

# The SAT<sup>®</sup>

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# Practice Test #8

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# Reading and Writing

27 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

Artist Marilyn Dingle's intricate, coiled baskets are \_\_\_\_\_ sweetgrass and palmetto palm. Following a Gullah technique that originated in West Africa, Dingle skillfully winds a thin palm frond around a bunch of sweetgrass with the help of a "sewing bone" to create the basket's signature look that no factory can reproduce.

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

- A) indicated by
- B) handmade from
- C) represented by
- D) collected with

3

*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

4

Diego Velázquez was the leading artist in the court of King Philip IV of Spain during the seventeenth century, but his influence was hardly \_\_\_\_\_ Spain: realist and impressionist painters around the world employed his techniques and echoed elements of his style.

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

- A) derived from
- B) recognized in
- C) confined to
- D) repressed by

5

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

6

Companies are providing consumers with more opportunities to purchase customized products than ever before. Whether buying customized sneakers, jewelry, or clothing, consumers can participate in the design of products to meet their specific needs and tastes. In turn, companies profit too: studies have shown that consumers are willing to pay more and wait longer for a customized product. Still, it can be difficult for companies to offer customization while keeping costs low, as the standard methods of mass production may not be able to accommodate making a unique product each time.

Which choice best describes the overall structure of the text?

- A) It discusses several recent innovations in product manufacturing and then suggests some potential applications of those innovations.
- B) It describes a company's recent success with new products and then explains multiple factors that may have contributed to that success.
- C) It introduces a trend in consumer products and then explains how the trend both benefits and poses a challenge to companies.
- D) It presents two contrasting product-marketing techniques and then provides examples of one of those techniques.

7

The following text is from the 1924 poem “Cycle” by D’Arcy McNickle, who was a citizen of the Confederated Salish and Kootenai Tribes.

There shall be new roads wending,  
A new beating of the drum—  
Men’s eyes shall have fresh seeing,  
Grey lives reprise their span—  
But under the new sun’s being,  
Completing what night began,  
There’ll be the same backs bending,  
The same sad feet shall drum—  
When this night finds its ending  
And day shall have come....

Which choice best states the main purpose of the text?

- A) To consider how the repetitiveness inherent in human life can be both rewarding and challenging
- B) To question whether activities completed at one time of day are more memorable than those completed at another time of day
- C) To refute the idea that joy is a more commonly experienced emotion than sadness is
- D) To demonstrate how the experiences of individuals relate to the experiences of their communities

8

The north celestial pole (NCP)—the fixed point around which stars in the Northern Hemisphere (including the Sun) appear to rotate—is discernible only at night. Inspired by the navigational strategies of some insects and birds, researchers devised a method for locating the NCP in daytime using skylight polarization, which occurs as atmospheric particles scatter sunlight. A polarimetric camera captures images of polarization patterns, which rotate as the Sun’s position in the sky changes; temporal variances across images can then be used to determine an observer’s latitude and bearing relative to the NCP.

Which choice best describes the overall structure of the text?

- A) It illustrates how most navigational tools utilize the NCP, recounts how researchers discovered that certain animals are able to navigate without using the NCP, and then proposes that this discovery could be used to avoid problems in navigation associated with reliance on the NCP.
- B) It presents a celestial-based method of navigation, enumerates the comparative benefits of an alternative method used by certain animals that is based on an unrelated natural occurrence, and then indicates how researchers assessed the relative accuracy of the two methods.
- C) It explains how the NCP is typically located, emphasizes a key difference between how humans and certain animals use the NCP for navigation, and then suggests an alternative way of using the NCP to improve existing navigational instruments.
- D) It notes an obstacle to observing an astronomical phenomenon, mentions a navigational ability of certain animals that inspired a solution to that obstacle, and then explains how researchers used an optical device to mimic that ability.

9

Culinary anthropologist Vertamae Smart-Grosvenor may be known for her decades of work in national public television and radio, but her book *Vibration Cooking: or, the Travel Notes of a Geechee Girl* is likely her most influential project. The 1970 book, whose title refers to Smart-Grosvenor's roots in the Low Country of South Carolina, was unusual for its time. It combined memoir, recipes, travel writing, and social commentary and challenged notions about conventions of food and cooking. Long admired by many, the book and its author have shaped contemporary approaches to writing about cuisine.

Which choice best describes the main idea of the text?

- A) Smart-Grosvenor's unconventional book *Vibration Cooking: or, the Travel Notes of a Geechee Girl* is an important contribution to food writing.
- B) Smart-Grosvenor held many different positions over her life, including reporter and food writer.
- C) Smart-Grosvenor's groundbreaking book *Vibration Cooking: or, the Travel Notes of a Geechee Girl* didn't receive the praise it deserved when it was first published in 1970.
- D) Smart-Grosvenor was a talented chef whose work inspired many people to start cooking for themselves.

10

The following text is from William Shakespeare's play *The Tempest*, first performed in 1611. Miranda has lived on an island with her father, Prospero, since she was three years old. Prospero has stated that Miranda likely does not remember anything other than her life on the island.

MIRANDA: 'Tis far off,  
And rather like a dream than an assurance  
That my remembrance warrants. Had I not  
Four or five women once that tended me?

PROSPERO: Thou hadst, and more, Miranda.  
But how is it  
That this lives in thy mind? What seest thou else  
In the dark backward and abysm of time?  
If thou remember'st ought ere thou camest here,  
How thou camest here thou mayst.

In the text, which point does Prospero most directly make about Miranda and her memories?

- A) Miranda's reminiscences about her early childhood have a melancholy quality that betrays her discontented view of her current circumstances.
- B) Miranda's doubts about the accuracy of one recollection of a place other than the island are clouding her judgment and seem to be making her reluctant to explore her recollection of traveling to the island.
- C) Miranda's ability to summon details of an experience she had before arriving on the island suggests that she may also be able to summon details of her arrival on the island.
- D) Miranda's impression of a scene is vague because she is remembering a scenario she had daydreamed about as a child rather than a scenario that had occurred in reality.

