , where  $m > 0$  and  $k > 0$ , is equivalent to  $\sqrt[k]{m}$ . Therefore,  $(a^{132})^{\frac{1}{144}}$  is equivalent to  $\sqrt[144]{a^{132}}$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 19

**Choice A** is correct. The median of a data set with an odd number of values that are in ascending or descending order is the middle value of the data set. Since the distribution of the values of both data set A and data set B form symmetric dot plots, and each data set has an odd number of values, it follows that the median is given by the middle value in each of the dot plots. Thus, the median of data set A is 13, and the median of data set B is 13. Therefore, statement I is true. Data set A and data set B have the same frequency for each of the values 11, 12, 14, and 15. Data set A has a frequency of 1 for values 10 and 16, whereas data set B has a frequency of 2 for values 10 and 16. Standard deviation is a measure of the spread of a data set; it is larger when there are more values farther from the mean, and smaller when there are more values closer to the mean. Since both distributions are symmetric with an odd number of values, the mean of each data set is equal to its median. Thus, each data set has a mean of 13. Since more of the values in data set A are closer to 13 than in data set B, it follows that data set A has a smaller standard deviation than data set B. Thus, statement II is false. Therefore, only statement I must be true.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 20

The correct answer is 46. It's given that  $O$  is the center of a circle and that points  $R$  and  $S$  lie on the circle. Therefore,  $\overline{OR}$  and  $\overline{OS}$  are radii of the circle. It follows that  $OR=OS$ . If two sides of a triangle are congruent, then the angles opposite them are congruent. It follows that the angles  $\angle RSO$  and  $\angle ORS$ , which are across from the sides of equal length, are congruent. Let  $x^\circ$  represent the measure of  $\angle RSO$ . It follows that the measure of  $\angle ORS$  is also  $x^\circ$ . It's given that the measure of  $\angle ROS$  is  $88^\circ$ . Because the sum of the measures of the interior angles of a triangle is  $180^\circ$ , the equation  $x^\circ+x^\circ+88^\circ=180^\circ$ , or  $2x+88=180$ , can be used to find the measure of  $\angle RSO$ . Subtracting 88 from both sides of this equation yields  $2x=92$ . Dividing both sides of this equation by 2 yields  $x=46$ . Therefore, the measure of  $\angle RSO$ , in degrees, is 46.

## QUESTION 21

The correct answer is 1.8. It's given that the regular price of a shirt at a store is \$11.70, and the sale price of the shirt is 80% less than the regular price. It follows that the sale price of the shirt is  $\$11.70\left(1-\frac{80}{100}\right)$ , or  $\$11.70(1-0.8)$ , which is equivalent to \$2.34. It's also given that the sale price of the shirt is 30% greater than the store's cost for the shirt. Let  $x$  represent the store's cost for the shirt. It follows that  $2.34=\left(1+\frac{30}{100}\right)x$ , or  $2.34=1.3x$ . Dividing both sides of this equation by 1.3 yields  $x=1.80$ . Therefore, the store's cost, in dollars, for the shirt is 1.80. Note that 1.8 and  $9/5$  are examples of ways to enter a correct answer.

## QUESTION 22

**Choice A** is correct. The volume of a cube can be found by using the formula  $V=s^3$ , where  $V$  is the volume and  $s$  is the edge length of the cube. Therefore, the volume of the given cube is  $V=68^3$ , or 314,432 cubic inches. The volume of a sphere can be found by using the formula  $V=\frac{4}{3}\pi r^3$ , where  $V$  is the volume and  $r$  is the radius of the sphere. Therefore, the volume of the given sphere is  $V=\frac{4}{3}\pi(34)^3$ , or approximately 164,636 cubic inches. The volume of the space in the cube not taken up by the sphere is the difference between the volume of the cube and volume of the sphere. Subtracting the approximate volume of the sphere from the volume of the cube gives  $314,432 - 164,636 = 149,796$  cubic inches.

