

# The SAT<sup>®</sup>

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# Practice Test #3



## ANSWER EXPLANATIONS

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



**SAT<sup>®</sup>**

# Reading and Writing

## Module 1

(33 questions)

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### QUESTION 1

**Choice A** is the best answer because it most logically completes the text's discussion of the writing system created by Sequoyah. In this context, "widespread" means widely accepted or practiced. The text indicates that because Sequoyah's script accurately represented the spoken sounds of the Cherokee language and was easy to learn, nearly all Cherokee people were able to read and write it soon after it was created. This context demonstrates that the script was widely used by the Cherokee people.

*Choice B* is incorrect. In this context, "careful" would mean exercised with care and attentive concern. Although the work of creating a writing system likely involved great care, the text indicates that the system was "easy to learn," which conflicts with the idea that using this system requires a noteworthy amount of care.

*Choice C* is incorrect because in this context "unintended" means not deliberate. The idea that using Sequoyah's script was unintentional conflicts directly with the claim that it was easy to learn and used by "over 90% of the Cherokee people" by 1830. In fact, because one had to learn this system, it's not clear how one could use it unintentionally. *Choice D* is incorrect because in this context "infrequent" means rare or not occurring often, which conflicts directly with the claim that "over 90% of the Cherokee people" were using Sequoyah's script by 1830.

## QUESTION 2

**Choice A** is the best answer because it most logically completes the text's discussion of Nuttall's 1886 research paper. In this context, "acknowledged" means recognized as having a certain status. The text indicates that other researchers recognized Nuttall's work as groundbreaking because of its "convincing demonstration" related to the age of the ancient sculptures. In other words, the researchers recognized the groundbreaking status of Nuttall's work.

*Choice B* is incorrect because in this context, "ensured" would mean to have guaranteed or made sure something was the case. The text states that other researchers gave Nuttall's work recognition after it was published, but there's no indication that they contributed to the work or had any involvement that would have allowed them to make sure the work would be groundbreaking.

*Choice C* is incorrect because the text doesn't suggest that other researchers "denied," or refused to admit or accept, that Nuttall's work was groundbreaking; on the contrary, it indicates that researchers praised the work, recognizing it as groundbreaking due to its "convincing demonstration" related to the age of the ancient sculptures. *Choice D* is incorrect because the text doesn't suggest that other researchers "underestimated," or undervalued, Nuttall's work; on the contrary, it indicates that researchers praised the work, recognizing it as groundbreaking due to its "convincing demonstration" related to the age of the ancient sculptures.

## QUESTION 3

**Choice A** is the best answer because it most logically completes the text's discussion of self-government among the Muscogee (Creek) Nation. In this context, "implement" means to carry out or put into effect. The text states that the National Council generates laws, while the principal chief and cabinet officials are responsible for "devising policies and administering services in accordance with" those laws. This context suggests that the principal chief and cabinet officials implement the laws: they put the laws into effect by creating policies and administering services that accord with those laws.

*Choice B* is incorrect because "presume" in this context would mean to assume based on incomplete information, and the text does not suggest that the principal chief and cabinet officials either made assumptions about the content of the laws or had incomplete information about them. *Choice C* is incorrect because in this context "improvise" would mean to create something without preparation, and the text does not suggest that the principal chief and cabinet officials create policies and administer services without advance preparation. *Choice D* is incorrect because nothing in the text suggests that the principal chief and cabinet officials "mimic," or imitate, the laws generated by the National Council. To mimic laws would mean to generate new laws that are imitations of existing laws, but the text indicates that the National Council, not the principal chief and cabinet officials, is responsible for generating laws. Instead of generating laws, the principal chief and cabinet officials put laws into effect by "devising policies and administering services in accordance with" the laws.

## 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 B** is the best answer because it most logically completes the text's discussion of bronze- and brass-casting techniques used by the Igun Eronmwon guild. In this context "adhere to" would mean to act in accordance with. The text states that although members of the Igun Eronmwon guild typically do something with techniques that have been passed down since the thirteenth century, they "don't strictly observe every tradition." By establishing a contrast with not always following traditions, the context suggests that guild members do typically adhere to traditional techniques.

*Choice A* is incorrect because in this context "experiment with" would mean to do something new with. Although using motors rather than manual bellows is presented as a new approach, the text establishes a contrast between what the guild members typically do with techniques that have been passed down over centuries and the idea that the members "don't strictly observe every tradition." The phrase "experiment with" wouldn't support the contrast because regularly trying new things with the techniques would be an example of not strictly following all traditions. *Choice C* is incorrect because in this context "improve on" would mean to make better. Although using motors rather than manual bellows might be an improved approach, the text establishes a contrast between what the guild members typically do with techniques that have been passed down over centuries and the idea that the members "don't strictly observe every tradition." The phrase "improve on" wouldn't support the contrast because regularly making changes to the techniques would be an example of not strictly following all traditions. *Choice D* is incorrect because in this context "grapple with" would mean to try hard to solve a

difficult problem. Although bronze- and brass-casting are likely challenging tasks, nothing in the text suggests that the guild members have any particular difficulties with the techniques passed down since the thirteenth century.

## QUESTION 6

**Choice A** is the best answer because it most logically completes the text's discussion of late nineteenth- and early twentieth-century household food purchases. In this context, "surmised" means formed an idea or assumption with little evidence. The text explains that certain economic historians "assumed" that large and small households spent different amounts on food per person, but that another economist found this supposition to be false based on evidence from available data. This context suggests that the economic historians made an incorrect assumption without enough consideration of evidence.

**Choice B** is incorrect. In this context, "contrived" would mean brought about or created through trickery. Nothing in the text suggests that the economic historians were deliberately trying to trick people with a claim about food purchasing behaviors in late nineteenth- and early twentieth-century households; the text simply suggests that they made an assumption about those behaviors that another historian believes isn't supported by the available data. **Choice C** is incorrect because the text indicates that it's Logan and not the economic historians who "questioned," or doubted, the assumption that large and small households in the late nineteenth and early twentieth centuries spent different amounts on food per person; the economic historians are the ones who made that assumption to begin with. **Choice D** is incorrect because nothing in the text suggests that some economic historians "regretted," or felt sad or remorseful about, the food purchasing behaviors of late nineteenth- and early twentieth-century households. The text focuses on the idea that the economic historians made an assumption about those behaviors that may not be supported by available data, not on the historians' emotional response to what households did in the past.

## QUESTION 7

**Choice C** is the best answer because it most logically completes the text's discussion of the artistic styles that have influenced Cannon's work. As used in this context, "disparate" means distinct or dissimilar. The text indicates that a tension exists among the styles that have influenced Cannon's work and goes on to describe how those styles differ: classic European portraiture favors realism, American pop art uses vivid colors, and intertribal flatstyle rejects the use of shading and perspective to achieve depth. This context suggests that the styles that have influenced Cannon's work are disparate.

**Choice A** is incorrect because the text indicates that there is a tension among the influences on Cannon's artwork, so it wouldn't make sense to say that the influences are "complementary," or that they complete one another or make up for one another's deficiencies. **Choice B** is incorrect because it wouldn't make sense to characterize Cannon's influences as "unknown," or not familiar; it's clear that the influences are known because the text goes on to list them. **Choice D** is incorrect because the text indicates that there is a tension among the influences on Cannon's work, not that they are "interchangeable," or capable of being used in one another's place.

**QUESTION 8**

**Choice B** is the best answer because it most logically and precisely completes the text's discussion of studies of altitude's effect on blood chemistry. In this context, "paucity of" means lack of. In describing the inspiration behind Al-Sweedan and Alhaj's research, the text uses the word "though" to suggest a contrasting relationship between two types of studies: those examining the effect on blood chemistry of living at a high altitude and those examining the effect on blood chemistry of living in locations below sea level. This contrasting relationship and the text's use of the word "many" provide context suggesting that there are few, if any, examples of the second type of study, whereas there are numerous examples of the first type.

*Choice A* is incorrect because it wouldn't make sense in context for there to be a "quarrel about," or open disagreement about, studies of the effect on blood chemistry of living in locations below sea level. The text's use of the words "though" and "many" suggests a contrasting relationship in terms of amount between two types of studies: those examining the effect on blood chemistry of living at a high altitude and those examining the effect on blood chemistry of living in locations below sea level. There's nothing in the text to suggest that the contrast between the two types of studies involves the extent to which researchers broadly agree or disagree about the contents of either type. *Choice C* is incorrect because it wouldn't make sense in context for there to be a "profusion of," or great abundance of, studies of the effect on blood chemistry of living in locations below sea level. The text's use of the words "though" and "many" suggests a contrasting relationship in terms of amount between two types of studies: those examining the effect on blood chemistry of living at a high altitude and those examining the effect on blood chemistry of living in locations below sea level. Rather than logically completing this contrast, "profusion of" would indicate that the two types of studies are similar in terms of amount, with many examples existing of both types. *Choice D* is incorrect because it wouldn't make sense in context for there to be a "verisimilitude in," or appearance of truth in, studies of the effect on blood chemistry of living in locations below sea level. The text's use of the words "though" and "many" suggests a contrasting relationship in terms of amount between two types of studies: those examining the effect on blood chemistry of living at a high altitude and those examining the effect on blood chemistry of living in locations below sea level. There's nothing in the text to suggest that the contrast between the two types of studies involves the extent to which either type of study presents an appearance of truth.

## QUESTION 9

**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 10

**Choice C** is the best answer because it best describes how the second sentence functions in the text as a whole. The first sentence establishes something astronomers believe with some certainty: that Betelgeuse will “explode in a supernova.” The second sentence then introduces a problem: astronomers aren’t certain *when* Betelgeuse will explode because they don’t have enough information about the star’s internal characteristics. Finally, the third sentence indicates that researcher Sarafina El-Badry Nance and colleagues investigated a possible method of obtaining the necessary information about Betelgeuse’s internal characteristics, though they found that the method wouldn’t be sufficient. Thus, the function of the second sentence is to identify the problem that Nance and colleagues attempted to solve but didn’t.

*Choice A* is incorrect because the second sentence doesn’t indicate how other astronomers or astrophysicists responded to the work done by Nance and colleagues; the text doesn’t address this information at all. *Choice B* is incorrect because the second sentence introduces the general problem Nance and colleagues hoped to solve, not the central finding they ultimately reported. It’s the third sentence that presents Nance and colleagues’ conclusion that a potential method for determining internal stellar states would be insufficient. *Choice D* is incorrect because the second sentence introduces the general problem Nance and colleagues hoped to solve, not a serious limitation of how they tried to solve it. It’s the third sentence that introduces Nance and colleagues, but no serious limitation of their approach to studying a method of determining internal stellar states is described.

## QUESTION 11

**Choice D** is the best answer because it provides a detail about Elinor that is established in the text. The text indicates that although Elinor is “only nineteen,” she gives good advice and exhibits such a high level of understanding and judgment that she serves as “the counsellor of her mother.” Thus, Elinor is mature beyond her years.

*Choice A* is incorrect because it isn’t supported by the text: although the text says that Elinor advises her mother and often counteracts her mother’s impulses, there’s no mention of Elinor arguing with her mother or failing to change her mother’s mind. *Choice B* is incorrect because it isn’t supported by the text: although the text mentions that Elinor has strong feelings, it doesn’t indicate that she’s excessively sensitive when it comes to family issues. *Choice C* is incorrect because it isn’t supported by the text: there’s no mention of what Elinor thinks about her mother and no suggestion that she thinks her mother is a bad role model. Because she’s described as having “an excellent heart,” Elinor likely doesn’t think ill of her mother.

## QUESTION 12

**Choice D** is the best answer because it most accurately states the main idea of the text. According to the text, conceptual artists Gins and Arakawa have designed an apartment building that is disorienting because of several unconventional elements, such as uneven kitchen counters and “a door to nowhere.” The text goes on to suggest that there may be benefits to this kind of design because filmmaker Yamaoka lived in the apartment building for four years and reported health benefits. Thus, although the design is impractical, it may improve the well-being of the apartment building’s residents.