11

In a research paper, a student criticizes some historians of modern African politics, claiming that they have evaluated Patrice Lumumba, the first prime minister of what is now the Democratic Republic of the Congo, primarily as a symbol rather than in terms of his actions.

Which quotation from a work by a historian would best illustrate the student's claim?

- A) "Lumumba is a difficult figure to evaluate due to the starkly conflicting opinions he inspired during his life and continues to inspire today."
- B) "The available information makes it clear that Lumumba's political beliefs and values were largely consistent throughout his career."
- C) "Lumumba's practical accomplishments can be passed over quickly; it is mainly as the personification of Congolese independence that he warrants scholarly attention."
- D) "Many questions remain about Lumumba's ultimate vision for an independent Congo; without new evidence coming to light, these questions are likely to remain unanswered."

12

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.

13

The musical *Hadestown* was produced off-Broadway in New York in 2016. A revised version of the musical premiered on Broadway in 2019, in a larger production. In a review of the Broadway production, theater critic Jesse Green enthusiastically praised the musical's storytelling. However, Green also explained that he had seen the earlier version of *Hadestown* in 2016 and had found the storytelling to be very confusing. This suggests that in Green's view, \_\_\_\_\_

Which choice most logically completes the text?

- A) the 2016 version of *Hadestown* had fewer storytelling problems than the 2019 version did.
- B) *Hadestown* should have had a larger production in 2019 than it actually did.
- C) the 2019 version of *Hadestown* was less enjoyable than the 2016 version.
- D) *Hadestown* improved greatly between 2016 and its premiere on Broadway.

14

If some artifacts recovered from excavations of the settlement of Kuulo Kataa, in modern Ghana, date from the thirteenth century CE, that may lend credence to claims that the settlement was founded before or around that time. There is other evidence, however, strongly supporting a fourteenth century CE founding date for Kuulo Kataa. If both the artifact dates and the fourteenth century CE founding date are correct, that would imply that \_\_\_\_\_

Which choice most logically completes the text?

- A) artifacts from the fourteenth century CE are more commonly recovered than are artifacts from the thirteenth century CE.
- B) the artifacts originated elsewhere and eventually reached Kuulo Kataa through trade or migration.
- C) Kuulo Kataa was founded by people from a different region than had previously been assumed.
- D) excavations at Kuulo Kataa may have inadvertently damaged some artifacts dating to the fourteenth century CE.

15

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.

16

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

17

In 1930, Japanese American artist Chiura Obata depicted the natural beauty of Yosemite National Park in two memorable woodcuts: *Evening at Carl Inn* and *Lake Basin in the High Sierra*. In 2019, \_\_\_\_\_ exhibited alongside 150 of Obata's other works in a single-artist show at the Smithsonian American Art Museum.

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

- A) it was
- B) they were
- C) this was
- D) some were

18

The city of Pompeii, which was buried in ash following the eruption of Mount Vesuvius in 79 CE, continues to be studied by archaeologists.

Unfortunately, as \_\_\_\_\_ attest, archaeological excavations have disrupted ash deposits at the site, causing valuable information about the eruption to be lost.

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

- A) researchers, Roberto Scandone and Christopher Kilburn,
- B) researchers, Roberto Scandone and Christopher Kilburn
- C) researchers Roberto Scandone and Christopher Kilburn
- D) researchers Roberto Scandone, and Christopher Kilburn

19

Journalists have dubbed Gil Scott-Heron the "godfather of rap," a title that has appeared in hundreds of articles about him since the 1990s. Scott-Heron himself resisted the godfather \_\_\_\_\_ feeling that it didn't encapsulate his devotion to the broader African American blues music tradition as well as "bluesologist," the moniker he preferred.

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

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

20

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

21

Sociologist Todd Gitlin co-opted the term “recombinant,” normally used in reference to genetic engineering, to describe serialized television shows of the 1980s. Gitlin’s use of the term referenced TV studios’ practice of repackaging successful narrative formulas as new \_\_\_\_\_ even shows that varied only slightly from other shows still attracted sizeable audiences.

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

- A) content, in that era
- B) content; in that era,
- C) content in that era,
- D) content, in that era,

22

Although those who migrated to California in 1849 dreamed of finding gold nuggets in streambeds, the state’s richest deposits were buried deeply in rock, beyond the reach of individual prospectors. \_\_\_\_\_ by 1852, many had given up their fortune-hunting dreams and gone to work for one of the large companies capable of managing California’s complex mining operations.

Which choice completes the text with the most logical transition?

- A) Furthermore,
- B) Still,
- C) Consequently,
- D) Next,

23

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,

24

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

- On January 3, 1959, Alaska became the 49th state to join the US.
- On August 21, 1959, Hawaii became the 50th state to join the US.
- A new 50-star US flag was unveiled the same day.

The student wants to emphasize the order in which Alaska and Hawaii became US states. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) Alaska, the 49th US state, became a state several months before Hawaii, the 50th state, did.
- B) On August 21, 1959, a new 50-star US flag was unveiled.
- C) The 49th and 50th states to join the US did so in the same year.
- D) The same day that Hawaii became a US state—August 21, 1959—a new US flag was unveiled.

25

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

- Physicist Muluneh Abebe was working on a garment suited for both warm and cold conditions.
- He analyzed the emissivity, or ability to emit heat, of the materials he planned to use.
- Abebe found that reflective metal fibers emitted almost no heat and had an emissivity of 0.02.
- He found that silicon carbide fibers absorbed large amounts of heat and had an emissivity of 0.74.
- The amount of heat a material absorbs is equal to the amount of heat it emits.

