

# The SAT<sup>®</sup>

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# Practice Test #1



## ANSWER EXPLANATIONS

ACADEMY  
TOURAN

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 B** is the best answer because it most logically completes the text's discussion of Ochoa's prediction that humans will one day need to live in places other than Earth. As used in this context, "speculates" would mean puts forward an idea without firm evidence. The text states that Ochoa "doesn't have a definite idea" about when humans might need to live in other environments and characterizes Ochoa's prediction as a "conjecture," or a conclusion presented without convincing evidence. This context indicates that Ochoa speculates when she makes this prediction.

*Choice A* is incorrect because saying that Ochoa "demands," or insists or requires, that humans will one day need to live in other environments than Earth's wouldn't make sense in context. The text indicates that she's unsure about the timing but hypothesizes that it will someday happen. *Choice C* is incorrect because saying that Ochoa "doubts," or questions or disbelieves, that humans will one day need to live in other environments than Earth's wouldn't make sense in context. The text indicates that although Ochoa is unsure about the timing, she hypothesizes that humans will need to live in places other than Earth and encourages research into future travel to the moon. *Choice D* is incorrect because saying that Ochoa "establishes," or proves, that humans will one day need to live in other environments than Earth's wouldn't make sense in context. Rather than stating that Ochoa discusses her idea with certainty and supports it with evidence, the text indicates that Ochoa is unsure about when humans might need to live in other environments.

## QUESTION 2

**Choice C** is the best answer because it most logically completes the text's discussion of Annie Dodge Wauneka's work as a Navajo Nation legislator. As used in this context, "persistent" means existing continuously. The text states that Wauneka "continuously worked to promote public health," traveling extensively and authoring a medical dictionary; this indicates that Wauneka's effort was persistent.

*Choice A* is incorrect because describing Wauneka's effort related to public health as "impartial," or not partial or biased and treating all things equally, wouldn't make sense in context. The text suggests that Wauneka's continuous work was partial in one way, as she focused specifically on promoting public health throughout the Navajo homeland and to speakers of the Navajo language. *Choice B* is incorrect because the text emphasizes that Wauneka's effort to promote public health as a Navajo Nation legislator was continuous and extensive, involving wide travels and the authoring of a medical dictionary. Because this work clearly involved care and dedication, it wouldn't make sense to describe it as "offhand," or casual and informal. *Choice D* is incorrect because nothing in the text suggests that Wauneka's effort to promote public health was "mandatory," or required by law or rule, even though Wauneka was a Navajo Nation legislator. Rather than suggesting that Wauneka's effort was required for any reason, the text emphasizes the continuous and extensive nature of her work.

## QUESTION 3

**Choice D** is the best answer because it most logically completes the text's discussion of the collaboration between the Crow Tribe and Montana State University. As used in this context, "exemplifies" means demonstrates. The text conveys how the Crow Tribe–Montana State University collaboration serves to illustrate the model of community-based participatory research introduced earlier in the text and expanded on later in the text.

*Choice A* is incorrect because referring to "circumvents," or avoids, wouldn't make sense in context. The text suggests that the Crow Tribe–Montana State University collaboration serves as an example of the principles of community-based participatory research, not that the collaboration evades this model. *Choice B* is incorrect because referring to "eclipses," or overshadows, wouldn't make sense in context. The text describes the Crow Tribe–Montana State University collaboration as an equal partnership, which indicates that it's an example of the community-based participatory research model, not that it overshadows the model. *Choice C* is incorrect because saying that the collaboration "fabricates," or creates, the model wouldn't make sense in context. The text indicates that the Crow Tribe–Montana State University collaboration serves as an example of the model, not that it created the model.

## QUESTION 4

**Choice A** is the best answer because it most logically completes the text's discussion of a relationship between the dodder plant and its host plant. As used in this context, "synchronization" means the act of things happening at the same time. The text indicates that the dodder and its host plant flower in unison and that this synchronization occurs because the dodder makes use of a protein produced by the host shortly before flowering.

**Choice B** is incorrect because referring to "hibernation," or the state of being dormant or inactive, wouldn't make sense in context. The text focuses on something the dodder plant actively engages in—making use of a protein and producing flowers. **Choice C** is incorrect because stating that the dodder plant and its host engage together in "prediction," or the act of declaring or indicating something in advance, wouldn't make sense in context. Rather than indicating that the dodder plant and its host plant make a prediction about flowering activity, the text suggests that the host produces a protein as part of its regular flowering process and that the dodder then absorbs and uses that protein to flower at the same time. **Choice D** is incorrect because referring to "moderation," or the act of causing something to become less intense or extreme, wouldn't make sense in context. Although the text states that the dodder plant absorbs and uses a protein made by its host plant, it doesn't suggest that the dodder lessens the host plant's flowering activity; the two plants simply flower in unison.

## QUESTION 5

**Choice B** is the best answer because it most logically completes the text's description of efforts to explain the existence of planets in binary star systems. As used in this context, describing an explanation as "a straightforward" one would mean that the explanation is direct and uncomplicated. The text asserts that since it should be "nearly impossible" for planets to form in binary star systems, it's "not surprising" that there isn't a straightforward explanation for the existence of planets in such systems; the fact that one potential approach involves "complex" factors offers further contextual support for this idea.