*Choice A* is incorrect. Although the text mentions that Yamaoka lived in the apartment for four years, it doesn’t address how long someone can beneficially live in a home surrounded by fanciful features or whether doing so can be sustained. *Choice B* is incorrect. Although the text mentions the potential benefits of living in a home with disorienting design features, it doesn’t suggest that this is the most effective method to create a physically stimulating environment. *Choice C* is incorrect because the text refers to Yamaoka to support the claim that Gins and Arakawa’s apartment building design may be beneficial, but the text doesn’t indicate that Yamaoka supports the designs of other conceptual artists.



## QUESTION 13

**Choice C** is the best answer because it illustrates the student’s claim about some historians viewing Lumumba primarily as a symbol. This quotation argues that Lumumba “warrants” (or deserves) “scholarly attention” as a symbol and not for his “practical accomplishments”—that is, his actions as prime minister—which “can be passed over quickly,” or dismissed as being of comparatively little importance. Thus, the quotation expresses the view that the student criticizes some historians for holding.

*Choice A* is incorrect. Although this quotation touches on the difficulty of evaluating Lumumba’s legacy, it doesn’t address how historians of modern African politics view him as a symbol. *Choice B* is incorrect. While this quotation mentions Lumumba’s political beliefs, it doesn’t discuss historians viewing him as a symbol. *Choice D* is incorrect. This quotation touches on Lumumba’s vision for his country, but it doesn’t discuss historians viewing him as a symbol.

## QUESTION 14

**Choice C** is the best answer because it uses data from the graph to effectively complete the example of Eludoyin and his colleagues’ findings concerning female farmers in some regions of Ondo State, Nigeria. The graph presents values for the percentage of Ondo State small-scale farmers who are female, by type of crop and region. The graph shows that of the farmers mainly cultivating non-root vegetables, approximately 57% in north Ondo and approximately 54% in south Ondo are female; in other words, most of those farmers are female, which exemplifies the idea that female farmers make up the majority (more than half) of the farmers cultivating specific types of crops in some regions.

*Choice A* is incorrect because it inaccurately cites data from the graph: the graph shows that in south Ondo, most of the farmers mainly cultivating non-root vegetables are women (approximately 54%), but that only about 35% (less than half) of the farmers mainly cultivating cereals are women. *Choice B* is incorrect because it inaccurately cites data from the graph: the graph shows that more women in central Ondo mainly cultivate cereals than mainly cultivate root crops (approximately 36% and 20%, respectively). Additionally, it doesn’t effectively complete the example because the graph shows that female farmers don’t make up the majority (more than half) of the farmers for any type of crop in central Ondo. *Choice D* is incorrect because it doesn’t effectively complete the example; it simply states that a relatively equal proportion of women across the three regions mainly cultivate cereals, which doesn’t address the value for that proportion and thus doesn’t show that a majority (more than half) of the farmers cultivating certain crops are female.

## QUESTION 15

**Choice C** is the best answer because it presents a finding that, if true, would weaken the astronomers' claim about the makeup of host stars and their planets. The text explains that because stars and planets begin forming from the same gas and dust, astronomers believe planets should be composed of the same materials as their host stars, but in equal or smaller quantities. The finding that the amount of iron in some rocky planets is much higher than the amount in their host star would weaken the astronomers' claim because it would show that some planets contain the same material as their host star, but in higher quantities.

*Choice A* is incorrect because a finding only about the makeup of stars, whether they've cooled or not, would provide no information about the makeup of planets. Thus, it wouldn't have any bearing on the claim that planets and their host stars are composed of the same materials in differing quantities. *Choice B* is incorrect because a finding about two host stars having similar proportions of certain materials wouldn't provide any information about the makeup of planets. Thus, it wouldn't be relevant to the claim that planets and their host stars are composed of the same materials in differing quantities. *Choice D* is incorrect because the text indicates that the astronomers' claim is based on a fact—that stars and planets begin forming from the same gas and dust in space—which would remain true regardless of the effectiveness of a method for analysis of compositions. The text does cite analysis of rocky planets in our solar system and the Sun, but only as a single piece of evidence that is consistent with the claim and not as the source of the claim; the finding that the method used for that analysis is less effective in other scenarios wouldn't weaken a claim that's based on knowledge of how stars and planets initially form.

## QUESTION 16

**Choice D** is the best answer because it presents a finding that, if true, would support Paredes's argument about the origin of Mexican American folklore. The text describes a disagreement among scholars about whether Mexican American folklore mostly derived from the folklore of Spain (the view held by Espinosa and others) or originated in Mexico and the United States through ongoing cultural interactions there (the view held by Paredes and others). If Mexican American folklore collected in the twentieth century mostly consists of ballads about history and social life that originated recently, then that would support Paredes's argument by suggesting that the folklore mostly arose after Spanish rule ended in the early nineteenth century and that the folklore reflects cultural interactions in Mexico and the United States rather than traditions from Spain.

*Choice A* is incorrect because the inclusion of songs influenced by sixteenth-century Spanish poetry among Mexican American folklore collected in the twentieth century would not support Paredes's view that the folklore was the result of cultural interactions in Mexico and the United States rather than an offshoot of Spanish folklore. If anything, the presence of such songs among the folklore collected in the twentieth century would weaken Paredes's argument, since it would reflect the influence of Spanish culture on the folklore. *Choice B* is incorrect because the mere presence of similarities in Mexican American

folklore across regions would not be sufficient to draw a conclusion about where the folklore originated, let alone to support Paredes's argument that the folklore reflects various cultural interactions in Mexico and the United States. In fact, Paredes would likely expect there to be regional variations in folklore as different cultures have interacted in different places. *Choice C* is incorrect because scholars' previous ignorance of the folklore would have no bearing on Paredes's argument that Mexican American folklore mostly reflects cultural interactions in Mexico and the United States; the folklore's actual origins exist regardless of the scholars' awareness.

## QUESTION 17

**Choice A** is the best answer because it most logically completes the text's discussion of Euro-American farmers' use of Haudenosaunee agricultural techniques. According to the text, some Euro-American farmers were using these techniques in the early nineteenth century despite few of the farmers having seen Haudenosaunee farms. One explanation for these facts might be that the farmers developed techniques on their own that already had been invented centuries earlier by the Haudenosaunee people, but the text explicitly bars, or rules out, this explanation. If Euro-American farmers didn't learn these techniques from direct observation of Haudenosaunee practices and didn't invent the techniques independently, then the most logical explanation is that they learned the techniques from other people who were more directly influenced by Haudenosaunee practices than the farmers themselves were. Once they learned about Haudenosaunee agricultural practices, Euro-American farmers could then apply those practices to their own farming.

*Choice B* is incorrect because the fact that some Euro-American farmers in the northeastern United States were using Haudenosaunee techniques suggests that the techniques were likely useful for the crops the farmers raised, not that the crops typically cultivated by the farmers were not well suited to Haudenosaunee farming techniques. If the farmers' crops were ill suited to the techniques, it's unlikely that the farmers would have used those techniques. *Choice C* is incorrect because the text indicates only that Haudenosaunee agricultural techniques were used by Euro-American farmers in the northeastern United States, not that these techniques were widely used outside this region. *Choice D* is incorrect because the text states that some Euro-American farmers were using Haudenosaunee farming techniques early in the nineteenth century. This suggests that some Euro-American farmers were beginning to recognize the benefits of these techniques near the start of the century, not that such farmers only began to recognize the benefits of the techniques much later.

**QUESTION 18**

**Choice B** is the best answer because it most logically completes the text's discussion of artifacts and Kuulo Kataa's founding date. If it were true both that Kuulo Kataa was founded in the fourteenth century CE and that artifacts found in excavations of the settlement are from the thirteenth century CE, it would be reasonable to conclude that the artifacts weren't created in the Kuulo Kataa settlement. That would suggest, then, that the artifacts originated somewhere else and eventually reached the settlement through trading or as people migrated.

*Choice A* is incorrect because the existence of thirteenth-century CE artifacts recovered during excavations of a settlement founded in the fourteenth century CE isn't logically connected to artifacts from one century being more commonly recovered than artifacts from another century. Rather than suggesting anything about how frequently artifacts from different times are found, the existence of artifacts confirmed as predating the settlement's founding suggests that those items arrived in Kuulo Kataa during or after its establishment. *Choice C* is incorrect because the text focuses on time periods and says nothing about which region the founders of Kuulo Kataa have been thought to come from; similarly, the text doesn't suggest anything about where the thirteenth-century CE artifacts originated other than not from Kuulo Kataa. Therefore, it isn't logical to conclude that the mere existence of artifacts confirmed as predating the Kuulo Kataa settlement suggests that the founders of the settlement came from a particular region other than one previously assumed. *Choice D* is incorrect because the existence of artifacts from the thirteenth century CE at a site dated to the fourteenth century CE doesn't imply that fourteenth-century objects were damaged during excavations. There's nothing in the text to suggest that any objects were damaged; rather, the existence of artifacts confirmed as predating the settlement's founding suggests that those items were brought to Kuulo Kataa during or after its establishment.

## QUESTION 19

**Choice C** is the best answer because it most logically completes the text's discussion of accelerated flowering in *A. thaliana* plants. The text indicates that *A. thaliana* plants show accelerated flowering at high temperatures. To investigate the mechanism for this accelerated flowering, biologists replaced the ELF3 protein in one group of *A. thaliana* plants with a similar protein found in another plant species that doesn't show accelerated flowering. The team then compared these modified plants to *A. thaliana* plants that retained their original ELF3 protein. The text states that the two samples of plants showed no difference in flowering at 22° Celsius, but at 27° Celsius the unaltered plants with ELF3 showed accelerated flowering while the plants without ELF3 didn't. If accelerated flowering at the higher temperature occurred in the *A. thaliana* plants with ELF3 but not in the plants without the protein, then ELF3 likely enables *A. thaliana* to respond to increased temperatures.

*Choice A* is incorrect because the text doesn't mention whether any plants other than *A. thaliana* and stiff brome show temperature-sensitive flowering, so there is no support for the idea that this type of flowering is unique to *A. thaliana*.

*Choice B* is incorrect because the text discusses the effects of ELF3 and not the production of it. There's nothing in the text to suggest that the amount of ELF3 in *A. thaliana* varies with temperature. *Choice D* is incorrect. While the text states that there was no difference in the flowering of modified and unmodified *A. thaliana* plants at 22° Celsius, there's no suggestion that *A. thaliana* only begins to flower at 22° Celsius; the text doesn't mention a specific temperature threshold required for *A. thaliana* flowering.

## QUESTION 20

**Choice A** is the best answer. The convention being tested is the use of finite and nonfinite verb forms within a sentence. Relative clauses, such as the one beginning with "which," require a finite verb, a verb that can function as the main verb of a clause. This choice correctly supplies the clause with the finite past tense verb "provided."

*Choice B* is incorrect because the nonfinite participle "having provided" doesn't supply the clause with a finite verb. *Choice C* is incorrect because the nonfinite to-infinitive "to provide" doesn't supply the clause with a finite verb. *Choice D* is incorrect because the nonfinite participle "providing" doesn't supply the clause with a finite verb.

## QUESTION 21

**Choice A** is the best answer. The convention being tested is the coordination of clauses within a sentence. This choice correctly uses a comma and the coordinating conjunction “but” to join a main clause (“Typically...value”) and a subordinate clause (“when...Whitman”) that precedes a main clause (“such... scholars”).

*Choice B* is incorrect because it results in a run-on sentence. A main clause is fused without punctuation and/or a conjunction to a subordinate clause that precedes a main clause. *Choice C* is incorrect because it results in a comma splice. A comma can’t be used in this way to mark the boundary between a main clause and a subordinate clause that precedes a main clause. *Choice D* is incorrect. Without a comma preceding it, the conjunction “but” can’t be used in this way to join a main clause and a subordinate clause that precedes a main clause.

## QUESTION 22

**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 23

**Choice D** is the best answer. The convention being tested is punctuation between a verb and a preposition. When, as in this case, a verb (“is added”) is immediately followed by a preposition (“whenever”), no punctuation is needed.