The student wants to contrast the emissivity of reflective metal fibers with that of silicon carbide fibers. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) The ability of reflective metal fibers and silicon carbide fibers to emit heat was determined by an analysis of each material's emissivity.
- B) The amount of heat a material absorbs is equal to the amount it emits, as evidenced in Abebe's analyses.
- C) Though the reflective metal fibers and silicon carbide fibers had different rates of emissivity, Abebe planned to use both in a garment.
- D) Whereas the reflective metal fibers had an emissivity of just 0.02, the silicon carbide fibers absorbed large amounts of heat, resulting in an emissivity of 0.74.

26

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?

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

27

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?

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

## 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

## 27 QUESTIONS

### DIRECTIONS

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1

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

2

For her 2021 art installation *Anthem*, Wu Tsang joined forces with singer and composer Beverly Glenn-Copeland to produce a piece that critics found truly \_\_\_\_\_. They praised Tsang for creatively transforming a museum rotunda into a dynamic exhibit by projecting filmed images of Glenn-Copeland onto a massive 84-foot curtain and filling the space with the sounds of his and other voices singing.

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

- A) restrained
- B) inventive
- C) inexplicable
- D) mystifying

3

The author’s claim about the relationship between Neanderthals and *Homo sapiens* is \_\_\_\_\_, as it fails to account for several recent archaeological discoveries. To be convincing, his argument would need to address recent finds of additional hominid fossils, such as the latest Denisovan specimens and *Homo longi*.

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

- A) disorienting
- B) tenuous
- C) nuanced
- D) unoriginal

4

Seminole/Muscogee director Sterlin Harjo \_\_\_\_\_ television's tendency to situate Native characters in the distant past: this rejection is evident in his series *Reservation Dogs*, which revolves around teenagers who dress in contemporary styles and whose dialogue is laced with current slang.

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

- A) repudiates
- B) proclaims
- C) foretells
- D) recants

5

The following text is adapted from Zora Neale Hurston's 1921 short story "John Redding Goes to Sea." John is a child who lives in a town in the woods.

Perhaps ten-year-old John was puzzling to the folk there in the Florida woods for he was an imaginative child and fond of day-dreams.

The St. John River flowed a scarce three hundred feet from his back door. On its banks at this point grow numerous palms, luxuriant magnolias and bay trees. On the bosom of the stream float millions of delicately colored hyacinths. [John Redding] loved to wander down to the water's edge, and, casting in dry twigs, watch them sail away down stream to Jacksonville, the sea, the wide world and [he] wanted to follow them.

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

- A) It provides an extended description of a location that John likes to visit.
- B) It reveals that some residents of John's town are confused by his behavior.
- C) It illustrates the uniqueness of John's imagination compared to the imaginations of other children.
- D) It suggests that John longs to experience a larger life outside the Florida woods.

6

### Text 1

When companies in the same industry propose merging with one another, they often claim that the merger will benefit consumers by increasing efficiency and therefore lowering prices. Economist Ying Fan investigated this notion in the context of the United States newspaper market. She modeled a hypothetical merger of Minneapolis-area newspapers and found that subscription prices would rise following a merger.

### Text 2

Economists Dario Focarelli and Fabio Panetta have argued that research on the effect of mergers on prices has focused excessively on short-term effects, which tend to be adverse for consumers. Using the case of consumer banking in Italy, they show that over the long term (several years, in their study), the efficiency gains realized by merged companies do result in economic benefits for consumers.

Based on the texts, how would Focarelli and Panetta (Text 2) most likely respond to Fan's findings (Text 1)?

- A) They would recommend that Fan compare the near-term effect of a merger on subscription prices in the Minneapolis area with the effect of a merger in another newspaper market.
- B) They would argue that over the long term the expenses incurred by the merged newspaper company will also increase.
- C) They would encourage Fan to investigate whether the projected effect on subscription prices persists over an extended period.
- D) They would claim that mergers have a different effect on consumer prices in the newspaper industry than in most other industries.

7

The following text is adapted from Lewis Carroll's 1889 satirical novel *Sylvie and Bruno*. A crowd has gathered outside a room belonging to the Warden, an official who reports to the Lord Chancellor.

One man, who was more excited than the rest, flung his hat high into the air, and shouted (as well as I could make out) "Who roar for the Sub-Warden?" Everybody roared, but whether it was for the Sub-Warden, or not, did not clearly appear: some were shouting "Bread!" and some "Taxes!"; but no one seemed to know what it was they really wanted.

All this I saw from the open window of the Warden's breakfast-saloon, looking across the shoulder of the Lord Chancellor.

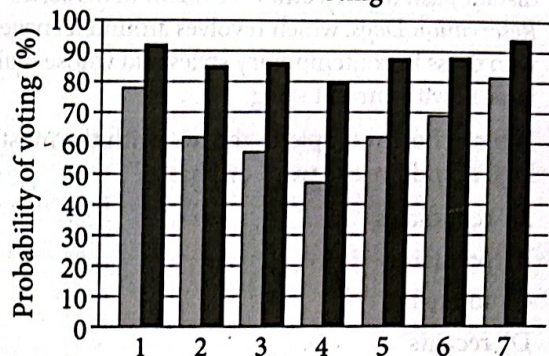
"What can it all mean?" he kept repeating to himself. "I never heard such shouting before—and at this time of the morning, too! And with such unanimity!"

Based on the text, how does the Lord Chancellor respond to the crowd?

- A) He asks about the meaning of the crowd's shouting, even though he claims to know what the crowd wants.
- B) He indicates a desire to speak to the crowd, even though the crowd has asked to speak to the Sub-Warden.
- C) He expresses sympathy for the crowd's demands, even though the crowd's shouting annoys him.
- D) He describes the crowd as being united, even though the crowd clearly appears otherwise.