**Choice A** is incorrect because it would not make sense in context to say that there isn't "a discernible" explanation—meaning an explanation capable of being perceived—for the existence of planets in binary star systems. The text discusses just such an explanation offered by Roman Rafikov and Kedron Silsbee, which indicates that their explanation can be discerned. **Choice C** is incorrect because the text emphasizes how difficult it is to explain the existence of planets in binary star systems, suggesting that the situation isn't marked by the lack of "an inconclusive" explanation—an explanation that does not resolve the issue—but rather that if any explanations have been offered, they've likely been inconclusive ones. **Choice D** is incorrect because nothing in the text suggests that there is a lack of "an unbiased," or impartial and unprejudiced, explanation for the existence of planets in binary star systems. The text indicates that it's difficult to explain the existence of planets in such systems and it describes one attempt to do so, but there is no evidence that explanations from Roman Rafikov and Kedron Silsbee or others are biased.

## QUESTION 6

**Choice A** is the best answer because it most logically completes the text's discussion of Sterlin Harjo's approach to representing Native characters on television. As used in this context, "repudiates" means rejects or refuses to have anything to do with. The text indicates that television shows tend to depict Native characters as living long ago, but that Harjo's series *Reservation Dogs* focuses on Native teenagers in the present day, representing a "rejection" of the typical approach to depicting Native characters. This context thus indicates that Harjo repudiates television's general tendency regarding Native characters.

**Choice B** is incorrect because the text describes Harjo's "rejection" of the typical approach to representing Native characters on television, so it wouldn't make sense to say that Harjo "proclaims," or declares or affirms, television's general tendency regarding Native characters. Harjo is described as refusing to follow the pattern of depicting Native characters in the distant past, not as proclaiming that pattern. **Choice C** is incorrect because the text describes television's tendency to represent Native characters in the distant past as something that is already occurring, not as something that Harjo "foretells," or predicts will happen in the future. The text is focused on Harjo's "rejection" of this pattern, not on any predictions he may have about it. **Choice D** is incorrect because saying that Harjo "recants" something would mean that he withdraws a previously held belief, and it wouldn't make sense to say that Harjo recants television's tendency to represent Native characters as living in the past. No beliefs previously held by Harjo are mentioned. Additionally, a tendency isn't a belief and thus isn't something that can be recanted.

## QUESTION 7

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

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

## QUESTION 8

**Choice D** is the best answer because it best describes how the underlined sentence functions in the text as a whole. The first sentence of the text establishes that Lily can be "keenly sensitive to" scenes that serve as a "fitting background" for her feelings—that is, she's very aware of when a setting seems to reflect her mood. The next sentence, which is underlined, then demonstrates this awareness: Lily views the landscape she's in as a large-scale reflection of her current mood, identifying with elements such as its calmness. Thus, the function of the underlined sentence is to illustrate an idea introduced in the previous sentence.

*Choice A* is incorrect because the underlined sentence describes the scene only in very general terms, referring to its calmness, breadth, and long stretches of land. It's the next sentence that adds specific details about colors, light, and various trees nearby. *Choice B* is incorrect because nothing in the underlined sentence suggests that Lily is experiencing an internal conflict. In fact, the sentence indicates that Lily thinks the landscape reflects her own feeling of calmness. *Choice C* is incorrect because the only assertion in the underlined sentence is that Lily feels that broad aspects of the landscape, such as its calmness, reflect her current mood, and that assertion isn't expanded on in the next sentence. Instead, the next sentence describes specific details of the scene without connecting them to Lily's feelings.

## QUESTION 9

**Choice C** is the best answer because it best describes how the underlined sentence functions in the text as a whole. The first sentence presents the implications of Veeraraghavan's team's study: sunshine exposure during work hours can cause overly optimistic behavior. The underlined sentence then describes the data the team consulted and how they were used (comparing predictions about earnings to what the companies actually earned), and the final sentence presents what the team found in their examination of the data. Thus, the underlined sentence mainly functions to explain part of the methodology used in the team's study.

*Choice A* is incorrect because the underlined sentence explains in part how the team conducted their analysis of the effect of sunshine but doesn't address what the team found; a broad summary is instead given in the other two sentences. *Choice B* is incorrect because the underlined sentence doesn't present any specific examples from the team's comparisons of 29,000 earnings predictions to actual earnings; it simply explains in part how the team conducted their analysis. *Choice D* is incorrect because the underlined sentence simply explains in part how the team conducted their analysis; the text never mentions any challenges that the team encountered in their study.

## QUESTION 10

**Choice C** is the best answer because it describes something that is true of Mother, as presented in the text. The text indicates that in addition to other activities, Mother writes stories for her children while they are at school and makes up "funny pieces of poetry" for certain occasions.

*Choice A* is incorrect because the text suggests that Mother prefers to spend her time with her children and doesn't sit at home hoping that ladies will visit her. *Choice B* is incorrect because the text says only that Mother makes up poetry for the children's birthdays, not that she likes birthdays more than other special occasions. *Choice D* is incorrect because the text doesn't suggest that Mother prefers reading to her children over the other activities she does with them, such as playing with them and writing stories and poems for them.