*Choice A* is incorrect because no punctuation is needed between the verb and the preposition. *Choice B* is incorrect because no punctuation is needed between the verb and the preposition. *Choice C* is incorrect because no punctuation is needed between the verb and the preposition.

## QUESTION 24

**Choice A** is the best answer. The convention being tested is subject-verb agreement. The singular verb “has enhanced” agrees in number with the singular subject “*A Sheaf Gleaned in French Fields*,” which is the title of a book of poems.

*Choice B* is incorrect because the plural verb “are enhancing” doesn’t agree in number with the singular subject “*A Sheaf Gleaned in French Fields*.” *Choice C* is incorrect because the plural verb “have enhanced” doesn’t agree in number with the singular subject “*A Sheaf Gleaned in French Fields*.” *Choice D* is incorrect because the plural verb “enhance” doesn’t agree in number with the singular subject “*A Sheaf Gleaned in French Fields*.”

## QUESTION 25

**Choice C** is the best answer. The convention being tested is punctuation use between a main clause and two supplementary elements. In this choice, the commas after “nickname” and “however” are correctly used to separate the supplementary adverb “however” from the main clause (“Scott-Heron... nickname”) on one side and the supplementary participial phrase (“feeling... bluesologist”) on the other.

*Choice A* is incorrect because it fails to mark the boundary between the supplementary adverb “however” and the supplementary phrase (“feeling... bluesologist”). *Choice B* is incorrect because a semicolon can’t be used in this way to join the supplementary adverb “however” and the supplementary phrase (“feeling...bluesologist”). *Choice D* is incorrect because a semicolon can’t be used in this way to join the main clause (“Scott-Heron...nickname”) and the supplementary word and phrase (“however” and “feeling...bluesologist”). Moreover, placing the semicolon after “nickname” illogically signals that the following information (Scott-Heron’s feeling that the nickname didn’t encapsulate his devotion to the blues tradition) is contrary to the information in the previous clause (Scott-Heron’s resistance to the nickname).

## QUESTION 26

**Choice B** is the best answer. The convention being tested is punctuation use between a main clause and a supplementary phrase. This choice correctly uses a comma to mark the boundary between the main clause (“the portraits...quilts”) and the supplementary noun phrase (“the stitching...fabric”) that provides a further description of how the portraits can be identified as quilts.

*Choice A* is incorrect. A comma and the conjunction “and” can’t be used in this way to join a main clause and a supplementary noun phrase. *Choice C* is incorrect because a semicolon can’t be used in this way to join a main clause and a supplementary noun phrase. *Choice D* is incorrect because it results in a rhetorically unacceptable sentence fragment beginning with “the stitching.”

## QUESTION 27

**Choice A** is the best answer. “For instance” logically signals that the information in this sentence—that larch trees lose their needles every fall—is an example supporting the claim in the previous sentence (that not all conifer species keep their leaves or needles year-round).

*Choice B* is incorrect because “nevertheless” illogically signals that the information in this sentence is true in spite of the claim about conifer species in the previous sentence. Instead, it’s an example supporting that claim. *Choice C* is incorrect because “meanwhile” illogically signals that the information in this sentence is separate from (while occurring simultaneously with) the claim about conifer species in the previous sentence. Instead, it’s an example supporting that claim. *Choice D* is incorrect because “in addition” illogically signals that the information in this sentence is merely an additional fact related to the claim about conifer species in the previous sentence. Instead, it’s an example supporting that claim.

## QUESTION 28

**Choice A** is the best answer. The sentence effectively describes the rocking chair to an audience unfamiliar with Sam Maloof, noting its sleek, contoured armrests and seat and explaining that Sam Maloof (the walnut chair's creator) was an American woodworker.

*Choice B* is incorrect. While the sentence explains who Sam Maloof was and mentions a chair, it doesn't describe the chair. *Choice C* is incorrect. While the sentence explains who Sam Maloof was, it doesn't describe the rocking chair. *Choice D* is incorrect. While the sentence describes the rocking chair, it doesn't explain who Sam Maloof was.

## QUESTION 29

**Choice C** is the best answer. The sentence emphasizes the decline in unique apple varieties in the US and specifies why this decline occurred, noting that thousands of apple varieties were lost because US farmers started mainly growing the same few unique varieties.

*Choice A* is incorrect. The sentence introduces the Lost Apple Project; it doesn't emphasize the decline in unique apple varieties in the US and specify why this decline occurred. *Choice B* is incorrect. While the sentence emphasizes the decline in unique apple varieties in the US, it doesn't explain why this decline occurred. *Choice D* is incorrect. The sentence emphasizes the general decline of crop varieties in the mid-1900s; it doesn't emphasize the specific decline in unique apple varieties in the US.

## QUESTION 30

**Choice C** is the best answer. The sentence effectively introduces the poetry collection *Precario/Precarious*, noting that it is a collection by Vicuña that was published in 1983 by Tanam Press.

*Choice A* is incorrect. While the sentence mentions the 1983 poetry collection *Precario/Precarious*, it focuses mainly on Vicuña's visual art. *Choice B* is incorrect. The sentence doesn't introduce the 1983 poetry collection *Precario/Precarious*; instead, it introduces Vicuña. *Choice D* is incorrect. The sentence emphasizes the location of Vicuña's 1971 exhibition *Pinturas, poemas y explicaciones*; it doesn't introduce the 1983 poetry collection *Precario/Precarious*.

## QUESTION 31

**Choice B** is the best answer. The sentence effectively emphasizes Kind's methodology: examining the student policies of 132 medical schools for guidelines about student social media use.

*Choice A* is incorrect. The sentence specifies how many medical schools' student policies are available online; it doesn't emphasize the study's methodology. *Choice C* is incorrect. The sentence emphasizes the study's results, not the study's methodology. *Choice D* is incorrect. The sentence emphasizes the aim of the study, not the study's methodology.



## QUESTION 32

**Choice C** is the best answer. The sentence emphasizes both the duration (the length of time) and the purpose of Cohen's and Rodrigues's work by noting that the women have been working since 2003 to preserve Gullah culture.

*Choice A* is incorrect. While the sentence emphasizes what visitors to Cohen's and Rodrigues's museums can learn, it doesn't mention the duration or purpose of the women's work. *Choice B* is incorrect. While the sentence emphasizes the purpose of Cohen's and Rodrigues's work, it doesn't mention the duration of that work (the length of time the women have been working to preserve Gullah culture). *Choice D* is incorrect. While the sentence emphasizes where and when Gullah culture developed, it doesn't mention the duration or purpose of Cohen's and Rodrigues's work.

## QUESTION 33

**Choice A** is the best answer. The sentence effectively emphasizes the aim, or goal, of the research study (in other words, what the researchers hoped to learn from the study): Rogers and Russell wanted to know if woodland expansion is related to changes in climate.

*Choice B* is incorrect. The sentence emphasizes the researchers' findings; it doesn't emphasize the aim of the study. *Choice C* is incorrect. The sentence emphasizes the results of the study; it doesn't emphasize the aim. *Choice D* is incorrect. The sentence emphasizes the methodology of the study; it doesn't emphasize the aim.

# Reading and Writing

## Module 2

(33 questions)

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### QUESTION 1

**Choice D** is the best answer because it most logically completes the text's discussion of damage to viburnum plants. In this context, "healthy" would mean not distressed or diseased. The text states that insect damage may cause viburnum plants to be discolored and have abnormal growths. In the next sentence, the phrase "on the other hand" indicates a contrast with the description of plants suffering from damage. Thus, the context contrasts the appearance of healthy, undamaged plants with the appearance of damaged plants.

*Choice A* is incorrect because in this context, "struggling" would mean working against difficulties. The text first describes viburnum plants experiencing damage by insects, and the phrase "on the other hand" then establishes a contrast with that description. It wouldn't make sense to contrast struggling viburnum plants with those being damaged by insects, because in both cases the plants would be experiencing difficulties. *Choice B* is incorrect because in this context, "beneficial" would mean producing good or helpful effects. The text doesn't discuss how viburnum plants affect other things or suggest that the plants are helpful in some way; rather, it focuses on how viburnum plants are affected by certain conditions. *Choice C* is incorrect because in this context "simple" would mean plain or uncomplicated. The text doesn't discuss whether certain viburnum plants are complicated or uncomplicated; rather, it focuses on how viburnum plants are affected by certain conditions.

## QUESTION 2

**Choice B** is the best answer because it most logically completes the text's discussion of Cole's book *Blind Spot*. In this context, "enthusiasm for" means excitement about. The text explains that *Blind Spot* consists of original photographs as well as poetic prose—two elements that correspond to Cole's passions, identified in the text, for photography and the written word. This context suggests that Cole's excitement about photography and writing led him to create a book that successfully combines the two mediums.

*Choice A* is incorrect because describing Cole as feeling "indifference to" his two passions wouldn't make sense in context. If Cole is indifferent to his passions, that would mean he doesn't care about photography or writing—in which case they wouldn't be his passions at all. *Choice C* is incorrect because there's nothing in the text to suggest that Cole feels "concern about," or uneasiness about, his passions. The text's use of the word "culminates" indicates that *Blind Spot* represents a triumphant climax of Cole's passions, not a work that results from his sense of discomfort with photography and writing. *Choice D* is incorrect because there's nothing in the text to suggest that Cole feels "surprise at," or astonished by, his passions. The text indicates that Cole's feeling about his passions "culminates" in a book that "evocatively" combines photographs and writing, suggesting that Cole has a long-standing and skillful relationship to his passions, not that he is startled by them.

## QUESTION 3

**Choice D** is the best answer because it most logically completes the text's discussion of Jemisin's writing. In this context, "conform to" means to act in accordance with something. The text suggests that in her science fiction writing, Jemisin's willingness to go against expectations and not use plots and themes that seem to follow a formula reflects how she treats the standard practices of the genre. This context conveys that Jemisin chooses not to act in accordance with those conventions.

*Choice A* is incorrect. In this context, "question" would mean doubt or object to. The text indicates that Jemisin is willing to go against expectations and not use formulaic plots and themes in her science fiction writing, suggesting that she may actually object to those conventions of the genre, not that she chooses not to question them. *Choice B* is incorrect because the text indicates that in her science fiction writing, Jemisin is willing to go against expectations and not use formulaic plots and themes. Rather than suggesting that Jemisin chooses not to "react to," or act in response to, the standard practices of the genre, this context suggests that she is acting in response to such conventions by deliberately avoiding them. *Choice C* is incorrect. In this context, "perceive" would mean become aware of or understand. The text indicates that in her science fiction writing, Jemisin is willing to go against expectations and not use formulaic plots and themes. This context conveys that Jemisin is aware of and deliberately avoids those conventions of the genre, not that she chooses not to be aware of them.

## QUESTION 4

**Choice B** is the best answer because it most logically completes the text's description of how Pico feels about the natural world. In this context, to say that Pico portrays his "ambivalence toward" nature would mean that he portrays his mixed feelings about nature. The text explains that Pico "honors the centrality of nature" and also makes it clear that he doesn't enjoy being in nature. This context suggests that Pico feels ambivalence toward nature.

*Choice A* is incorrect because saying that Pico portrays his "responsiveness to" nature would mean that he portrays himself as quick to react to nature, which isn't supported by the text. Instead, the text focuses on Pico's mixed feelings toward nature, describing him as both honoring nature's role in his tribe's beliefs and expressing his personal dislike for being in nature. *Choice C* is incorrect because saying that Pico portrays his "renunciation of" nature would mean that he portrays himself as rejecting nature, which isn't supported by the text. The text conveys that Pico demonstrates both positive and negative responses toward nature, not that he's giving it up completely. *Choice D* is incorrect because saying that Pico portrays his "mastery over" nature would mean that he portrays himself as having control over nature, which isn't supported by the text. The text focuses on Pico's mixed feelings about nature; nothing in the text suggests that Pico feels mastery over nature.