8

Voters' Political Orientation, Level of Political Information, and Probability of Voting



Voters' political orientation  
(1 = strong Democrat/liberal;  
4 = independent;  
7 = strong Republican/conservative)

■ low information  
■ high information

Economists Kerwin Kofi Charles and Melvin Stephens Jr. investigated a variety of factors that influence voter turnout in the United States. Using survey data that revealed whether respondents voted in national elections and how knowledgeable respondents are about politics, Charles and Stephens claim that the likelihood of voting is driven in part by potential voters' confidence in their assessments of candidates—essentially, the more informed voters are about politics, the more confident they are at evaluating whether candidates share their views, and thus the more likely they are to vote.

Which choice best describes data in the graph that support Charles and Stephens's claim?

- A) At each point on the political orientation scale, high-information voters were more likely than low-information voters to vote.
- B) Only low-information voters who identify as independents had a voting probability below 50%.
- C) The closer that low-information voters are to the ends of the political orientation scale, the more likely they were to vote.
- D) High-information voters were more likely to identify as strong Democrats or strong Republicans than low-information voters were.

9

## 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.

10

When digging for clams, their primary food, sea otters damage the roots of eelgrass plants growing on the seafloor. Near Vancouver Island in Canada, the otter population is large and well established, yet the eelgrass meadows are healthier than those found elsewhere off Canada's coast. To explain this, conservation scientist Erin Foster and colleagues compared the Vancouver Island meadows to meadows where otters are absent or were reintroduced only recently. Finding that the Vancouver Island meadows have a more diverse gene pool than the others do, Foster hypothesized that damage to eelgrass roots increases the plant's rate of sexual reproduction; this, in turn, boosts genetic diversity, which benefits the meadows' health overall.

Which finding, if true, would most directly undermine Foster's hypothesis?

- A) At some sites in the study, eelgrass meadows are found near otter populations that are small and have only recently been reintroduced.
- B) At several sites not included in the study, there are large, well-established sea otter populations but no eelgrass meadows.
- C) At several sites not included in the study, eelgrass meadows' health correlates negatively with the length of residence and size of otter populations.
- D) At some sites in the study, the health of plants unrelated to eelgrass correlates negatively with the length of residence and size of otter populations.

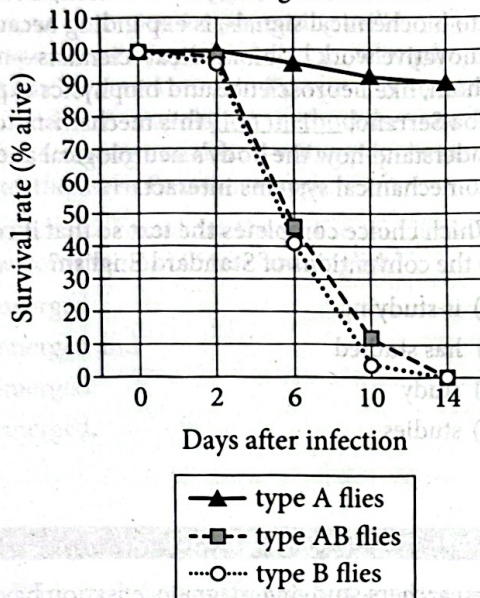
11

In the twentieth century, ethnographers made a concerted effort to collect Mexican American folklore, but they did not always agree about that folklore's origins. Scholars such as Aurelio Espinosa claimed that Mexican American folklore derived largely from the folklore of Spain, which ruled Mexico and what is now the southwestern United States from the sixteenth to early nineteenth centuries. Scholars such as Américo Paredes, by contrast, argued that while some Spanish influence is undeniable, Mexican American folklore is mainly the product of the ongoing interactions of various cultures in Mexico and the United States.

Which finding, if true, would most directly support Paredes's argument?

- A) The folklore that the ethnographers collected included several songs written in the form of a *décima*, a type of poem originating in late sixteenth-century Spain.
- B) Much of the folklore that the ethnographers collected had similar elements from region to region.
- C) Most of the folklore that the ethnographers collected was previously unknown to scholars.
- D) Most of the folklore that the ethnographers collected consisted of *corridos*—ballads about history and social life—of a clearly recent origin.

12

Average Survival of Fruit Flies  
following Infection

In a study of the evolution of *DptA* and *DptB*—*Diptericin* genes encoding antimicrobial peptides that combat pathogens and foster beneficial microbes in fruit flies (*Drosophila*)—researchers assessed *Drosophila melanogaster* resistance to pathogenic infections by *Providencia rettgeri* and *Acetobacter sicerae*, bacteria common in the flies' environments. Subjects included flies identified by mutations silencing *DptA*, *DptB*, or both *DptA* and *DptB* (termed types A, B, and AB, respectively). In conjunction with the observation that resistance to *P. rettgeri* correlates with *DptA* activity but is not significantly affected by *DptB* activity, data in the graph of survival rates post-*A. sicerae* infection suggest that \_\_\_\_\_

Which completion of the text is best supported by data in the graph?

- A) *DptA* confers defense against *A. sicerae* regardless of the presence of *DptB*.
- B) *DptB* protects against only one bacteria species, whereas *DptA* protects against multiple species.
- C) *DptB* may have developed as a specific defense against *A. sicerae*.
- D) defense against *A. sicerae* is strongest when both *DptA* and *DptB* are present.

13

Some economists have attributed the increasing adoption of automation technology by firms in the United States in part to the productivity gains firms can achieve by automating tasks previously requiring paid labor. Daron Acemoglu et al. recently complicated this account by showing not only that automation's productivity gains are often unremarkable, but that there is a disparity in the US tax code between automation technology and the labor it is nominally equivalent to: the tax code classifies automation-related technology as a depreciating asset, meaning that capital expenditures on that technology can reduce a firm's tax burden relative to its tax burden if equivalent expenditures were labor costs. Together, these findings suggest that \_\_\_\_\_

Which choice most logically completes the text?