**Choice B** is incorrect and may result from conceptual or calculation errors.

**Choice C** is incorrect and may result from conceptual or calculation errors.

**Choice D** is incorrect and may result from conceptual or calculation errors.

## QUESTION 23

**Choice B** is correct. A system of two linear equations in two variables,  $x$  and  $y$ , has no solution if the lines represented by the equations in the  $xy$ -plane are parallel and distinct. Lines represented by equations in standard form,  $Ax+By=C$  and  $Dx+Ey=F$ , are parallel if the coefficients for  $x$  and  $y$  in one equation are proportional to the corresponding coefficients in the other equation, meaning

$\frac{D}{A} = \frac{E}{B}$ ; and the lines are distinct if the constants are not proportional, meaning  $\frac{F}{C}$  is not equal to  $\frac{D}{A}$  or  $\frac{E}{B}$ . The given equation,  $y=6x+18$ , can be written in standard form by subtracting  $6x$  from both sides of the equation to yield  $-6x+y=18$ . Therefore, the given equation can be written in the form  $Ax+By=C$ , where  $A=-6$ ,  $B=1$ , and  $C=18$ . The equation in choice B,  $-6x+y=22$ , is written in the form  $Dx+Ey=F$ , where  $D=-6$ ,  $E=1$ , and  $F=22$ . Therefore,  $\frac{D}{A} = \frac{-6}{-6}$ , which can be rewritten as  $\frac{D}{A}=1$ ;  $\frac{E}{B}=\frac{1}{1}$ , which can be rewritten as  $\frac{E}{B}=1$ ; and  $\frac{F}{C}=\frac{22}{18}$ , which can be rewritten as  $\frac{F}{C}=\frac{11}{9}$ . Since  $\frac{D}{A}=1$ ,  $\frac{E}{B}=1$ , and  $\frac{F}{C}$  is not equal to 1, it follows that the given equation and the equation  $-6x+y=22$  are parallel and distinct. Therefore, a system of two linear equations consisting of the given equation and the equation  $-6x+y=22$  has no solution. Thus, the equation in choice B could be the second equation in the system.

*Choice A* is incorrect. The equation  $-6x+y=18$  and the given equation represent the same line in the  $xy$ -plane. Therefore, a system of these linear equations would have infinitely many solutions, rather than no solution. *Choice C* is incorrect. The equation  $-12x+y=36$  and the given equation represent lines in the  $xy$ -plane that are distinct and not parallel. Therefore, a system of these linear equations would have exactly one solution, rather than no solution. *Choice D* is incorrect. The equation  $-12x+y=18$  and the given equation represent lines in the  $xy$ -plane that are distinct and not parallel. Therefore, a system of these linear equations would have exactly one solution, rather than no solution.

## QUESTION 24

**Choice C** is correct. Since  $P=(4, 5)$  and  $Q=(4, 7)$ , side  $PQ$  is parallel to the  $y$ -axis and has a length of 2. Since  $P=(4, 5)$  and  $R=(6, 5)$ , side  $PR$  is parallel to the  $x$ -axis and has a length of 2. Therefore, triangle  $PQR$  is a right isosceles triangle, where  $\angle P$  has measure  $90^\circ$  and  $\angle Q$  and  $\angle R$  each have measure  $45^\circ$ . It follows that if the measure of  $\angle Q$  is  $t^\circ$ , then  $t=45$ . Since  $L=(4, 5)$  and  $M=(4, 7+k)$ , side  $LM$  is parallel to the  $y$ -axis and has a length of  $k+2$ . Since  $L=(4, 5)$  and  $N=(6+k, 5)$ , side  $LN$  is parallel to the  $x$ -axis and has a length of  $k+2$ . Therefore, triangle  $LMN$  is a right isosceles triangle, where  $\angle L$  has measure  $90^\circ$  and  $\angle M$  and  $\angle N$  each have measure  $45^\circ$ . Of the given choices, only  $(90-t)^\circ$  is equal to  $45^\circ$ , so the measure of  $\angle N$  is  $(90-t)^\circ$ .