## QUESTION 5

**Choice A** is the best answer because it accurately states the main purpose of the text. The text begins by discussing the promise of the future, with positive references to renewal such as "new roads," "new beating of the drum," and "fresh seeing." But with the "new sun," the text continues, there will still be "the same backs bending" and "the same sad feet" drumming, indicating that these difficulties will follow people into this new day. The poem thus considers both the rewards and challenges associated with the repetitiveness of human life.

*Choice B* is incorrect because the text doesn't say anything about how memorable activities are, let alone compare the memorability of activities completed at different times of the day. *Choice C* is incorrect. Although the text contrasts hope with difficulty, it does not compare the relative frequency of joyful feelings with that of sad feelings. *Choice D* is incorrect because the text makes no distinction between the experiences of individuals and the experiences of their communities.

## QUESTION 6

**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 7

**Choice A** is the best answer because it accurately describes the organization of the elements within the text. The text begins with the claim that Joni Mitchell's album covers use images she creates in order to emphasize ideas embedded in her albums. It then goes on to provide an example of how Mitchell's self-portrait on the cover of *Turbulent Indigo* resembles a painting by Van Gogh, which the text indicates helps emphasize the strong connection Mitchell feels toward Van Gogh, a connection that is also expressed in the album's title song.

*Choice B* is incorrect because there are no references in the text to artists other than Joni Mitchell and Van Gogh. *Choice C* is incorrect because there is nothing in the text that calls attention to any similarities or differences between Joni Mitchell and Van Gogh. Instead, it mentions that Mitchell feels a strong "artistic connection" to Van Gogh. *Choice D* is incorrect because the text discusses the cover before referring to any songs, and it only references one song from the album not all the songs.

## QUESTION 8

**Choice C** is the best answer because it reflects how Putirka and Xu (Text 2) would likely characterize the conclusion presented in Text 1. Text 1 discusses a study by Mark Holland and colleagues in which they detected traces of lithium and sodium in the atmospheres of four white dwarf stars. The team claims that this supports the idea that exoplanets with continental crusts like Earth's once orbited these stars. Text 2 introduces Putirka and Xu, who indicate that sodium and lithium are present in several different minerals and that some of those minerals might exist in types of rock that are not found on Earth. Therefore, Putirka and Xu would likely describe the conclusion in Text 1 as questionable because it does not consider that lithium and sodium are also found in rocks that are not like Earth's continental crust.

*Choice A* is incorrect because the texts do not indicate how widely held any of the viewpoints described are. *Choice B* is incorrect because neither text discusses how new this area of study is. *Choice D* is incorrect because neither text discusses how likely lithium and sodium are to be detected by analyzing wavelengths of light.

## QUESTION 9

**Choice A** is the best answer because it presents an explanation that is directly stated in the text for why ecologists are worried about Pando. The text states that Pando is a colony of about 47,000 quaking aspen trees that represents one of the largest organisms on Earth. According to the text, ecologists are worried that Pando's growth is declining, partly because animals are feeding on the trees. In other words, the ecologists are worried that Pando isn't growing at the same rate it used to.

*Choice B* is incorrect. Rather than indicating that Pando isn't producing young trees anymore, the text reveals that Pando is indeed producing young trees, stating that those trees can be protected from grazing deer by strong fences. *Choice C* is incorrect because the text states that fences can be used to prevent deer from eating Pando's young trees, not that Pando itself can't grow in new areas because it's blocked by fences. *Choice D* is incorrect because the text offers no evidence that Pando's root system is incapable of supporting new trees or is otherwise a cause of worry for ecologists.

## 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 A** is the best answer because it presents a finding that, if true, would support the scholar's claim about Toni Morrison's likely goal of strengthening the presence of Black writers on Random House's list of published authors. The text explains that Morrison was the first Black woman to be an editor for Random House and that she was an editor there from 1967 to 1983. If it were true that Random House published a higher percentage of works by Black authors throughout the 1970s—during most of Morrison's time working there—than it had previously published, that would suggest that Morrison may have made a deliberate effort to strengthen the presence of Black authors on the list of Random House's published authors, thus supporting the scholar's claim.

*Choice B* is incorrect because the scholar's claim is about Morrison's work as an editor at a publishing company and her likely effort to strengthen the presence of Black writers on that company's list of published authors. It might be true that Black authors interviewed in the 1980s and 1990s often cited Morrison's novels as an influence on their work, but that finding would simply suggest something about how those authors approached their work; it wouldn't show that Morrison intended to increase the number of Black writers among the published authors specifically at Random House. *Choice C* is incorrect because the scholar's claim is about Morrison's work as an editor at a publishing company, not about her work as a novelist. Therefore, a finding that Morrison's novels published after 1983 sold more copies and were more widely acclaimed than her earlier novels would have no bearing on the claim that as an editor Morrison made an effort to ensure that more Black writers were present on Random House's list of published authors. *Choice D* is incorrect. Although the text discusses Morrison's work as an editor at Random House, the scholar's claim focuses on Morrison's likely effort in that role to increase the number of Black writers present on Random House's list of published authors, not on the influence she may have had on the content of the works she edited. Without knowing whether Morrison's stylistic influence led to more publications or if Morrison applied her influence specifically to works by Black writers, the finding that works edited by Morrison could be identified by stylistic characteristics would have no bearing on the claim that Morrison intended to strengthen the presence of Black writers among the published authors at Random House.

## QUESTION 12

**Choice A** is the best answer because it most effectively illustrates the claim that Martí argues that a society's spiritual well-being depends on the character of its literary culture. In the quotation, Martí asserts that poetry is "more necessary to a people than industry itself" and that it has the power to provide people with "faith and vigor." He also adds that literature gives people "the desire and strength for life." Therefore, this quotation shows that Martí believes that literature is a societal necessity because it uplifts people and nourishes their spiritual well-being.

*Choice B* is incorrect. Although this quotation emphasizes the importance of literature, it focuses on how the nature of a society is reflected in that society's literature rather than on literature's value for people's spiritual well-being.

*Choice C* is incorrect. Although this quotation involves an element of spirituality, it doesn't discuss literature. The quotation instead focuses on humanity's actions.

*Choice D* is incorrect because this quotation mainly focuses on the importance of Walt Whitman rather than on the value of literature in general.

## QUESTION 13

**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 14

**Choice A** is the best answer because it most effectively uses data from the table to support the researchers' conclusion about the harvesting of clamshells by Neanderthals for use as tools. The text explains that Neanderthals used clamshells to make tools and that the sturdiest, and therefore the most desirable, shells for this purpose are found on the seafloor, not on the beach. However, the researchers also concluded that the clamshell tools made from shells from the seafloor are rarer than those made from shells from the beach. Meanwhile the table shows that at each depth, the number of tools made from shells from the beach exceeds the number made from the more desirable shells from the seafloor. The fact that the more desirable shells are less common suggests that it was significantly more difficult to harvest shells from the seafloor than from the beach.

*Choice B* is incorrect because knowing which depth represents the period of time with the highest Neanderthal population does not help answer the question of why the Neanderthals consistently made more tools from the less desirable shells from the beach than they made from the more desirable shells from the seafloor. *Choice C* is incorrect because it claims that the beach shells are more durable than the seafloor shells, which contradicts the text's description of shells from the seafloor as smoother and sturdier than shells from the beach. *Choice D* is incorrect because knowing which depth has the most artifacts or whether the clam population fluctuated does not help explain why tools made from the less desirable shells from the beach outnumber tools made from the more desirable shells from the seafloor.

## QUESTION 15

**Choice C** is the best answer because it describes data from the table that support the researcher's hypothesis. According to the text, the researcher hypothesized that Arctic ground squirrels would exhibit longer torpor bouts and shorter arousal episodes than Alaska marmots do—or, put the other way, that the marmots would show shorter torpor bouts and longer arousal episodes than the ground squirrels do. The table shows data about torpor bouts and arousal episodes for the two species from 2008 to 2011. According to the table, the average duration of torpor bouts was 13.81 days for Alaska marmots, shorter than the average of 16.77 days for Arctic ground squirrels, and the average duration of arousal episodes was 21.2 hours for Alaska marmots, longer than the average of 14.2 hours for Arctic ground squirrels. Thus, the table supports the researcher's hypothesis by showing that Alaska marmots had shorter bouts of torpor and longer arousal episodes than Arctic ground squirrels did.

*Choice A* is incorrect because it inaccurately describes data from the table and doesn't support the researcher's hypothesis. The table shows that the average duration of arousal episodes was less than a day for both Alaska marmots (21.2 hours) and Arctic ground squirrels (14.2 hours). Additionally, information about arousal episodes for Alaska marmots and Arctic ground squirrels isn't sufficient to support a hypothesis involving comparisons of both arousal episodes and torpor bouts for those animals. *Choice B* is incorrect because it doesn't support the researcher's hypothesis, which involves comparisons of arousal episodes

as well as torpor bouts for Alaska marmots and Arctic ground squirrels. Noting that both animals had torpor bouts lasting several days, on average, doesn't address arousal episodes at all, nor does it reveal how the animals' torpor bouts compared. *Choice D* is incorrect because it doesn't support the researcher's hypothesis. Although the table does show that Alaska marmots had more torpor bouts (12) than arousal episodes (11) and that their arousal episodes were much shorter than their torpor bouts (21.2 hours and 13.81 days, respectively), comparing data across only Alaska marmot behaviors isn't sufficient to support a hypothesis about torpor and arousal behaviors of both Alaska marmots and Arctic ground squirrels.

## QUESTION 16

**Choice C** is the best answer because it most logically completes the argument about an unintended effect of the Nagoya Protocol. The text explains that the Nagoya Protocol is an agreement ensuring that Indigenous communities are compensated when their agricultural resources and knowledge are used by corporations. The text then states that the protocol allows corporations to keep their agreements with Indigenous communities confidential, about which some Indigenous advocates express concern. *Choice C*, when inserted into the blank, gives a good justification for the advocates' concern: such secrecy could mean that the public is unable to determine whether participating Indigenous communities were properly compensated under these agreements.

*Choice A* is incorrect. The text suggests that because corporations can keep their agreements with Indigenous communities confidential, Indigenous communities, not corporations, might not be compensated fairly. *Choice B* is incorrect because the text doesn't suggest that the ability of corporations to keep their agreements with Indigenous communities confidential would place limits on how much research corporations can undertake. *Choice D* is incorrect because the text doesn't indicate that Indigenous communities aim to learn new harvesting methods from their corporate partners. Rather, the text suggests that corporations use the knowledge of Indigenous communities for their research.

**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 B** is the best answer. The convention being tested is the use of verbs to express tense in a sentence. In this choice, the present tense verb “reach” is consistent with the present tense verbs “travel” and “are diverted” used to describe how atoms move through the synchrotron.

*Choice A* is incorrect because the future tense verb “will reach” is inconsistent with the present tense verbs used to describe how atoms move through the synchrotron. Though the atoms’ movement is a recurring action and “will reach” can also be used to indicate a habitual or recurring action, it creates a logical inconsistency in this sentence when paired with the present tense verbs “travel” and “are diverted.” *Choice C* is incorrect because the past perfect tense verb “had reached” is inconsistent with the present tense verbs used to describe how atoms move through the synchrotron. *Choice D* is incorrect because the present progressive tense verb “are reaching” is inconsistent with the present tense verbs used to describe how atoms move through the synchrotron. While both verbs occur in the present, the present progressive tense suggests that the action is currently in progress. This creates a logical inconsistency when paired with the present tense verbs “travel” and “are diverted,” which offer a general description of the tendencies of the atoms’ movement, rather than a description of an action that is currently in progress.

## QUESTION 19

**Choice A** is the best answer. The convention being tested is the use of 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, “a recent study”), and this choice supplies the finite present tense verb “explains” to indicate that the study explains why plants that attract bats have evolved to produce moderately sweet nectar.

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

## QUESTION 20

**Choice C** is the best answer. The convention being tested is subject-verb agreement. The singular verb “outlines” agrees in number with the singular subject “document.”