## QUESTION 11

**Choice A** is the best answer because it most accurately states the main purpose of the text. In the first part of the text, the speaker addresses Paul Laurence Dunbar's ability to understand people (he has "read the hearts and souls of men" and written of their "joy and mirth"). In the second part of the text, the speaker describes Dunbar's thorough understanding of the natural world (he has read "the language of the flowers" and engaged with "the little brook"). Thus, the text mainly praises Dunbar for being especially perceptive about people and nature.

*Choice B* is incorrect because the speaker describes Dunbar as having read the "hearts and souls of men" and the "language of flowers" to convey Dunbar's ability to comprehend people and nature, not to suggest that Dunbar has literally read any of these things or has read a great deal about them. *Choice C* is incorrect because the text notes how well Dunbar has made sense of the topics he's written about but doesn't address any specific parts of Dunbar's writing process beyond the suggestion that he used a pen. *Choice D* is incorrect because the text focuses on Dunbar's understanding of people and nature as expressed in his writing. Nothing in the text suggests that the speaker is recalling a particular afternoon actually spent in nature with Dunbar; even if there had been a shared experience, the text isn't focused on reminiscing.

## QUESTION 12

**Choice A** is the best answer because it presents the quotation that most directly illustrates the claim that Whitman's poem suggests that its readers haven't fully understood themselves. This quotation makes that point directly by saying to readers, "You have not known what you are." The quotation goes on to reinforce this point using a metaphor of sleep, saying that readers have "slumber'd" and that their "eyelids have been the same as closed most of the time."

*Choice B* is incorrect because this quotation doesn't suggest that readers haven't fully understood themselves but instead characterizes readers as "immense" and "interminable." Although immense and interminable things can be difficult to understand, this quotation doesn't make that point. *Choice C* is incorrect because this quotation doesn't suggest that readers haven't fully understood themselves but instead conveys the speaker's regret over not having celebrated readers sooner. In fact, this quotation says nothing at all about readers themselves—it's focused solely on the speaker's feelings about readers. *Choice D* is incorrect because this quotation doesn't suggest that readers haven't fully understood themselves; instead, this quotation makes the point that the speaker has understood readers and is determined to create "hymns" about them.



## QUESTION 13

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

**Choice B** is incorrect because the student's claim is that Chambi's photographs have considerable ethnographic value because they depict diverse elements of Peruvian society; the student doesn't claim anything about the technical skill demonstrated in the photographs. **Choice C** is incorrect because neither Chambi's reputation nor the locations where his photographs may have been published would be relevant to the student's claim that his photographs are valuable as an ethnographic record of Peru's diverse society. **Choice D** is incorrect because the popularity among other photographers of the people and places that Chambi photographed would be irrelevant to the student's claim that Chambi's photographs are valuable as an ethnographic record of Peru's diverse society.

## QUESTION 14

**Choice C** is the best answer because it uses data from the table to effectively exemplify the idea that the film outputs of the four individuals included in the table should be considered bare minimums—that is, that we should assume that the individuals actually had higher outputs than those recorded. The table presents the years during which the individuals were active and the number of known films the individuals are credited in. The table indicates that Lillian St. Cyr has 66 film credits as an actor and that Edwin Carewe has 58 film credits as a director; it follows that if some films and records for the era were lost, it's possible that Lillian St. Cyr acted in far more than 66 films and that Edwin Carewe directed more than 58 films.

**Choice A** is incorrect because it doesn't effectively exemplify the idea that the film outputs of the four individuals included in the table should be considered bare minimums. Rather than addressing the idea that the individuals likely had higher outputs than those presented in the table, this choice simply compares data from the table to make the point that Dark Cloud has fewer credited acting roles than Lillian St. Cyr (35 and 66, respectively). **Choice B** is incorrect because it misrepresents data from the table, even though it may exemplify the idea that the film outputs of the four individuals included in the table should be considered bare minimums by implying that Edwin Carewe acted in more than 47 films. The table indicates that Edwin Carewe was active from 1912 to 1934, meaning that his 47 credited acting roles were in films made before or during 1934, not after that time. **Choice D** is incorrect because it doesn't effectively exemplify the idea that the film outputs of the four individuals included in the table should be considered



bare minimums. Instead of addressing the idea that the individuals likely had higher outputs than those recorded, this choice suggests that James Young Deer actually acted in and directed fewer films than presented in the table (only 33 known films as a director instead of 35, and only 10 known films as an actor instead of 33).

## QUESTION 15

**Choice D** is the best answer because it provides the most direct support from the table for the claim that the plants growing in close proximity to other plants gained an advantage at an early developmental stage. The table shows the total number of juvenile plants from five species that were found growing on bare ground and in patches of vegetation as well as the percentage of the total number of each species that were growing in patches of vegetation. For each of the five species, more than 50% of the juvenile plants were growing in patches of vegetation. The text notes, however, that a random distribution of plants across the landscape should result in only about 15% of the plants being found in patches of vegetation. In other words, for each of the five species, the percentage of juvenile plants found growing in patches of vegetation was substantially higher than could be explained by chance alone. This finding supports the claim in the text: if plants growing in patches are overrepresented among plants that have survived to the juvenile stage, as the data show they are, then it suggests that it's advantageous for plants at an early stage of development to grow in patches of vegetation.