- A) the explanation that some economists have offered for US firms' increasing adoption of automation technology may be based on an overestimation of the tax benefits and productivity gains associated with that technology.
- B) US firms' increasing adoption of automation technology may be driven more by the fact that the government indirectly incentivizes firms to adopt that technology than by the ongoing benefits that the technology has for firms' outputs.
- C) changes to the US tax code that result in capital expenditures on automation technology being treated the same as expenditures on labor costs would likely have little effect on firms' productivity but may encourage further adoption of that technology.
- D) US firms have actually tended to experience a decrease in productivity as a result of adopting automation technology, but that decrease is overlooked due to the tax advantages associated with the technology.

14

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.

15

Interest in mechanotransduction, the mechanism by which cells sense and convert mechanical stimuli into biochemical signals, is expanding because of innovative work by biomedical scientists—many of whom, like neuroscience and biophysics expert Elba Serrano, \_\_\_\_\_ this mechanism to better understand how the body's neurological and biomechanical systems interact.

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

- A) is studying
- B) has studied
- C) study
- D) studies

16

Researchers studying magnetosensation have determined why some soil-dwelling roundworms in the Southern Hemisphere move in the opposite direction of Earth's magnetic field when searching for \_\_\_\_\_ in the Northern Hemisphere, the magnetic field points down, into the ground, but in the Southern Hemisphere, it points up, toward the surface and away from worms' food sources.

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

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

17

As cheesemaking practices spread throughout Europe and Asia during and after the Neolithic, divergent strategies for preserving milk \_\_\_\_\_ whereas rennet-coagulated cheesemaking became key to milk preservation in Europe and Southwest Asia, acid-heat coagulation methods became common among nomadic herding populations of the northeastern Eurasian steppe.

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

- A) emerged
- B) emerged and
- C) emerged:
- D) emerged,

18

Walt Whitman's *Leaves of Grass* first appeared in 1855 as a slim collection of twelve poems, but Whitman would revise and expand it substantially over the next four decades. These extensive \_\_\_\_\_ the addition of hundreds of new poems, the removal of some existing ones, and the insertion of prefatory material, reflected the poet's evolving literary perspective and experience of the US Civil War.

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

- A) changes, including
- B) changes would include
- C) changes included
- D) changes, include

19

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

20

Researchers studying the “terra-cotta army,” the thousands of life-size statues of warriors found interred near the tomb of Emperor Qin Shi Huang of China, were shocked to realize that the shape of each statue's ears, like the shape of each person's ears, \_\_\_\_\_ unique.

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

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

21

A firefly uses specialized muscles to draw oxygen into its lower abdomen through narrow tubes, triggering a chemical reaction whereby the oxygen combines with chemicals in the firefly's abdomen to produce a glow. \_\_\_\_\_ when the firefly stops drawing in oxygen, the reaction—and the glow—cease.

Which choice completes the text with the most logical transition?

- A) For instance,
- B) By contrast,
- C) Specifically,
- D) In conclusion,

22

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,

23

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.

24

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

- In 2020, theater students at Radford and Virginia Tech chose an interactive, online format to present a play about woman suffrage activists.
- Their “Women and the Vote” website featured an interactive digital drawing of a Victorian-style house.
- Audiences were asked to focus on a room of their choice and select from that room an artifact related to the suffrage movement.
- One click took them to video clips, songs, artwork, and texts associated with the artifact.
- The play was popular with audiences because the format allowed them to control the experience.

The student wants to explain an advantage of the “Women and the Vote” format. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) “Women and the Vote” featured a drawing of a Victorian-style house with several rooms, each containing suffrage artifacts.
- B) To access video clips, songs, artwork, and texts, audiences had to first click on an artifact.
- C) The “Women and the Vote” format appealed to audiences because it allowed them to control the experience.
- D) Using an interactive format, theater students at Radford and Virginia Tech created “Women and the Vote,” a play about woman suffrage activists.

25

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

- Malapportionment is the over- or underrepresentation (relative to population size) of electoral districts in a governing body.
- It is a common feature of representative governments.
- There are 169 seats in Norway’s supreme legislature (the Storting).
- Seats are distributed by a formula that awards 1 point per resident and 1.8 points per unit of land.
- Less populated rural districts with large tracts of land receive a disproportionate number of seats compared to smaller but more populated urban districts.

The student wants to refute a claim that malapportionment in the Storting favors small urban districts. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A) Less populated rural districts are disproportionately underrepresented in the Storting, creating an unfair advantage for smaller but more populated urban districts.
- B) It’s untrue that malapportionment in the 169-seat Storting favors small urban districts; rather, the formula for distributing seats overrepresents more populated districts.
- C) A common feature of representative governments, malapportionment occurs when electoral districts are over- or underrepresented.
- D) Awarding more points per unit of land than points per resident, the formula for distributing Storting seats overrepresents less populated rural districts with large tracts of land.

26

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

- Ducklings expend up to 62.8% less energy when swimming in a line behind their mother than when swimming alone.
- The physics behind this energy savings hasn't always been well understood.
- Naval architect Zhiming Yuan used computer simulations to study the effect of the mother duck's wake.
- The study revealed that ducklings are pushed in a forward direction by the wake's waves.
- Yuan determined this push reduces the effect of wave drag on the ducklings by 158%.

The student wants to present the study and its methodology. Which choice most effectively uses relevant information from the notes to accomplish this goal?

- A study revealed that ducklings, which expend up to 62.8% less energy when swimming in a line behind their mother, also experience 158% less drag.
- Seeking to understand how ducklings swimming in a line behind their mother save energy, Zhiming Yuan used computer simulations to study the effect of the mother duck's wake.
- Zhiming Yuan studied the physics behind the fact that by being pushed in a forward direction by waves, ducklings save energy.
- Naval architect Zhiming Yuan discovered that ducklings are pushed in a forward direction by the waves of their mother's wake, reducing the effect of drag by 158%.