*Choice A* is incorrect because the plural verb “have outlined” doesn’t agree in number with the singular subject “document.” *Choice B* is incorrect because the plural verb “were outlining” doesn’t agree in number with the singular subject “document.” *Choice D* is incorrect because the plural verb “outline” doesn’t agree in number with the singular subject “document.”

## QUESTION 21

**Choice D** is the best answer. The convention being tested is punctuation between a main clause and a subordinate clause. This choice correctly uses a comma to mark the boundary between the main clause (“the colorful...decade”) and the subordinate clause (“while...centuries”) that provides contrasting information about the life span of rougheye rockfish.

*Choice A* is incorrect because a colon can't be used in this way to join a main clause and a subordinate clause. *Choice B* is incorrect because it results in a rhetorically unacceptable sentence fragment beginning with “while.” *Choice C* is incorrect because a semicolon can't be used in this way to join a main clause and a subordinate clause.

## QUESTION 22

**Choice C** is the best answer. The convention being tested is punctuation between a supplementary phrase and a main clause. This choice correctly uses a comma to mark the boundary between the supplementary phrase (“powered...day”), which describes how the LEDs are powered, and the main clause (“the blinking...night”).

*Choice A* is incorrect because it fails to mark the boundary between the supplementary phrase and the main clause with appropriate punctuation. Furthermore, placing commas around the phrase “by solar panels” suggests that it could be removed without affecting the coherence of the sentence, which isn't the case. *Choice B* is incorrect because it fails to mark the boundary between the supplementary phrase and the main clause with appropriate punctuation. *Choice D* is incorrect. Placing commas around the phrase “collected by solar panels during the day” suggests that it could be removed without affecting the coherence of the sentence, which isn't the case.

## QUESTION 23

**Choice D** is the best answer. The convention being tested is the coordination of main clauses. This choice correctly uses a comma and the coordinating conjunction “but” to join the first main clause (“Materials... Ru”) and the second main clause (“the alloy...NiCoCr”).

*Choice A* is incorrect because it results in a run-on sentence. The two main clauses are fused without punctuation and/or a conjunction. *Choice B* is incorrect because when coordinating two longer main clauses such as these, it's conventional to use a comma before the coordinating conjunction. *Choice C* is incorrect because it results in a comma splice. Without a conjunction following it, a comma can't be used in this way to join two main clauses.

## QUESTION 24

**Choice A** is the best answer. The convention being tested here is subject-verb agreement. The singular verb “was” agrees in number with the singular subject “Josephine St. Pierre Ruffin.”

*Choice B* is incorrect because the plural verb “were” doesn’t agree in number with the singular subject “Josephine St. Pierre Ruffin.” *Choice C* is incorrect because the plural verb “are” doesn’t agree in number with the singular subject “Josephine St. Pierre Ruffin.” *Choice D* is incorrect because the plural verb “have been” doesn’t agree in number with the singular subject “Josephine St. Pierre Ruffin.”

## QUESTION 25

**Choice A** is the best answer. The convention being tested is subject-modifier placement. This choice makes the noun phrase “researcher Robert Losey” the subject of the sentence and places it immediately after the modifying phrase “since...Siberia.” In doing so, this choice clearly establishes that researcher Robert Losey—and not another noun in the sentence—is who uncovered fragments of a 2,000-year-old reindeer training harness in northern Siberia.

*Choice B* is incorrect because it results in a dangling modifier. The placement of the noun phrase “researcher Robert Losey’s argument” immediately after the modifying phrase illogically suggests that the “argument” is what uncovered fragments of a 2,000-year-old reindeer training harness in northern Siberia. *Choice C* is incorrect because it results in a dangling modifier. The placement of the noun “domestication” immediately after the modifying phrase illogically suggests that “domestication” is what uncovered fragments of a 2,000-year-old reindeer training harness in northern Siberia. *Choice D* is incorrect because it results in a dangling modifier. The placement of the noun phrase “the argument” immediately after the modifying phrase illogically suggests that the “argument” is what uncovered fragments of a 2,000-year-old reindeer training harness in northern Siberia.

## QUESTION 26

**Choice A** is the best answer. The convention being tested is punctuation use between sentences. In this choice, the period after “tombs” is used correctly to mark the boundary between one sentence (“Archaeologist...tombs”) and another (“Built...nature”).

*Choice B* 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 C* is incorrect. Without a comma preceding it, the conjunction “and” can’t be used in this way to join the two sentences. *Choice D* is incorrect because it results in a run-on sentence. The sentences (“Archaeologist...tombs” and “Built...nature”) are fused without punctuation and/or a conjunction.

## QUESTION 27

**Choice D** is the best answer. The convention being tested is the use of punctuation around noun phrases. No punctuation is needed because the noun phrase “aluminum oxide” is a restrictive appositive, meaning that it provides essential identifying information about the noun phrase before it, “the chemical compound.”

*Choice A* is incorrect because no punctuation is needed. *Choice B* is incorrect because no punctuation is needed. *Choice C* is incorrect because the noun phrase “aluminum oxide” is a restrictive appositive. Setting the phrase off with commas suggests that it could be removed without affecting the coherence of the sentence, which isn’t the case.

## 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 D** is the best answer. “Second” logically signals that the information in this sentence—that the effort to bury the ship would likely only have been made for a king—joins the information in the previous sentence (“first...”) in supporting Brunning’s claim that the burial site was likely the tomb of a king.

*Choice A* is incorrect because “instead” illogically signals that the information in this sentence presents an alternative or substitute to the previous information about the gold artifacts inside the ship. Rather, this sentence presents a second piece of information that supports Brunning’s claim. *Choice B* is incorrect because “still” illogically signals that the information in this sentence exists in contrast to or despite the previous information about the gold artifacts inside the ship. Instead, this sentence presents a second piece of information that supports Brunning’s claim. *Choice C* is incorrect because “specifically” illogically signals that the information in this sentence specifies or elaborates on the previous information about the gold artifacts inside the ship. Instead, this sentence presents a second piece of information that supports Brunning’s claim.

### QUESTION 30

**Choice D** is the best answer. “Thus” logically signals that the claim in this sentence—that animals performing only basic actions should allocate relatively few resources to their brain tissue—is a consequence of the previous sentence’s claim about the energy demands of animal brains (namely, that the more diverse an animal’s behaviors, the more energy its brain needs).

*Choice A* is incorrect because “subsequently” illogically signals that the claim in this sentence occurs later in a chronological sequence of events than the previous sentence’s claim about the energy demands of animal brains. Instead, the second claim is a consequence of the first. *Choice B* is incorrect because “besides” illogically signals that the claim in this sentence provides a separate point in addition to, or apart from, the previous sentence’s claim about the energy demands of animal brains. Instead, the second claim is a consequence of the first. *Choice C* is incorrect because “nevertheless” illogically signals that the claim in this sentence is true in spite of the previous sentence’s claim about the energy demands of animal brains. Instead, the second claim is a consequence of the first.

### QUESTION 31

**Choice A** is the best answer. “Nevertheless” logically signals that the information in this sentence—that the spacesuits Suttirat Larlarb designed for the film *Sunshine* were made in standard sizes in a factory—presents a notable exception to Larlarb’s typical approach of custom-fitting garments to actors, which is described in the previous sentence.

*Choice B* is incorrect because “thus” illogically signals that the information in this sentence is a result or consequence of the previous information about Larlarb’s typical approach of custom-fitting garments to actors. Instead, it presents a notable exception to Larlarb’s typical approach. *Choice C* is incorrect because “likewise” illogically signals that the information in this sentence is similar to the previous information about Larlarb’s typical approach of custom-fitting garments to actors. Instead, it presents a notable exception to Larlarb’s typical approach. *Choice D* is incorrect because “moreover” illogically signals that the information in this sentence merely adds to the previous information about Larlarb’s typical approach of custom-fitting garments to actors. Instead, it presents a notable exception to Larlarb’s typical approach.



**QUESTION 32**

**Choice D** is the best answer. The sentence uses “both” to emphasize a thematic similarity between Tan’s two books, noting that both *Tales from Outer Suburbia* and *Tales from the Inner City* describe surreal events occurring in otherwise ordinary places.

*Choice A* is incorrect. The sentence emphasizes a difference (one contains fewer stories than the other), not a similarity, between the two books. *Choice B* is incorrect. The sentence indicates that Tan’s books were published ten years apart; it doesn’t emphasize a similarity between the two books. *Choice C* is incorrect. The sentence uses “unlike” to emphasize a difference between *Tales from Outer Suburbia* and *Tales from the Inner City*; it doesn’t emphasize a similarity between the two books.

**QUESTION 33**

**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.

# Math

## Module 1

(27 questions)

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### QUESTION 1

**Choice B** is correct. Subtracting 12 from both sides of the given equation yields  $k = 324$ . Therefore, the solution to the given equation is 324.

*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 2

**Choice C** is correct. The value of  $f(2)$  is the value of  $f(x)$  when  $x = 2$ . Substituting 2 for  $x$  in the given function yields  $f(2) = (2)^3 + 15$ , or  $f(2) = 8 + 15$ , which is equivalent to  $f(2) = 23$ . Therefore, the value of  $f(2)$  is 23.

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

*Choice B* is incorrect. This is the value of  $f(2)$  when  $f(x) = x(3) + 15$ , rather than  $f(x) = x^3 + 15$ . *Choice D* is incorrect and may result from conceptual or calculation errors.

### QUESTION 3

**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 4**

**Choice D** is correct. The sum of consecutive interior angles between two parallel lines and on the same side of the transversal is 180 degrees. Since it's given that line  $m$  is parallel to line  $n$ , it follows that  $x + 26 = 180$ . Subtracting 26 from both sides of this equation yields 154. Therefore, the value of  $x$  is 154.

*Choice A* is incorrect. This is half of the given angle measure. *Choice B* is incorrect. This is the value of the given angle measure. *Choice C* is incorrect. This is twice the value of the given angle measure.

**QUESTION 5**

**Choice C** is correct. It's given that John made a \$16 payment each month for  $p$  months. The total amount of these payments can be represented by the expression  $16p$ . The down payment can be added to that amount to find the total amount John paid, yielding the expression  $16p + 37$ . It's given that John paid a total of \$165. Therefore, the expression for the total amount John paid can be set equal to that amount, yielding the equation  $16p + 37 = 165$ .

*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 6**

The correct answer is 50. Substituting 8 for  $x$  in the given equation yields  $y = 5(8) + 10$ , or  $y = 50$ . Therefore, the value of  $y$  is 50 when  $x = 8$ .

**QUESTION 7**

The correct answer is 40. The height of each bar in the bar graph shown represents the number of cans collected by the group specified at the bottom of the bar. The bar for group 6 reaches a height of 40. Therefore, group 6 collected 40 cans.

**QUESTION 8**

**Choice C** is correct. If one of these students is selected at random, the probability of selecting a student whose vote for the new mascot was for a lion is given by the number of votes for a lion divided by the total number of votes. The given table indicates that the number of votes for a lion is 20 votes, and the total number of votes is 80 votes. The table gives the distribution of votes for 80 students, and the table shows a total of 80 votes were counted. It follows that each of the 80 students voted exactly once. Thus, the probability of selecting a student whose vote for the new mascot was for a lion is  $\frac{20}{80}$ , or  $\frac{1}{4}$ .

*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 9

**Choice A** is correct. It's given that the electrician charges a onetime fee plus an hourly rate. It's also given that the graph represents the total charge, in dollars, for  $x$  hours of work. This graph shows a linear relationship in the  $xy$ -plane. Thus, the total charge  $y$ , in dollars, for  $x$  hours of work can be represented as  $y = mx + b$ , where  $m$  is the slope and  $(0, b)$  is the  $y$ -intercept of the graph of the equation in the  $xy$ -plane. Since the given graph represents the total charge, in dollars, by an electrician for  $x$  hours of work, it follows that its slope is  $m$ , or the electrician's hourly rate.

**Choice B** is incorrect. The electrician's onetime fee is represented by the  $y$ -coordinate of the  $y$ -intercept, not the slope, of the graph. **Choice C** is incorrect and may result from conceptual errors. **Choice D** is incorrect and may result from conceptual errors.