**Choice A** is incorrect because the statement that less than 75% of juvenile plants were found growing in patches of vegetation, while true, doesn't clearly support the claim that the plants growing in close proximity to other plants gained an advantage at an early developmental stage. Saying that less than 75% of plants were found in patches doesn't indicate how the percentage growing in patches compares with the percentage that would be expected to grow in patches on the basis of chance alone, which is the information necessary to evaluate whether the claim in the text has support in the table. Put another way, if the percentage of plants found growing in patches was 15% or less, it would be true that less than 75% were found in patches, but the data would in fact weaken the claim in the text, not strengthen it, since the data would show that growing in patches wasn't advantageous. **Choice B** is incorrect because only 12 plants of this species were found growing in patches, which was the lowest number of any species, not the greatest number. Additionally, even if it were true that this species had the greatest number of plants growing in patches, the finding would be irrelevant to the claim that plants of all five species gained an advantage by growing in close proximity to other plants. **Choice C** is incorrect because 59.1% of the plants of these species were found growing in patches, which is a far greater percentage, not a lower percentage, than what would be expected if plants were randomly distributed (around 15%). Additionally, if it were true that the percentage of plants growing in patches was lower for these species than what would be expected from chance alone, that finding would weaken, not strengthen, the claim that growing in patches is advantageous.

## QUESTION 16

**Choice C** is the best answer because it presents a finding that, if true, would support the researchers' hypothesis about the plants' dependence on dissolving rock. The text indicates that the roots of the two plant species grow directly into quartzite rock, where hairs on the roots secrete acids that dissolve the rock. The researchers hypothesize that the plants depend on this process because dissolving rock opens spaces for the roots to grow and releases phosphates that provide the plants with phosphorous, a vital nutrient. If the plants carry out this process of dissolving rock even when the rock already has spaces into which the roots could grow, that would support the researchers' hypothesis because it suggests that the plants are getting some advantage—such as access to phosphorous—from the action of dissolving rock. If the plants don't benefit from dissolving rock, they would be expected to grow in the cracks that already exist, as doing so would mean that the plants don't have to spend energy creating and secreting acids; if, however, the plants create new entry points by dissolving rock even when cracks already exist, that would support the hypothesis that they depend on dissolving rock for some benefit.

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

## QUESTION 17

**Choice B** is the best answer because it presents the conclusion that most logically follows from the text's discussion of the relationship between atmospheric carbon dioxide and sauropod body size. The text establishes that sauropods evolved to reach enormous sizes, and it notes that some scientists have asserted that the cause of this phenomenon was increased plant production that resulted from increased atmospheric carbon dioxide. The text goes on to

state, however, that atmospheric carbon dioxide levels didn't increase around the time of important periods in sauropods' evolution of larger body sizes. If significant periods of sauropod evolution toward larger sizes occurred without increased atmospheric carbon dioxide levels, that suggests that the evolution of larger sizes didn't depend on increased carbon dioxide in the atmosphere.

*Choice A* is incorrect because the text doesn't describe any fluctuations in atmospheric carbon dioxide, so there's no evidence in the text to support the conclusion that such fluctuations had different effects on different sauropod lineages. All that the text says about atmospheric carbon dioxide levels is that there weren't increases at particular points that correspond with key moments in sauropod evolution. *Choice C* is incorrect because the text indicates that there weren't significant increases in atmospheric carbon dioxide around the time of important periods in sauropods' evolution toward larger body sizes, not that atmospheric carbon dioxide was higher when the largest sauropods lived than when sauropods first appeared. *Choice D* is incorrect because the text indicates that atmospheric carbon dioxide levels didn't increase at important periods in sauropod evolution, not that higher levels would have affected that evolution. The text provides no information about how higher levels of atmospheric carbon dioxide might have affected sauropods.

## QUESTION 18

**Choice B** is the best answer because it most logically completes the text's discussion of Anita Allen's argument about judges citing philosophers in their judicial opinions. The text indicates that judges sometimes cite philosophers when writing their judicial opinions and that, according to Allen, judges tend to cite philosophers whose views are in agreement with those of the judges themselves. Allen claims, however, that the best judicial opinions consider potential objections and rebut them, which suggests that judges may be able to strengthen their opinions by including discussions of philosophers with views contrary to their own.

*Choice A* is incorrect because Allen's claim is that judges could improve their judicial opinions by citing philosophers who disagree with the views expressed in the opinions, which would necessarily require judges to consult philosophical works. *Choice C* is incorrect because there's no discussion in the text about making judicial opinions more easily understood by any particular group of readers. The focus of the text is on Allen's claim that judicial opinions could be strengthened by the inclusion of discussions of philosophers whose views disagree with those of the judges authoring the opinions. *Choice D* is incorrect because the text presents Allen's argument that discussing philosophers whose views judges disagree with could strengthen judicial opinions, not that doing so could bring those opinions into line with views that are popular among philosophers.

## QUESTION 19

**Choice A** is the best answer. The convention being tested is pronoun-antecedent agreement. The plural pronoun “they” agrees in number with the plural antecedent “customers.”