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 25

**Choice B** is correct. The two given equations are equivalent because the second equation can be obtained from the first equation by multiplying each side of the equation by 5. Thus, the graphs of the equations are coincident, so if a point lies on the graph of one of the equations, it also lies on the graph of the other equation. A point  $(x, y)$  lies on the graph of an equation in the  $xy$ -plane if and only

if this point represents a solution to the equation. It is sufficient, therefore, to find the point that represents a solution to the first given equation. Substituting the  $x$ - and  $y$ -coordinates of choice B,  $-\frac{3r}{2} + \frac{7}{2}$  and  $r$ , for  $x$  and  $y$ , respectively, in the first equation yields  $2\left(-\frac{3r}{2} + \frac{7}{2}\right) + 3r = 7$ , which is equivalent to  $-3r + 7 + 3r = 7$ , or  $7 = 7$ . Therefore, the point  $(-\frac{3r}{2} + \frac{7}{2}, r)$  represents a solution to the first equation and thus lies on the graph of each equation in the  $xy$ -plane for the given system.

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

*Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 26

**Choice D** is correct. If  $x^2 - c^2 \leq 0$ , then neither side of the given equation is defined and there can be no solution. Therefore,  $x^2 - c^2 > 0$ . Subtracting  $\frac{c^2}{\sqrt{x^2 - c^2}}$  from both sides of the given equation yields  $\frac{x^2}{\sqrt{x^2 - c^2}} - \frac{c^2}{\sqrt{x^2 - c^2}} = 39$ , or  $\frac{x^2 - c^2}{\sqrt{x^2 - c^2}} = 39$ . Squaring both sides of this equation yields  $\left(\frac{x^2 - c^2}{\sqrt{x^2 - c^2}}\right)^2 = 39^2$ , or  $\frac{(x^2 - c^2)(x^2 - c^2)}{x^2 - c^2} = 39^2$ . Since  $x^2 - c^2$  is positive and, therefore, nonzero, the expression  $\frac{x^2 - c^2}{x^2 - c^2}$  is defined and equivalent to 1. It follows that the equation  $\frac{(x^2 - c^2)(x^2 - c^2)}{x^2 - c^2} = 39^2$  can be rewritten as  $(\frac{x^2 - c^2}{x^2 - c^2})(x^2 - c^2) = 39^2$ , or  $(1)(x^2 - c^2) = 39^2$ , which is equivalent to  $x^2 - c^2 = 39^2$ .

Adding  $c^2$  to both sides of this equation yields  $x^2 = c^2 + 39^2$ . Taking the square root of both sides of this equation yields two solutions:  $x = \sqrt{c^2 + 39^2}$  and  $x = -\sqrt{c^2 + 39^2}$ . Therefore, of the given choices,  $-\sqrt{c^2 + 39^2}$  is one of the solutions to the given equation.

*Choice A* is incorrect and may result from conceptual or calculation errors.

*Choice B* is incorrect and may result from conceptual or calculation errors.

*Choice C* is incorrect and may result from conceptual or calculation errors.

## QUESTION 27

The correct answer is 168. The quadratic function  $g$  gives the estimated depth of the seal,  $g(t)$ , in meters,  $t$  minutes after the seal enters the water. It's given that function  $g$  estimates that the seal reached its maximum depth of 302.4 meters 6 minutes after it entered the water. Therefore, function  $g$  can be expressed in vertex form as  $g(t) = a(t - 6)^2 + 302.4$ , where  $a$  is a constant. Since it's also given that the seal reached the surface of the water after 12 minutes,  $g(12) = 0$ .

Substituting 12 for  $t$  and 0 for  $g(t)$  in  $g(t) = a(t - 6)^2 + 302.4$  yields  $0 = a(12 - 6)^2 + 302.4$ , or  $36a = -302.4$ . Dividing both sides of this equation by 36 gives  $a = -8.4$ . Substituting  $-8.4$  for  $a$  in  $g(t) = a(t - 6)^2 + 302.4$  gives  $g(t) = -8.4(t - 6)^2 + 302.4$ . Substituting 10 for  $t$  in  $g(t)$  gives  $g(10) = -8.4(10 - 6)^2 + 302.4$ , which is equivalent to  $g(10) = -8.4(4)^2 + 302.4$ , or  $g(10) = 168$ . Therefore, the estimated depth, to the nearest meter, of the seal 10 minutes after it entered the water was 168 meters.