## QUESTION 10

**Choice D** is correct. The perimeter,  $P$ , of a square can be found using the formula  $P = 4s$ , where  $s$  is the length of each side of the square. It's given that square X has a side length of 12 centimeters. Substituting 12 for  $s$  in the formula for the perimeter of a square yields  $P = 4(12)$ , or  $P = 48$ . Therefore, the perimeter of square X is 48 centimeters. It's also given that the perimeter of square Y is 2 times the perimeter of square X. Therefore, the perimeter of square Y is  $2(48)$ , or 96, centimeters. Substituting 96 for  $P$  in the formula  $P = 4s$  gives  $96 = 4s$ . Dividing both sides of this equation by 4 gives  $24 = s$ . Therefore, the length of one side of square Y is 24 centimeters.

**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 11

**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 12

**Choice A** is correct. An equation defining a linear function can be written in the form  $h(x) = ax + b$ , where  $a$  and  $b$  are constants. It's given that  $h(0) = 41$ . Substituting 0 for  $x$  and 41 for  $h(x)$  in the equation  $h(x) = ax + b$  yields  $41 = a(0) + b$ , or  $b = 41$ . Substituting 41 for  $b$  in the equation  $h(x) = ax + b$  yields  $h(x) = ax + 41$ . It's also given that  $h(1) = 40$ . Substituting 1 for  $x$  and 40 for  $h(x)$  in the equation  $h(x) = ax + 41$  yields  $40 = a(1) + 41$ , or  $40 = a + 41$ . Subtracting 41 from the left- and right-hand sides of this equation yields  $-1 = a$ . Substituting  $-1$  for  $a$  in the equation  $h(x) = ax + 41$  yields  $h(x) = -1x + 41$ , or  $h(x) = -x + 41$ .

**Choice B** is incorrect. Substituting 0 for  $x$  and 41 for  $h(x)$  in this equation yields  $41 = -0$ , which isn't a true statement. **Choice C** is incorrect. Substituting 0 for  $x$  and 41 for  $h(x)$  in this equation yields  $41 = -41(0)$ , or  $41 = 0$ , which isn't a true statement. **Choice D** is incorrect. Substituting 41 for  $h(x)$  in this equation yields  $41 = -41$ , which isn't a true statement.

## QUESTION 13

The correct answer is 410. It's given that  $t$  minutes after an initial observation, the number of bacteria in a population is  $60,000(2)^{\frac{t}{410}}$ . This expression consists of the initial number of bacteria, 60,000, multiplied by the expression  $2^{\frac{t}{410}}$ . The time it takes for the number of bacteria to double is the increase in the value of  $t$  that causes the expression  $2^{\frac{t}{410}}$  to double. Since the base of the expression  $2^{\frac{t}{410}}$  is 2, the expression  $2^{\frac{t}{410}}$  will double when the exponent increases by 1. Since the exponent of the expression  $2^{\frac{t}{410}}$  is  $\frac{t}{410}$ , the exponent will increase by 1 when  $t$  increases by 410. Therefore the time, in minutes, it takes for the number of bacteria in the population to double is 410.

## QUESTION 14

The correct answer is 76. It's given that the graph of  $y = g(x)$  is the result of translating the graph of  $y = f(x)$  up 4 units in the  $xy$ -plane. It follows that the graph of  $y = g(x)$  is the same as the graph of  $y = f(x) + 4$ . Substituting  $g(x)$  for  $y$  in the equation  $y = f(x) + 4$  yields  $g(x) = f(x) + 4$ . It's given that  $f(x) = (x - 6)(x - 2)(x + 6)$ . Substituting  $(x - 6)(x - 2)(x + 6)$  for  $f(x)$  in the equation  $g(x) = f(x) + 4$  yields  $g(x) = (x - 6)(x - 2)(x + 6) + 4$ . Substituting 0 for  $x$  in this equation yields  $g(0) = (0 - 6)(0 - 2)(0 + 6) + 4$ , or  $g(0) = 76$ . Thus, the value of  $g(0)$  is 76.

## QUESTION 15

**Choice D** is correct. It's given that the candle starts with 17 ounces of wax and has 6 ounces of wax remaining after a period of time has passed. The amount of wax the candle has lost during the time period can be found by subtracting the

remaining amount of wax from the amount of wax the candle was made of, which yields  $17 - 6$  ounces, or 11 ounces. This means the candle loses 11 ounces of wax during that period of time. It's given that the amount of wax decreases by 1 ounce every 4 hours. If  $h$  represents the number of hours the candle has been burning, it follows that  $\frac{1}{4} = \frac{11}{h}$ . Multiplying both sides of this equation by  $4h$  yields  $h = 44$ . Therefore, the candle has been burning for 44 hours.

*Choice A* is incorrect and may result from using the equation  $\frac{1}{4} = \frac{h}{11}$  rather than  $\frac{1}{4} = \frac{11}{h}$  to represent the situation, and then rounding to the nearest whole number. *Choice B* is incorrect. This is the amount of wax, in ounces, remaining in the candle, not the number of hours it has been burning. *Choice C* is incorrect and may result from using the equation  $\frac{1}{4} = \frac{6}{h}$  rather than  $\frac{1}{4} = \frac{11}{h}$  to represent the situation.

## QUESTION 16

**Choice A** is correct. Subtracting  $14j$  from each side of the given equation results in  $5k = m - 14j$ . Dividing each side of this equation by 5 results in  $k = \frac{m - 14j}{5}$ .

*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 17

**Choice B** is correct. If two triangles are similar, then their corresponding angles are congruent. It's given that right triangle  $FGH$  is similar to right triangle  $JKL$  and angle  $F$  corresponds to angle  $J$ . It follows that angle  $F$  is congruent to angle  $J$  and, therefore, the measure of angle  $F$  is equal to the measure of angle  $J$ . The sine ratios of angles of equal measure are equal. Since the measure of angle  $F$  is equal to the measure of angle  $J$ ,  $\sin(F) = \sin(J)$ . It's given that  $\sin(F) = \frac{308}{317}$ . Therefore,  $\sin(J)$  is  $\frac{308}{317}$ .

*Choice A* is incorrect. This is the value of  $\cos(J)$ , not the value of  $\sin(J)$ .

*Choice C* is incorrect. This is the reciprocal of the value of  $\sin(J)$ , not the value of  $\sin(J)$ . *Choice D* is incorrect. This is the reciprocal of the value of  $\cos(J)$ , not the value of  $\sin(J)$ .

## QUESTION 18

**Choice B** is correct. Let  $x$  be the first integer and let  $y$  be the second integer. If the first integer is 11 greater than twice the second integer, then  $x = 2y + 11$ . If the product of the two integers is 546, then  $xy = 546$ . Substituting  $2y + 11$  for  $x$  in this equation results in  $(2y + 11)y = 546$ . Distributing the  $y$  to both terms in the parentheses results in  $2y^2 + 11y = 546$ . Subtracting 546 from both sides of this equation results in  $2y^2 + 11y - 546 = 0$ . The left-hand side of this equation can be factored by finding two values whose product is  $2(-546)$ , or  $-1,092$ , and whose sum is 11. The two values whose product is  $-1,092$  and whose sum is 11 are 39 and  $-28$ . Thus, the equation  $2y^2 + 11y - 546 = 0$  can be rewritten as

$2y^2 + 28y - 39y - 546 = 0$ , which is equivalent to  $2y(y - 14) + 39(y - 14) = 0$ , or  $(2y + 39)(y - 14) = 0$ . By the zero product property, it follows that  $2y + 39 = 0$  and  $y - 14 = 0$ . Subtracting 39 from both sides of the equation  $2y + 39 = 0$  yields  $2y = -39$ . Dividing both sides of this equation by 2 yields  $y = -\frac{39}{2}$ . Since  $y$  is a positive integer, the value of  $y$  is not  $-\frac{39}{2}$ . Adding 14 to both sides of the equation  $y - 14 = 0$  yields  $y = 14$ . Substituting 14 for  $y$  in the equation  $xy = 546$  yields  $x(14) = 546$ . Dividing both sides of this equation by 14 results in  $x = 39$ . Therefore, the two integers are 14 and 39, so the smaller of the two integers is 14.

*Choice A* is incorrect and may result from conceptual or calculation errors. *Choice C* is incorrect. This is the larger of the two integers. *Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 19

**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 20

The correct answer is  $-3$ . Squaring both sides of the given equation yields  $(x - 2)^2 = 3x + 34$ , which can be rewritten as  $x^2 - 4x + 4 = 3x + 34$ . Subtracting  $3x$  and 34 from both sides of this equation yields  $x^2 - 7x - 30 = 0$ . This quadratic equation can be rewritten as  $(x - 10)(x + 3) = 0$ . According to the zero product property,  $(x - 10)(x + 3)$  equals zero when either  $x - 10 = 0$  or  $x + 3 = 0$ . Solving each of these equations for  $x$  yields  $x = 10$  or  $x = -3$ . Therefore, the given equation has two solutions, 10 and  $-3$ . Of these two solutions,  $-3$  is the smallest solution to the given equation.

## 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. It's given that the sample is in the shape of a cube with edge lengths of 0.9 meters. Therefore, the volume of the sample is  $0.90^3$ , or 0.729, cubic meters. It's also given that the sample has a density of 807 kilograms per 1 cubic meter. Therefore, the mass of this sample is 0.729 cubic meters  $\left(\frac{807 \text{ kilograms}}{1 \text{ cubic meter}}\right)$ , or 588.303 kilograms. Rounding this mass to the nearest whole number gives 588 kilograms. Therefore, to the nearest whole number, the mass, in kilograms, of this sample is 588.

*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 D** is correct. It's given that for  $x > 0$ ,  $f(x)$  is equal to 201% of  $x$ . This is equivalent to  $f(x) = \frac{201}{100}x$ , or  $f(x) = 2.01x$ , for  $x > 0$ . This function indicates that as  $x$  increases,  $f(x)$  also increases, which means  $f$  is an increasing function. Furthermore,  $f(x)$  increases at a constant rate of 2.01 for each increase of  $x$  by 1. A function with a constant rate of change is linear. Thus, the function  $f$  can be described as an increasing linear function.

*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 could describe the function  $f(x) = (2.01)^x$ , where  $f(x)$  is equal to 201% of  $f(x-1)$ , not  $x$ , for  $x > 0$ .

## QUESTION 24

**Choice C** is correct. It's given that  $f(x) = \frac{a}{x+b}$  and that the graph shown is a partial graph of  $y = f(x)$ . Substituting  $y$  for  $f(x)$  in the equation  $f(x) = \frac{a}{x+b}$  yields  $y = \frac{a}{x+b}$ . The graph passes through the point  $(-7, -2)$ . Substituting  $-7$  for  $x$  and  $-2$  for  $y$  in the equation  $y = \frac{a}{x+b}$  yields  $-2 = \frac{a}{-7+b}$ . Multiplying each side of this equation by  $-7+b$  yields  $-2(-7+b) = a$ , or  $14 - 2b = a$ . The graph also passes through the point  $(-5, -6)$ . Substituting  $-5$  for  $x$  and  $-6$  for  $y$  in the equation  $y = \frac{a}{x+b}$  yields  $-6 = \frac{a}{-5+b}$ . Multiplying each side of this equation by



$-5 + b$  yields  $-6(-5 + b) = a$ , or  $30 - 6b = a$ . Substituting  $14 - 2b$  for  $a$  in this equation yields  $30 - 6b = 14 - 2b$ . Adding  $6b$  to each side of this equation yields  $30 = 14 + 4b$ . Subtracting 14 from each side of this equation yields  $16 = 4b$ .

Dividing each side of this equation by 4 yields  $4 = b$ . Substituting 4 for  $b$  in the equation  $14 - 2b = a$  yields  $14 - 2(4) = a$ , or  $6 = a$ . Substituting 6 for  $a$  and 4

for  $b$  in the equation  $f(x) = \frac{a}{x+b}$  yields  $f(x) = \frac{6}{x+4}$ . It's given that  $g(x) = f(x+4)$ .