27

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

- In North America, woodlands have expanded into areas that were once grasslands.
- Thomas Rogers and F. Leland Russell of Wichita State University investigated whether woodland expansion is related to changes in climate.
- Rogers and Russell analyzed core samples from oak trees on a site that was not wooded in the past and indexed the age of the trees with historical climate data to see if tree populations and climate were correlated.
- Tree population growth was associated with dry intervals.
- Droughts may have played a role in woodland expansion.

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?

- Thomas Rogers and F. Leland Russell, researchers at Wichita State University, wanted to know if woodland expansion is related to changes in climate.
- Thanks to the work done by Thomas Rogers and F. Leland Russell, we now know that droughts may have played a role in woodland expansion.
- Wichita State University researchers have determined that tree population growth was associated with dry intervals.
- Thomas Rogers and F. Leland Russell analyzed core samples from oak trees on a site that was not wooded in the past, indexing the age of the trees with historical climate data.

## 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

## 22 QUESTIONS

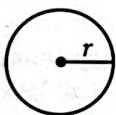
**DIRECTIONS**

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

**NOTES**

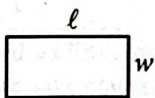
Unless otherwise indicated:

- 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.

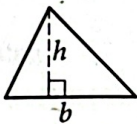
**REFERENCE**

$$A = \pi r^2$$

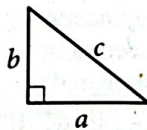
$$C = 2\pi r$$



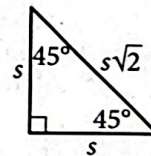
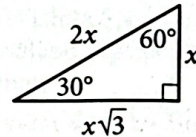
$$A = \ell w$$



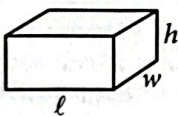
$$A = \frac{1}{2}bh$$



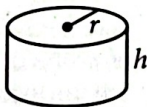
$$c^2 = a^2 + b^2$$



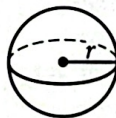
Special Right Triangles



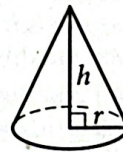
$$V = \ell wh$$



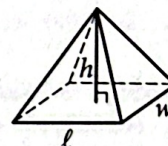
$$V = \pi r^2 h$$



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



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



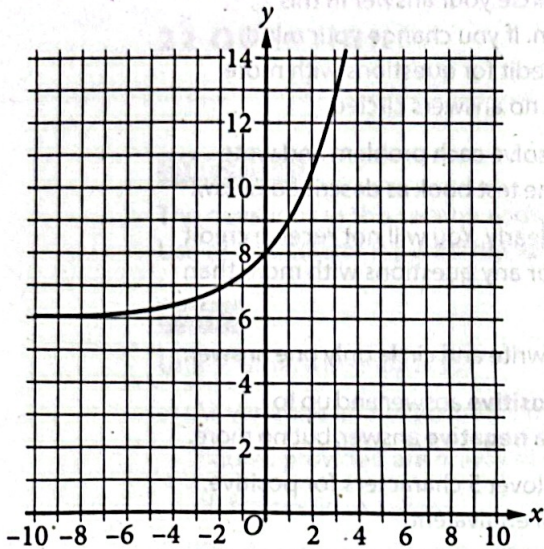
$$V = \frac{1}{3}\ell wh$$

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

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

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

1



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

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

2

The function  $f$  is defined by  $f(x) = -3x + 60$ . What is the value of  $f(x)$  when  $x = -8$ ?

- A) 49
- B) 52
- C) 57
- D) 84

3

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?

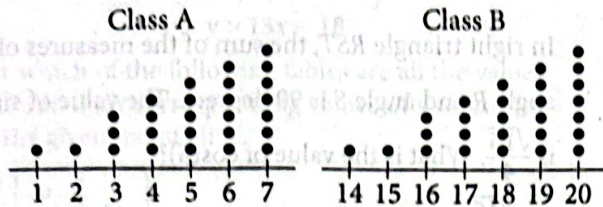
- A)  $4xy = 70$
- B)  $4(x + y) = 70$
- C)  $3x + y = 70$
- D)  $x + 3y = 70$

4

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

5



Each of the dot plots shown represents the number of glue sticks brought in by each student for two classes, class A and class B. Which statement best compares the standard deviations of the numbers of glue sticks brought in by each student for these two classes?

- A) The standard deviation of the number of glue sticks brought in by each student for class A is less than the standard deviation of the number of glue sticks brought in by each student for class B.
- B) The standard deviation of the number of glue sticks brought in by each student for class A is equal to the standard deviation of the number of glue sticks brought in by each student for class B.
- C) The standard deviation of the number of glue sticks brought in by each student for class A is greater than the standard deviation of the number of glue sticks brought in by each student for class B.
- D) There is not enough information to compare these standard deviations.

6

Which expression is equivalent to  $(7x^3 + 7x) - (6x^3 - 3x)$ ?

- A)  $x^3 + 10x$
- B)  $-13x^3 + 10x$
- C)  $-13x^3 + 4x$
- D)  $x^3 + 4x$

7

In triangle  $ABC$ , the measure of angle  $A$  is  $54^\circ$ , the measure of angle  $B$  is  $90^\circ$ , and the measure of angle  $C$  is  $\left(\frac{k}{2}\right)^\circ$ . What is the value of  $k$ ?

- A) 36
- B) 45
- C) 72
- D) 108

8

$$3x(x - 4)(x + 5) = 0$$

What is one of the solutions to the given equation?

- A)  $-4$
- B)  $0$
- C)  $3$
- D)  $5$

9

A chemist combines water and acetic acid to make a mixture with a volume of 56 milliliters (mL). The volume of acetic acid in the mixture is 10 mL. What is the volume of water, in mL, in the mixture? (Assume that the volume of the mixture is the sum of the volumes of water and acetic acid before they were mixed.)

10

A distance of 354 furlongs is equivalent to how many feet? (1 furlong = 220 yards and 1 yard = 3 feet)

- A) 306
- B) 402
- C) 25,960
- D) 233,640

11

$$y = 2x + 10$$

$$y = 2x - 1$$

At how many points do the graphs of the given equations intersect in the  $xy$ -plane?