*Choice B* is incorrect because the singular pronoun “one” doesn’t agree in number with the plural antecedent “customers.” *Choice C* is incorrect because the second person pronoun “you” isn’t conventional as a substitute for “customers.” It suggests that the audience (“you”) is the customer. *Choice D* is incorrect because the singular pronoun “it” doesn’t agree in number with the plural antecedent “customers.”

## QUESTION 20

**Choice A** is the best answer. The convention being tested is punctuation use between a main clause and a participial phrase. This choice correctly uses a comma to mark the boundary between the main clause (“Epicurus...’soul”) and the participial phrase (“positing...absence”) that provides additional information about how Epicurus defined pleasure.

*Choice B* is incorrect because a colon can’t be used in this way to join a main clause and a participial phrase. *Choice C* is incorrect because a semicolon can’t be used in this way to join a main clause and a participial phrase. *Choice D* is incorrect because it results in a rhetorically unacceptable sentence fragment beginning with “positing.”

## QUESTION 21

**Choice C** is the best answer. The convention being tested is the use of possessive determiners. The plural possessive determiner “their” agrees in number with the plural conjoined noun phrase “Watson and Crick” and thus indicates that the findings were those of Watson and Crick.

*Choice A* is incorrect because “they’re” is the contraction for “they are,” not a possessive determiner. *Choice B* is incorrect because “it’s” is the contraction for “it is” or “it has,” not a possessive determiner. *Choice D* is incorrect because the singular possessive determiner “its” doesn’t agree in number with the plural conjoined noun phrase “Watson and Crick.”

## QUESTION 22

**Choice C** is the best answer. The conventions being tested are punctuation use between titles and proper nouns and between verbs and integrated quotations. No punctuation is needed to set off the proper noun “Stina Chyn” from the title that describes Chyn, “critic.” Because “Stina Chyn” is essential information identifying the “critic,” no punctuation is necessary. Further, no punctuation is needed between the verb “claims” and the following quotation because the quotation is integrated into the structure of the sentence.

*Choice A* is incorrect because no punctuation is needed before or after the proper noun “Stina Chyn.” Setting the critic’s name off with commas suggests that it could be removed without affecting the coherence of the sentence, which isn’t the case. *Choice B* is incorrect because no punctuation is needed before or after the proper noun “Stina Chyn.” Setting the critic’s name off with commas suggests that it could be removed without affecting the coherence of the sentence, which isn’t the case. Additionally, no punctuation is needed between “claims” and the integrated quotation. *Choice D* is incorrect because no punctuation is needed between the verb “claims” and its subject, “critic Stina Chyn.” Additionally, no punctuation is needed between the verb “claims” and the integrated quotation.

## QUESTION 23

**Choice B** 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, “some historians”), and this choice supplies the finite present tense verb “claim” to indicate what some historians do.

*Choice A* is incorrect because the nonfinite participle “claiming” doesn’t supply the main clause with a finite verb. *Choice C* is incorrect because the nonfinite participle “having claimed” doesn’t supply the main clause with a finite verb. *Choice D* is incorrect because the nonfinite to-infinitive “to claim” doesn’t supply the main clause with a finite verb.

## QUESTION 24

**Choice A** is the best answer. The convention being tested is colon use within a sentence. A colon used in this way introduces information that illustrates or explains information that has come before it. In this case, the colon introduces the following explanation of why some roundworms in the Southern Hemisphere move in the opposite direction of Earth’s magnetic field.

*Choice B* is incorrect because it results in a comma splice. A comma can’t be used in this way to join two long independent clauses (“Researchers...food” and “in...sources”) such as these. *Choice C* is incorrect because it results in a run-on sentence. The two clauses (“Researchers...food” and “in...sources”) are fused without punctuation. Furthermore, the conjunction “while” fails to indicate that what follows is an explanation of why some roundworms in the Southern Hemisphere move in the opposite direction of Earth’s magnetic field. *Choice D* is incorrect because it results in a run-on sentence. The two clauses (“Researchers...food” and “in...sources”) are fused without punctuation and/or a conjunction.

## QUESTION 25

**Choice B** is the best answer. The convention being tested is pronoun-antecedent agreement. The plural reflexive pronoun “themselves” agrees in number with the plural antecedent “turtle barnacles,” correctly indicating what is attached to a sea turtle shell.

*Choice A* is incorrect because the singular pronoun “it” doesn’t agree in number with the plural antecedent “turtle barnacles.” *Choice C* is incorrect because it results in an unclear and confusing sentence. In this context, it’s unclear what the plural pronoun “them” refers to. *Choice D* is incorrect because the singular reflexive pronoun “itself” doesn’t agree in number with the plural antecedent “turtle barnacles.”

## QUESTION 26

**Choice A** is the best answer. The convention being tested is subject-verb agreement. The singular verb “allows” agrees in number with the singular subject “landing.”

*Choice B* is incorrect because the plural verb “are allowing” doesn’t agree in number with the singular subject “landing.” *Choice C* is incorrect because the plural verb “have allowed” doesn’t agree in number with the singular subject “landing.” *Choice D* is incorrect because the plural verb “allow” doesn’t agree in number with the singular subject “landing.”