Substituting  $x+4$  for  $x$  in the equation  $f(x) = \frac{6}{x+4}$  yields  $f(x+4) = \frac{6}{x+4+4}$ ,

which is equivalent to  $f(x+4) = \frac{6}{x+8}$ . It follows that  $g(x) = \frac{6}{x+8}$ .

*Choice A* is incorrect. This could define function  $g$  if  $g(x) = f(x-4)$ . *Choice B* is incorrect. This could define function  $g$  if  $g(x) = f(x)$ . *Choice D* is incorrect. This could define function  $g$  if  $g(x) = f(x) \cdot (x+4)$ .

## QUESTION 25

**Choice C** is correct. Factoring the denominator in the second term of the given expression gives  $\frac{y+12}{x-8} + \frac{y(x-8)}{xy(x-8)}$ . This expression can be rewritten with common denominators by multiplying the first term by  $\frac{xy}{xy}$ , giving  $\frac{xy(y+12)}{xy(x-8)} + \frac{y(x-8)}{xy(x-8)}$ . Adding these two terms yields  $\frac{xy(y+12)+y(x-8)}{xy(x-8)}$ . Using the distributive property to rewrite this expression gives  $\frac{xy^2+12xy+xy-8y}{x^2y-8xy}$ . Combining the like terms in the numerator of this expression gives  $\frac{xy^2+13xy-8y}{x^2y-8xy}$ .

*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. It's given that 483 out of 803 voters responded that they would vote for Angel Cruz. Therefore, the proportion of voters from the poll who responded they would vote for Angel Cruz is  $\frac{483}{803}$ . It's also given that there are a total of 6,424 voters in the election. Therefore, the total number of people who would be expected to vote for Angel Cruz is  $6,424\left(\frac{483}{803}\right)$ , or 3,864. Since 3,864 of the 6,424 total voters would be expected to vote for Angel Cruz, it follows that  $6,424 - 3,864$ , or 2,560 voters would be expected not to vote for Angel Cruz. The difference in the number of votes for and against Angel Cruz is  $3,864 - 2,560$ , or 1,304 votes. Therefore, if 6,424 people vote in the election, Angel Cruz would be expected to win by 1,304 votes.

*Choice A* is incorrect. This is the difference in the number of voters from the poll who responded that they would vote for and against Angel Cruz. *Choice C* is incorrect. This is the total number of people who would be expected to vote for Angel Cruz. *Choice D* is incorrect. This is the difference between the total number of people who vote in the election and the number of voters from the poll.

## QUESTION 27

The correct answer is 10. It's given that the graph of  $x^2 + x + y^2 + y = \frac{199}{2}$  in the  $xy$ -plane is a circle. The equation of a circle in the  $xy$ -plane can be written in the form  $(x-h)^2 + (y-k)^2 = r^2$ , where the coordinates of the center of the circle are  $(h, k)$  and the length of the radius of the circle is  $r$ . The term  $(x-h)^2$  in this equation can be obtained by adding the square of half the coefficient of  $x$  to both sides of the given equation to complete the square. The coefficient of  $x$  is 1. Half the coefficient of  $x$  is  $\frac{1}{2}$ . The square of half the coefficient of  $x$  is  $\frac{1}{4}$ .

Adding  $\frac{1}{4}$  to each side of  $(x^2 + x) + (y^2 + y) = \frac{199}{2}$  yields

$(x^2 + x + \frac{1}{4}) + (y^2 + y) = \frac{199}{2} + \frac{1}{4}$ , or  $(x + \frac{1}{2})^2 + (y^2 + y) = \frac{199}{2} + \frac{1}{4}$ . Similarly, the term  $(y-k)^2$  can be obtained by adding the square of half the coefficient of  $y$  to both

sides of this equation, which yields  $(x + \frac{1}{2})^2 + (y^2 + y + \frac{1}{4}) = \frac{199}{2} + \frac{1}{4} + \frac{1}{4}$ , or

$(x + \frac{1}{2})^2 + (y + \frac{1}{2})^2 = \frac{199}{2} + \frac{1}{4} + \frac{1}{4}$ . This equation is equivalent to

$(x + \frac{1}{2})^2 + (y + \frac{1}{2})^2 = 100$ , or  $(x + \frac{1}{2})^2 + (y + \frac{1}{2})^2 = 10^2$ . Therefore, the length of the circle's radius is 10.

# Math

## Module 2

(27 questions)

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### QUESTION 1

**Choice B** is correct. The number of harvested potatoes Isabel saved to plant next year can be calculated by multiplying the total number of potatoes Isabel harvested, 760, by the proportion of potatoes she saved. Since she saved 10% of the potatoes she harvested, the proportion of potatoes she saved is  $\frac{10}{100}$ , or 0.1. Multiplying 760 by this proportion gives  $760(0.1)$ , or 76, potatoes that she saved to plant next year.

*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 2

**Choice B** 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  $(0, 2)$ . Therefore, the  $y$ -intercept of the graph shown 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 3

**Choice C** is correct. Since 1 meter is equal to 100 centimeters, 51 meters is equal to 51 meters  $\left(\frac{100 \text{ centimeters}}{1 \text{ meter}}\right)$ , or 5,100 centimeters.

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

*Choice B* is incorrect and may result from dividing, rather than multiplying, 51 by 100. *Choice D* is incorrect. This is the length, in millimeters rather than centimeters, that is equivalent to a length of 51 meters.

**QUESTION 4**

**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 5**

**Choice B** is correct. Combining like terms inside the parentheses of the given expression,  $20w - (4w + 3w)$ , yields  $20w - (7w)$ . Combining like terms in this resulting expression yields  $13w$ .

**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 6**

The correct answer is 27. Multiplying both sides of the given equation by 3 yields  $3(6 + x) = 3(9)$ , or  $18 + 3x = 27$ . Therefore, the value of  $18 + 3x$  is 27.

**QUESTION 7**

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 8**

**Choice A** is correct. Since  $x$  is a factor of each term in the given expression, the expression is equivalent to  $x(9x) + x(5)$ , or  $x(9x + 5)$ .

**Choice B** is incorrect. This expression is equivalent to  $45x^2 + 5x$ , not  $9x^2 + 5x$ .  
**Choice C** is incorrect. This expression is equivalent to  $9x^2 + 45x$ , not  $9x^2 + 5x$ .  
**Choice D** is incorrect. This expression is equivalent to  $9x^3 + 5x^2$ , not  $9x^2 + 5x$ .

**QUESTION 9**

**Choice D** is correct. The sum of the angle measures of a triangle is  $180^\circ$ . Adding the measures of angles  $B$  and  $C$  gives  $52 + 17 = 69^\circ$ . Therefore, the measure of angle  $A$  is  $180 - 69 = 111^\circ$ .

*Choice A* is incorrect and may result from subtracting the sum of the measures of angles  $B$  and  $C$  from  $90^\circ$ , instead of from  $180^\circ$ . *Choice B* is incorrect and may result from subtracting the measure of angle  $C$  from the measure of angle  $B$ . *Choice C* is incorrect and may result from adding the measures of angles  $B$  and  $C$  but not subtracting the result from  $180^\circ$ .

## QUESTION 10

**Choice D** is correct. Since the graphs of the equations in the given system intersect at the point  $(x, y)$ , the point  $(x, y)$  represents a solution to the given system of equations. The first equation of the given system of equations states that  $x = 8$ . Substituting 8 for  $x$  in the second equation of the given system of equations yields  $y = 8^2 + 8$ , or  $y = 72$ . Therefore, the value of  $y$  is 72.

*Choice A* is incorrect. This is the value of  $x$ , not  $y$ . *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 11

**Choice B** is correct. The line of best fit shown intersects the  $y$ -axis at a positive  $y$ -value and has a negative slope. The graph of an equation of the form  $y = a + bx$ , where  $a$  and  $b$  are constants, intersects the  $y$ -axis at a  $y$ -value of  $a$  and has a slope of  $b$ . Of the given choices, only choice B represents a line that intersects the  $y$ -axis at a positive  $y$ -value, 13.5, and has a negative slope,  $-0.8$ .

*Choice A* is incorrect. This equation represents a line that has a positive slope, not a negative slope. *Choice C* is incorrect. This equation represents a line that intersects the  $y$ -axis at a negative  $y$ -value, not a positive  $y$ -value, and has a positive slope, not a negative slope. *Choice D* is incorrect. This equation represents a line that intersects the  $y$ -axis at a negative  $y$ -value, not a positive  $y$ -value.

## QUESTION 12

**Choice C** is correct. It's given that  $f(x) = 8\sqrt{x}$ . Substituting 48 for  $f(x)$  in this equation yields  $48 = 8\sqrt{x}$ . Dividing both sides of this equation by 8 yields  $6 = \sqrt{x}$ . This can be rewritten as  $\sqrt{x} = 6$ . Squaring both sides of this equation yields  $x = 36$ . Therefore, the value of  $x$  for which  $f(x) = 48$  is 36.

*Choice A* is incorrect. If  $x = 6$ ,  $f(x) = 8\sqrt{6}$ , not 48. *Choice B* is incorrect. If  $x = 8$ ,  $f(x) = 8\sqrt{8}$ , not 48. *Choice D* is incorrect. If  $x = 64$ ,  $f(x) = 8\sqrt{64}$ , which is equivalent to 64, not 48.

## QUESTION 13

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 14

The correct answer is  $\frac{29}{3}$ . Applying the distributive property to the left-hand side of the given equation,  $x(x+1) - 56$ , yields  $x^2 + x - 56$ . Applying the distributive property to the right-hand side of the given equation,  $4x(x-7)$ , yields  $4x^2 - 28x$ . Thus, the equation becomes  $x^2 + x - 56 = 4x^2 - 28x$ . Combining like terms on the left- and right-hand sides of this equation yields  $0 = (4x^2 - x^2) + (-28x - x) + 56$ , or  $3x^2 - 29x + 56 = 0$ . For a quadratic equation in the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are constants, the quadratic formula gives the solutions to

the equation in the form  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ . Substituting 3 for  $a$ ,  $-29$  for  $b$ , and

56 for  $c$  from the equation  $3x^2 - 29x + 56 = 0$  into the quadratic formula yields

$$x = \frac{29 \pm \sqrt{(-29)^2 - 4(3)(56)}}{2(3)}, \text{ or } x = \frac{29}{6} \pm \frac{13}{6}.$$

It follows that the solutions to the given equation are  $\frac{29}{6} + \frac{13}{6}$  and  $\frac{29}{6} - \frac{13}{6}$ . Adding these two solutions gives the sum of the

solutions:  $\frac{29}{6} + \frac{13}{6} + \frac{29}{6} - \frac{13}{6}$ , which is equivalent to  $\frac{29}{6} + \frac{29}{6}$ , or  $\frac{29}{3}$ . Note that 29/3,

9.666, and 9.667 are examples of ways to enter a correct answer.

## QUESTION 15

**Choice C** is correct. It's given by the first equation in the system that  $y = 3x$ . Substituting  $3x$  for  $y$  in the equation  $2x + y = 12$  yields  $2x + 3x = 12$ , or  $5x = 12$ .

*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. The volume,  $V$ , of a cube can be found using the formula  $V = s^3$ , where  $s$  is the edge length of the cube. It's given that a cube has an edge length of 41 inches. Substituting 41 inches for  $s$  in this equation yields  $V = 41^3$  cubic inches, or  $V = 68,921$  cubic inches. Therefore, the volume of the cube is 68,921 cubic inches.

*Choice A* is incorrect. This is the perimeter, in inches, of the cube. *Choice B* is incorrect. This is the area, in square inches, of a face of the cube. *Choice C* is incorrect. This is the surface area, in square inches, of the cube.