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

12

13 is  $p\%$  of 25. What is the value of  $p$ ?

13

The function  $f(t) = 60,000(2)^{\frac{t}{410}}$  gives the number of bacteria in a population  $t$  minutes after an initial observation. How much time, in minutes, does it take for the number of bacteria in the population to double?

14

Each year, the value of an investment increases by 0.49% of its value the previous year. Which of the following functions best models how the value of the investment changes over time?

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

15

A circle in the  $xy$ -plane has a diameter with endpoints  $(2, 4)$  and  $(2, 14)$ . An equation of this circle is  $(x - 2)^2 + (y - 9)^2 = r^2$ , where  $r$  is a positive constant. What is the value of  $r$ ?

16

In right triangle  $RST$ , the sum of the measures of angle  $R$  and angle  $S$  is 90 degrees. The value of  $\sin(R)$  is  $\frac{\sqrt{15}}{4}$ . What is the value of  $\cos(S)$ ?

- A)  $\frac{\sqrt{15}}{15}$
- B)  $\frac{\sqrt{15}}{4}$
- C)  $\frac{4\sqrt{15}}{15}$
- D)  $\sqrt{15}$

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

$$y > 13x - 18$$

For which of the following tables are all the values of  $x$  and their corresponding values of  $y$  solutions to the given inequality?

A) 

$x$	$y$
3	21
5	47
8	86

B) 

$x$	$y$
3	26
5	42
8	86

C) 

$x$	$y$
3	16
5	42
8	81

D) 

$x$	$y$
3	26
5	52
8	91

19

Line  $\ell$  is defined by  $3y + 12x = 5$ . Line  $n$  is perpendicular to line  $\ell$  in the  $xy$ -plane. What is the slope of line  $n$ ?

20

$$y = 2(x - d)(x + d)(x + g)(x - d)$$

In the given equation,  $d$  and  $g$  are unique positive constants. When the equation is graphed in the  $xy$ -plane, how many distinct  $x$ -intercepts does the graph have?

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

21

For the exponential function  $f$ , the value of  $f(1)$  is  $k$ , where  $k$  is a constant. Which of the following equivalent forms of the function  $f$  shows the value of  $k$  as the coefficient or the base?

- A)  $f(x) = 50(1.6)^{x+1}$   
B)  $f(x) = 80(1.6)^x$   
C)  $f(x) = 128(1.6)^{x-1}$   
D)  $f(x) = 204.8(1.6)^{x-2}$

22

$$f(x) = 4x^2 + 64x + 262$$

The function  $g$  is defined by  $g(x) = f(x + 5)$ . For what value of  $x$  does  $g(x)$  reach its minimum?

- A) -13  
B) -8  
C) -5  
D) -3

**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

## 22 QUESTIONS

## DIRECTIONS

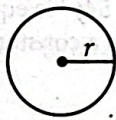
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## NOTES

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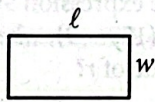
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## REFERENCE

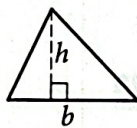


$$A = \pi r^2$$

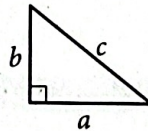
$$C = 2\pi r$$



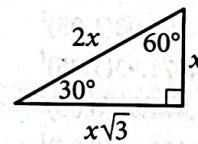
$$A = \ell w$$



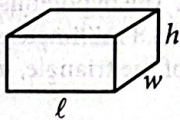
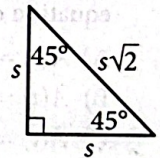
$$A = \frac{1}{2}bh$$



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



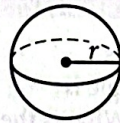
Special Right Triangles



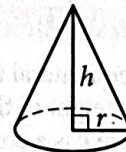
$$V = \ell wh$$



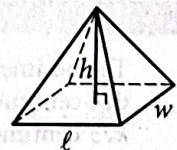
$$V = \pi r^2 h$$



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



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



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

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

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

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

1

$$4x + 6 = 18$$

Which equation has the same solution as the given equation?

- A)  $4x = 108$
- B)  $4x = 24$
- C)  $4x = 12$
- D)  $4x = 3$

2

The total cost  $f(x)$ , in dollars, to lease a car for 36 months from a particular car dealership is given by  $f(x) = 36x + 1,000$ , where  $x$  is the monthly payment, in dollars. What is the total cost to lease a car when the monthly payment is \$400?

- A) \$13,400
- B) \$13,000
- C) \$15,400
- D) \$37,400

3

If the graph of  $27x + 33y = 297$  is shifted down 5 units in the  $xy$ -plane, what is the  $y$ -intercept of the resulting graph?

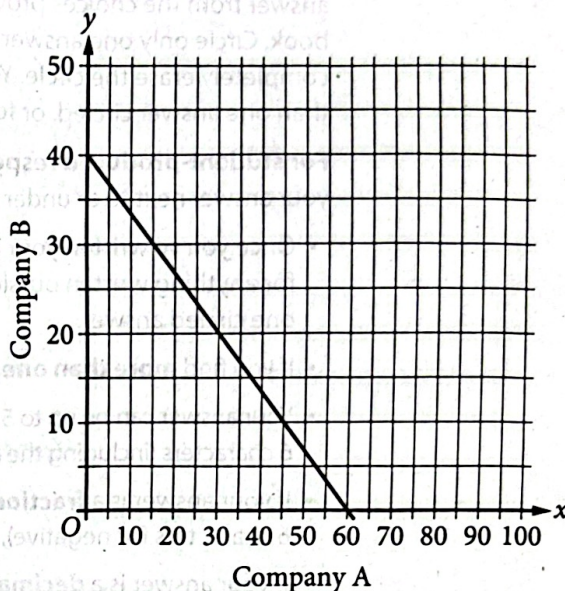
- A) (0, 4)
- B) (0, 6)
- C) (0, 14)
- D) (0, 28)

4

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)  $(0, \frac{1}{10})$
- D)  $(\frac{1}{10}, 0)$

5



The graph shows the relationship between the number of shares of stock from Company A,  $x$ , and the number of shares of stock from Company B,  $y$ , that Simone can purchase. Which equation could represent this relationship?