## QUESTION 27

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

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

## QUESTION 28

**Choice A** is the best answer. The convention being tested is subject-modifier placement. This choice ensures that the introductory phrase “upon recovering two years later” appears immediately before the noun it modifies (“Henry”), clearly establishing that Henry recovered two years later.

**Choice B** is incorrect because it results in a dangling modifier. The placement of the noun phrase “the reign of Henry” immediately after the introductory phrase illogically suggests that the reign of Henry recovered two years later. **Choice C** is incorrect because it results in a dangling modifier. The placement of the noun phrase “Henry’s reign” immediately after the introductory phrase illogically suggests that Henry’s reign recovered two years later. **Choice D** is incorrect because it results in a dangling modifier. The placement of the function word “it” immediately after the introductory phrase illogically suggests that “it” recovered two years later.

## QUESTION 29

**Choice D** is the best answer. “For example” logically signals that the information in this sentence—that *The Emperor’s Babe* is a novel conveyed in lines of poetry—exemplifies the claim in the previous sentence about hybrid works that incorporate elements of both novels and poems.

**Choice A** is incorrect because “by contrast” illogically signals that the information in this sentence contrasts with the claim about hybrid works in the previous sentence. Instead, the information demonstrates that Evaristo’s novel is an example of a hybrid work. **Choice B** is incorrect because “consequently” illogically signals that the information in this sentence is a consequence, or result, of the claim about hybrid works in the previous sentence. Instead, the information demonstrates that Evaristo’s novel is an example of a hybrid work. **Choice C** is incorrect because “secondly” illogically signals that the information in this sentence is a second, separate claim from the previous sentence’s claim about hybrid works. Instead, the information demonstrates that Evaristo’s novel is an example of a hybrid work.

## QUESTION 30

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

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



## QUESTION 31

**Choice D** is the best answer. “Increasingly” logically signals that the claim in this sentence—that mathematicians are collaborating with their peers—marks a change relative to what was traditionally done. As the previous sentence explains, while mathematicians may have traditionally worked alone, evidence points to a shift in the opposite direction. The claim describes the shift: a rise in collaboration.

*Choice A* is incorrect because “similarly” illogically signals that the claim in this sentence is similar to, but separate from, the previous claim about the shift away from mathematicians working alone. Instead, the claim about the rise in collaboration elaborates on the previous claim, describing the shift. *Choice B* is incorrect because “for this reason” illogically signals that the claim in this sentence is caused by the previous claim about the shift away from mathematicians working alone. Instead, the claim about the rise in collaboration elaborates on the previous claim, describing the shift. *Choice C* is incorrect because “furthermore” illogically signals that the claim in this sentence is in addition to the previous claim about the shift away from mathematicians working alone. Instead, the claim about the rise in collaboration elaborates on the previous claim, describing the shift.

## QUESTION 32

**Choice D** is the best answer. The sentence presents both the study and its findings, noting the study’s date and the researcher’s name as well as describing what the researcher determined about the jawbones and how she determined it.

*Choice A* is incorrect. While the sentence describes the study and the researcher’s initial assessment, it doesn’t present the study’s findings. *Choice B* is incorrect. While the sentence describes the study and its focus, it doesn’t present the study’s findings or the name of the researcher who conducted it. *Choice C* is incorrect. While the sentence mentions the study’s methodology and provides information about pterosaurs, it doesn’t present the study’s findings.

## QUESTION 33

**Choice C** is the best answer. The sentence compares the two women’s contributions to the march: Hedgeman worked behind the scenes to make sure a woman speaker was included, whereas Bates actually spoke at the event.

*Choice A* is incorrect. While it acknowledges that the two women both contributed to the march, it doesn’t indicate what Hedgeman did, so no comparison is made. *Choice B* is incorrect. While the sentence provides information about the two women, it doesn’t mention anything about Bates’s contribution to the march. *Choice D* is incorrect. While the sentence indicates that the two women both fought for civil rights, it doesn’t compare their individual contributions to the march.

# Reading and Writing

## Module 2

(33 questions)

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### QUESTION 1

**Choice B** is the best answer because it most logically completes the text's discussion of Jacob Lawrence's artistic process. In this context, "observant" means watchful and perceptive. The text emphasizes that the "close attention" Lawrence paid to "all the details" of his neighborhood allowed him to reflect subtle elements of "the beauty and vitality of the Black experience" in his artwork. This context indicates that being observant of his surroundings was an important part of Lawrence's work as an artist.

*Choice A* is incorrect because the text gives no indication that Lawrence was "skeptical," or had an attitude of doubt in general or about particular things, let alone that skepticism was important to him as an artist. Rather than indicating that he was skeptical, the text focuses on how Lawrence paid careful attention to everything around him and reflected his observations in his artwork. *Choice C* is incorrect because the text gives no indication that Lawrence was "critical," which in this context would mean inclined to criticize harshly or unfairly. Rather than indicating that Lawrence found fault in things, the text suggests that he paid careful attention to everything around him and that his artwork reflects this careful attention. *Choice D* is incorrect because the text doesn't suggest that Lawrence was "confident," or self-assured. Rather than addressing how Lawrence felt about himself and how that feeling affected his artistic process, the text emphasizes the careful attention Lawrence paid to everything around him—attention that allowed him to capture subtle elements of a particular place and time in his artwork.