### QUESTION 17

**Choice D** is correct. It's given that the function  $p$  models the population of Lowell  $t$  years after a census. Since there are 12 months in a year,  $m$  months after the census is equivalent to  $\frac{m}{12}$  years after the census. Substituting  $\frac{m}{12}$  for  $t$  in the equation  $p(t) = 90,000(1.06)^t$  yields  $p\left(\frac{m}{12}\right) = 90,000(1.06)^{\frac{m}{12}}$ . Therefore, the function  $r$  that best models the population of Lowell  $m$  months after the census is  $r(m) = 90,000(1.06)^{\frac{m}{12}}$ .

*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 18

**Choice A** is correct. The given system of linear equations can be solved by the elimination method. Multiplying each side of the second equation in the given system by 3 yields  $(2x + 2y)(3) = (10)(3)$ , or  $6x + 6y = 30$ . Subtracting this equation from the first equation in the given system yields  $(6x + 7y) - (6x + 6y) = (28) - (30)$ , which is equivalent to  $(6x - 6x) + (7y - 6y) = 28 - 30$ , or  $y = -2$ .

*Choice B* is incorrect. This is the value of  $x$ , not the value of  $y$ . *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 B** is correct. It's given that the minimum value of  $x$  is 12 less than 6 times another number  $n$ . Therefore, the possible values of  $x$  are all greater than or equal to the value of 12 less than 6 times  $n$ . The value of 6 times  $n$  is given by the expression  $6n$ . The value of 12 less than  $6n$  is given by the expression  $6n - 12$ . Therefore, the possible values of  $x$  are all greater than or equal to  $6n - 12$ . This can be shown by the inequality  $x \geq 6n - 12$ .

*Choice A* is incorrect. This inequality shows the possible values of  $x$  if the maximum, not the minimum, value of  $x$  is 12 less than 6 times  $n$ . *Choice C* is incorrect. This inequality shows the possible values of  $x$  if the maximum, not the minimum, value of  $x$  is 6 times  $n$  less than 12, not 12 less than 6 times  $n$ .

*Choice D* is incorrect. This inequality shows the possible values of  $x$  if the minimum value of  $x$  is 6 times  $n$  less than 12, not 12 less than 6 times  $n$ .

### QUESTION 20

The correct answer is 44. The mean of a data set is computed by dividing the sum of the values in the data set by the number of values in the data set. It's given that data set A consists of the heights of 75 buildings and has a mean of 32 meters.

This can be represented by the equation  $\frac{x}{75} = 32$ , where  $x$  represents the sum of the heights of the buildings, in meters, in data set A. Multiplying both sides of this equation by 75 yields  $x = 75(32)$ , or  $x = 2,400$  meters. Therefore, the sum

of the heights of the buildings in data set A is 2,400 meters. It's also given that data set B consists of the heights of 50 buildings and has a mean of 62 meters. This can be represented by the equation  $\frac{y}{50} = 62$ , where  $y$  represents the sum of the heights of the buildings, in meters, in data set B. Multiplying both sides of this equation by 50 yields  $y = 50(62)$ , or  $y = 3,100$  meters. Therefore, the sum of the heights of the buildings in data set B is 3,100 meters. Since it's given that data set C consists of the heights of the 125 buildings from data sets A and B, it follows that the mean of data set C is the sum of the heights of the buildings, in meters, in data sets A and B divided by the number of buildings represented in data sets A and B, or  $\frac{2,400+3,100}{125}$ , which is equivalent to 44 meters. Therefore, the mean, in meters, of data set C is 44.

## QUESTION 21

The correct answer is  $\frac{59}{9}$ . When the graph of an equation in the form  $Ax + By = C$ , where  $A$ ,  $B$ , and  $C$  are constants, is translated down  $k$  units in the  $xy$ -plane, the resulting graph can be represented by the equation  $Ax + B(y + k) = C$ . It's given that the graph of  $9x - 10y = 19$  is translated down 4 units in the  $xy$ -plane. Therefore, the resulting graph can be represented by the equation  $9x - 10(y + 4) = 19$ , or  $9x - 10y - 40 = 19$ . Adding 40 to both sides of this equation yields  $9x - 10y = 59$ . The  $x$ -coordinate of the  $x$ -intercept of the graph of an equation in the  $xy$ -plane is the value of  $x$  in the equation when  $y = 0$ . Substituting 0 for  $y$  in the equation  $9x - 10y = 59$  yields  $9x - 10(0) = 59$ , or  $9x = 59$ . Dividing both sides of this equation by 9 yields  $x = \frac{59}{9}$ . Therefore, the  $x$ -coordinate of the  $x$ -intercept of the resulting graph is  $\frac{59}{9}$ . Note that  $59/9$ , 6.555, and 6.556 are examples of ways to enter a correct answer.

## QUESTION 22

**Choice D** is correct. Since the value of  $y$  increases by a constant factor, 4, for each increase of 1 in the value of  $x$ , the relationship between  $x$  and  $y$  is exponential. An exponential relationship between  $x$  and  $y$  can be represented by an equation of the form  $y = a(b)^x$ , where  $a$  is the value of  $x$  when  $y = 0$  and  $y$  increases by a factor of  $b$  for each increase of 1 in the value of  $x$ . Since  $y = 200$  when  $x = 0$ ,  $a = 200$ . Since  $y$  increases by a factor of 4 for each increase of 1 in the value of  $x$ ,  $b = 4$ . Substituting 200 for  $a$  and 4 for  $b$  in the equation  $y = a(b)^x$  yields  $y = 200(4)^x$ . Thus, the equation  $y = 200(4)^x$  represents the relationship between  $x$  and  $y$ .

*Choice A* is incorrect and may result from conceptual errors. *Choice B* is incorrect. This equation represents a relationship where for each increase of 1 in the value of  $x$ , the value of  $y$  increases by a factor of 200, not 4, and when  $x = 0$ ,  $y$  is equal to 4, not 200. *Choice C* is incorrect and may result from conceptual errors.

## QUESTION 23

**Choice B** is correct. Adding 9 to each side of the given equation yields  $x^2 - 2x = 9$ . To complete the square, adding 1 to each side of this equation



yields  $x^2 - 2x + 1 = 9 + 1$ , or  $(x - 1)^2 = 10$ . Taking the square root of each side of this equation yields  $x - 1 = \pm\sqrt{10}$ . Adding 1 to each side of this equation yields  $x = 1 \pm \sqrt{10}$ . Since it's given that one of the solutions to the equation can be written as  $1 + \sqrt{k}$ , the value of  $k$  must be 10.

Alternate approach: It's given that  $1 + \sqrt{k}$  is a solution to the given equation. It follows that  $x = 1 + \sqrt{k}$ . Substituting  $1 + \sqrt{k}$  for  $x$  in the given equation yields  $(1 + \sqrt{k})^2 - 2(1 + \sqrt{k}) - 9 = 0$ , or  $(1 + \sqrt{k})(1 + \sqrt{k}) - 2(1 + \sqrt{k}) - 9 = 0$ . Expanding the products on the left-hand side of this equation yields  $1 + 2\sqrt{k} + k - 2 - 2\sqrt{k} - 9 = 0$ , or  $k - 10 = 0$ . Adding 10 to each side of this equation yields  $k = 10$ .

*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 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 further 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 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 25

**Choice B** is correct. It's given that the right triangle is isosceles. In an isosceles right triangle, the two legs have equal lengths, and the length of the hypotenuse is  $\sqrt{2}$  times the length of one of the legs. Let  $\ell$  represent the length, in inches, of each leg of the isosceles right triangle. It follows that the length of the hypotenuse is  $\ell\sqrt{2}$  inches. The perimeter of a figure is the sum of the lengths of the sides of the figure. Therefore, the perimeter of the isosceles right triangle is  $\ell + \ell + \ell\sqrt{2}$  inches. It's given that the perimeter of the triangle is  $94 + 94\sqrt{2}$  inches. It follows that  $\ell + \ell + \ell\sqrt{2} = 94 + 94\sqrt{2}$ . Factoring the left-hand side of this equation yields  $(1 + 1 + \sqrt{2})\ell = 94 + 94\sqrt{2}$ , or  $(2 + \sqrt{2})\ell = 94 + 94\sqrt{2}$ . Dividing both sides of this

equation by  $2 + \sqrt{2}$  yields  $\ell = \frac{94 + 94\sqrt{2}}{2 + \sqrt{2}}$ . Rationalizing the denominator of the right-hand side of this equation by multiplying the right-hand side of the equation by  $\frac{2 - \sqrt{2}}{2 - \sqrt{2}}$  yields  $\ell = \frac{(94 + 94\sqrt{2})(2 - \sqrt{2})}{(2 + \sqrt{2})(2 - \sqrt{2})}$ . Applying the distributive property to the numerator and to the denominator of the right-hand side of this equation yields  $\ell = \frac{188 - 94\sqrt{2} + 188\sqrt{2} - 94\sqrt{4}}{4 - 2\sqrt{2} + 2\sqrt{2} - \sqrt{4}}$ . This is equivalent to  $\ell = \frac{94\sqrt{2}}{2}$ , or  $\ell = 47\sqrt{2}$ . Therefore, the length, in inches, of one leg of the isosceles right triangle is  $47\sqrt{2}$ .

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

*Choice C* is incorrect. This is the length, in inches, of the hypotenuse. *Choice D* is incorrect and may result from conceptual or calculation errors.

## QUESTION 26

**Choice C** is correct. It's given that the equation  $-9x^2 + 30x + c = 0$  has exactly one solution. A quadratic equation of the form  $ax^2 + bx + c = 0$  has exactly one solution if and only if its discriminant,  $-4ac + b^2$ , is equal to zero. It follows that for the given equation,  $a = -9$  and  $b = 30$ . Substituting  $-9$  for  $a$  and  $30$  for  $b$  into  $b^2 - 4ac$  yields  $30^2 - 4(-9)(c)$ , or  $900 + 36c$ . Since the discriminant must equal zero,  $900 + 36c = 0$ . Subtracting  $36c$  from both sides of this equation yields  $900 = -36c$ . Dividing each side of this equation by  $-36$  yields  $-25 = c$ . Therefore, the value of  $c$  is  $-25$ .

*Choice A* is incorrect. If the value of  $c$  is  $3$ , this would yield a discriminant that is greater than zero. Therefore, the given equation would have two solutions, rather than exactly one solution. *Choice B* is incorrect. If the value of  $c$  is  $0$ , this would yield a discriminant that is greater than zero. Therefore, the given equation would have two solutions, rather than exactly one solution. *Choice D* is incorrect. If the value of  $c$  is  $-53$ , this would yield a discriminant that is less than zero. Therefore, the given equation would have no real solutions, rather than exactly one solution.

## QUESTION 27

The correct answer is **6**. 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 first equation in the given system is  $\frac{3}{2}y - \frac{1}{4}x = \frac{2}{3} - \frac{3}{2}y$ . Multiplying each side of this equation by  $12$  yields  $18y - 3x = 8 - 18y$ . Adding  $18y$  to each side of this equation yields  $36y - 3x = 8$ , or  $-3x + 36y = 8$ . The second equation in the given system is  $\frac{1}{2}x + \frac{3}{2} = py + \frac{9}{2}$ .

Multiplying each side of this equation by 2 yields  $x + 3 = 2py + 9$ . Subtracting  $2py$  from each side of this equation yields  $x + 3 - 2py = 9$ . Subtracting 3 from each side of this equation yields  $x - 2py = 6$ . Therefore, the two equations in the given system, written in standard form, are  $-3x + 36y = 8$  and  $x - 2py = 6$ . As previously stated, if this system has no solution, the lines represented by the equations in the  $xy$ -plane are parallel and distinct, meaning the proportion

$\frac{1}{-3} = \frac{-2p}{36}$ , or  $-\frac{1}{3} = -\frac{p}{18}$ , is true and the proportion  $\frac{6}{8} = \frac{1}{-3}$  is not true. The proportion  $\frac{6}{8} = \frac{1}{-3}$  is not true. Multiplying each side of the true proportion,  $-\frac{1}{3} = -\frac{p}{18}$ , by  $-18$  yields  $6 = p$ . Therefore, if the system has no solution, then the value of  $p$  is 6.