- A)  $y = 8x + 12$
- B)  $8x + 12y = 480$
- C)  $y = 12x + 8$
- D)  $12x + 8y = 480$

6

$$\frac{7}{2}x + 6y = 25$$

$$\frac{5}{2}x + 6y = 23$$

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

What is the value of  $\frac{17}{2}x + 18y$ ?

- A) 2
- B) 3
- C) 48
- D) 71

7

$$f(x) = (x + 6)(x + 5)(x - 4)$$

The function  $f$  is given. Which table of values represents  $y = f(x) - 3$ ?

A) 

$x$	$y$
-6	-9
-5	-8
4	1

B) 

$x$	$y$
-6	-3
-5	-3
4	-3

C) 

$x$	$y$
-6	-3
-5	-2
4	7

D) 

$x$	$y$
-6	3
-5	3
4	3

8

For the function  $q$ , the value of  $q(x)$  decreases by 45% for every increase in the value of  $x$  by 1. If  $q(0) = 14$ , which equation defines  $q$ ?

- A)  $q(x) = 0.55(14)^x$   
 B)  $q(x) = 1.45(14)^x$   
 C)  $q(x) = 14(0.55)^x$   
 D)  $q(x) = 14(1.45)^x$

9

A submersible device is used for ocean research. The function  $g(x) = -\frac{1}{55}(x + 19)(x - 35)$  gives the depth below the surface of the ocean, in meters, of the submersible device  $x$  minutes after collecting a sample, where  $x > 0$ . How many minutes after collecting the sample did it take for the submersible device to reach the surface of the ocean?

10

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

11

$$x(x + 1) - 56 = 4x(x - 7)$$

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

12

$$y < 6x + 2$$

For which of the following tables are all the values of  $x$  and their corresponding values of  $y$  solutions to the given inequality?

A)

$x$	$y$
3	20
5	32
7	44

B)

$x$	$y$
3	16
5	36
7	40

C)

$x$	$y$
3	16
5	28
7	40

D)

$x$	$y$
3	24
5	36
7	48

13

What is the diameter of the circle in the  $xy$ -plane with equation  $(x - 5)^2 + (y - 3)^2 = 16$ ?

- A) 4  
B) 8  
C) 16  
D) 32

14

$$-9x^2 + 30x + c = 0$$

In the given equation,  $c$  is a constant. The equation has exactly one solution. What is the value of  $c$ ?

- A) 3  
B) 0  
C) -25  
D) -53

15

In triangle  $XYZ$ , angle  $Y$  is a right angle, the measure of angle  $Z$  is  $33^\circ$ , and the length of  $\overline{YZ}$  is 26 units. If the area, in square units, of triangle  $XYZ$  can be represented by the expression  $k \tan 33^\circ$ , where  $k$  is a constant, what is the value of  $k$ ?

16

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)

17

In triangles  $ABC$  and  $DEF$ , angles  $B$  and  $E$  each have measure  $27^\circ$  and angles  $C$  and  $F$  each have measure  $41^\circ$ . Which additional piece of information is sufficient to determine whether triangle  $ABC$  is congruent to triangle  $DEF$ ?

- A) The measure of angle  $A$   
B) The length of side  $AB$   
C) The lengths of sides  $BC$  and  $EF$   
D) No additional information is necessary.

18

$$48x - 72y = 30y + 24$$

$$ry = \frac{1}{6} - 16x$$

In the given system of equations,  $r$  is a constant. If the system has no solution, what is the value of  $r$ ?

19

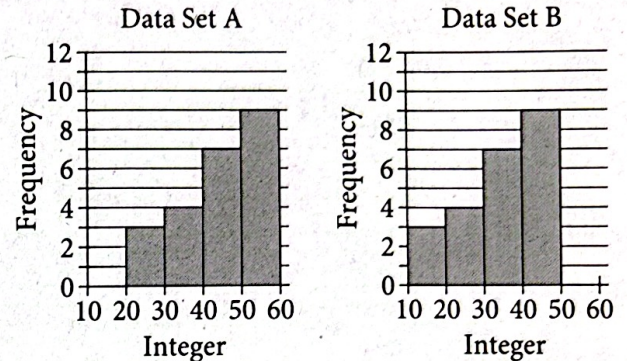
Which of the following expressions has a factor of  $x + 2b$ , where  $b$  is a positive integer constant?

- A)  $3x^2 + 7x + 14b$
- B)  $3x^2 + 28x + 14b$
- C)  $3x^2 + 42x + 14b$
- D)  $3x^2 + 49x + 14b$

20

The perimeter of an equilateral triangle is 624 centimeters. The height of this triangle is  $k\sqrt{3}$  centimeters, where  $k$  is a constant. What is the value of  $k$ ?

21



Two data sets of 23 integers each are summarized in the histograms shown. For each of the histograms, the first interval represents the frequency of integers greater than or equal to 10, but less than 20. The second interval represents the frequency of integers greater than or equal to 20, but less than 30, and so on. What is the smallest possible difference between the mean of data set A and the mean of data set B?

- A) 0
- B) 1
- C) 10
- D) 23

22

Poll Results	
Angel Cruz	483
Terry Smith	320

The table shows the results of a poll. A total of 803 voters selected at random were asked which candidate they would vote for in the upcoming election. According to the poll, if 6,424 people vote in the election, by how many votes would Angel Cruz be expected to win?

- A) 163
- B) 1,304
- C) 3,864
- D) 5,621

## 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.