## QUESTION 2

**Choice D** is the best answer because it most logically completes the text's discussion of the research that Lopes-Ferreira and her colleagues are conducting on the stingray species *Potamotrygon rex*. As used in this context, "a substantial" effect means an effect that is sizable or noteworthy. The text indicates that the researchers are seeking to determine whether there are "considerable variations" in the potency of stingray venom that are associated with variation in the stingrays' age and sex. This context suggests that the researchers want to find out whether stingray age and sex have a substantial effect on venom toxicity.

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

## QUESTION 3

**Choice A** is the best answer because it most logically completes the text's discussion of diaphragm contractions and hiccups. In this context, "involuntarily" means done without any control, or by reflex. The text explains that when a person's diaphragm repeatedly contracts and results in hiccups (which may be beneficial for infants), those muscle contractions are "uncontrollable." This context indicates that the diaphragm contractions occur without the person's control.

**Choice B** is incorrect because it wouldn't support the logical relationship established in the text's discussion of diaphragm contractions and hiccups. The text indicates that although specific causes for hiccups haven't been identified, it may be the case that the muscle contractions that occur have an important purpose in infants. It wouldn't make sense to say that even though the contractions occur "beneficially," or with a good or helpful effect, they might play a positive role in infants' breathing regulation. **Choice C** is incorrect because the text indicates that the diaphragm contractions that result in hiccups are "uncontrollable." Because those muscle contractions are described as happening automatically and without the person's control, it wouldn't make sense to

describe them as occurring “strenuously,” or in a way that requires great effort or energy. *Choice D* is incorrect because the text doesn’t describe the quality of the diaphragm contractions that result in hiccups beyond stating that they are “uncontrollable.” Nothing in the text indicates that those muscle contractions occur “smoothly,” or evenly and continuously.

## QUESTION 4

**Choice D** is the best answer because it most logically completes the text’s discussion about the relationship between fine art and fashion. As used in this context, “intersect” means to connect or overlap. The text indicates that Jamie Okuma challenges the position held by critics because her work can be seen at an art museum and can be bought by the public from her online boutique. The text also presents the critics’ view as being influenced by a perception that fine artists create works that are “timeless” and meant for exhibition, whereas fashion designers periodically produce new styles that are meant for purchase. This context suggests that the critics believe that fine art and fashion tend not to overlap—in other words, that they rarely intersect.

*Choice A* is incorrect because it wouldn’t make sense in context to say that critics contend that fine art and fashion rarely “prevail,” or prove to be triumphant or widespread. The text indicates that Okuma is an example of an artist who demonstrates that it’s possible to make fine art that is also available to the public as fashion. *Choice B* is incorrect because it wouldn’t make sense in context to say that fine art and fashion rarely “succumb,” or surrender. The text establishes that unlike what critics believe, Okuma creates works that are in art museums and available for the public to purchase, suggesting that critics believe fine art and fashion rarely overlap, not that they rarely succumb. *Choice C* is incorrect because saying that critics believe that fine art and fashion rarely “diverge,” or disagree or move in different directions, wouldn’t make sense in context. The text presents Okuma’s work as both fine art and fashion, thereby undermining what the critics assert. This suggests that the critics believe that fine art and fashion rarely intersect rather than that the two rarely diverge.

## QUESTION 5

**Choice D** is the best answer because it most logically completes the text’s discussion of gender roles in Shakespeare’s comedies. As used in this context, “prescribed” would mean laid down as rules. The text indicates that the characters in the comedies often defy gender roles that are “socially dictated” (even if most characters do return to those roles eventually) and that scholars have been very interested in these acts of defiance. This context indicates that what the characters are rebelling against are standards of behavior prescribed by the society of the time.

*Choice A* is incorrect because saying that expectations about gender were “interjected,” or suddenly inserted between other things, wouldn’t make sense in context. There’s no suggestion in the text that the issue of gender roles was inserted between other things or was an interruption in a larger discussion. *Choice B* is incorrect because the text indicates that Shakespeare depicts characters rebelling against expectations about gender that have been “socially dictated,” not expectations that society has “committed,” or carried out, entrusted, or promised. *Choice C* is incorrect because the text indicates that Shakespeare depicts characters rebelling against expectations about gender that have been “socially dictated,” not expectations that have been “illustrated,” or clarified with examples. Although it’s possible for expectations about gender roles to be illustrated, there’s nothing in the text to indicate that characters in Shakespeare’s comedies rebel against illustrations of gender expectations.

## QUESTION 6

**Choice B** is the best answer because it most logically completes the text’s discussion of Ward and colleagues’ findings. As used in this context, “innocuous” means mild or unharmful. The text describes the vibration and warming that Ward and colleagues used to alleviate itching as “harmless applications” and goes on to contrast these applications with another stimulus that actually offers more relief even though it seems to be stronger and “less benign.” This context conveys the idea that vibration and warming were innocuous stimuli.

*Choice A* is incorrect because the text focuses on a distinction between harmless stimuli and those that seem to be less benign. Nothing in the text suggests that any of the treatments are “deceptive,” or misleading; indeed, even the less effective ones are described as offering some relief. *Choice C* is incorrect because the text focuses on the amount of relief from itching offered by harmless stimuli and those that seem to be less benign. The text doesn’t suggest that any of these stimuli are “novel,” or original and new; heat, vibration, and electricity aren’t new inventions. *Choice D* is incorrect because it wouldn’t make sense to describe an application of vibration or warming as “impractical,” or not suitable for use. The text indicates that these harmless applications are useful in that they offer at least some temporary relief.

## QUESTION 7

**Choice D** is the best answer because it most logically completes the text’s discussion of the location of the province of Xoconochco within the Aztec Empire. As used in this context, “peripheral” means situated toward the outer bounds rather than the center. The text indicates that Xoconochco was located on a coast, hundreds of kilometers away from the capital of the Aztec Empire. The text also states that trade between the province and the capital required “a long overland journey.” This context suggests that Xoconochco was situated toward an edge of the empire’s territory rather than near its center.

*Choice A* is incorrect because it wouldn't make sense in context to refer to Xoconochco's location within the Aztec Empire as "unobtrusive," or not blatant or undesirably prominent; it's not clear how a province's physical location would or wouldn't be blatant. Instead of focusing on how noticeable Xoconochco's location was, the text emphasizes the province's distance from the capital of the empire, pointing out that because of this distance trade between the two required "a long overland journey." *Choice B* is incorrect because the text indicates that the province of Xoconochco was located on a coast far from the capital of the Aztec Empire, not that it was "concealed," or kept out of sight or hidden from view. Nothing in the text suggests that Xoconochco was actually hidden such that people couldn't see it, and being hidden wouldn't necessarily result in trade between the province and the capital requiring "a long overland journey." *Choice C* is incorrect because to say that Xoconochco's location within the Aztec Empire was "approximate" would mean that the location either wasn't precisely correct or was close to some other location. Neither of these meanings would make sense in context because the text indicates that Xoconochco's location is known and that it was far from the empire's capital, so there's no reason to characterize the location as either not precisely correct or close to another location.

## QUESTION 8

**Choice A** is the best answer because it most accurately describes the main purpose of the text, which is to show that while Jane calmly goes about her daily tasks, she is experiencing internal agitation about possibly seeking a new job. At the start of the text, Jane says, "I went on with my day's business tranquilly," indicating that she is outwardly calm. This outward calmness is then contrasted with her intense internal restlessness, as Jane says that thoughts of leaving her job keep running through her mind, that she is "involuntarily framing advertisements" (meaning that she can't stop herself from thinking up potential listings for jobs), and that she often wonders what new "situations" (or jobs) would be like.

*Choice B* is incorrect because the text gives no indication of Jane's feelings, either positive or negative, about the people she works for at Thornfield Hall. And rather than emphasizing that Jane feels particularly loyal to her employers, the text focuses on her constant consideration of leaving her job. *Choice C* is incorrect because the text gives no indication that Jane finds her current situation fulfilling, or satisfying. Given that much of the text is focused on Jane's thoughts about possibly leaving her job for a new one, it might be the case that she finds her situation challenging, but there is no evidence in the text that Jane also finds that situation satisfying—she says nothing positive about her current job at all, in fact. *Choice D* is incorrect because the text describes Jane as wondering about getting a new job, not as determined to definitely do so. Jane keeps thinking about reasons why she "should" quit her current job (indicating that she hasn't yet decided to) and imagining possible new situations she could find, but she says at the end of the text that these thoughts "might germinate and bear fruit if they could," meaning that the thoughts haven't yet led to a decision—that Jane isn't yet determined to get a new job somewhere else.

## QUESTION 9

**Choice B** is the best answer because it reflects how the author of Text 2 would most likely respond to Text 1 based on the information provided. Text 1 discusses the discovery of a regeneration-linked gene, EGR, in both three-banded panther worms (which are capable of full regeneration) and humans (who have relatively limited regeneration abilities). Text 1 characterizes this discovery as “especially promising” and a sign of “exciting progress” in understanding human regeneration. The author of Text 2, on the other hand, focuses on the fact that the team that reported the EGR finding pointed out that while EGR’s function in humans isn’t yet known, it’s likely very different from its function in panther worms. Therefore, the author of Text 2 would most likely say that Text 1’s enthusiasm about the EGR discovery is overly optimistic given Srivastava’s team’s observations about EGR in humans.

**Choice A** is incorrect because the author of Text 2 explains that Srivastava and her team explicitly reported that they haven’t yet identified how EGR functions in humans; therefore, the author of Text 2 wouldn’t say that Text 1’s excitement is reasonable for the stated reason. Instead, the author of Text 2 would likely characterize Text 1’s excitement as premature and overly optimistic. **Choice C** is incorrect because Text 1 does treat Srivastava’s team’s findings with enthusiasm; it describes the discovery of EGR in both three-banded panther worms and humans as promising and exciting. It would be illogical for the author of Text 2 to say that because most others treat the discovery with enthusiasm, Text 1’s enthusiastic characterization of the discovery is unexpected. **Choice D** is incorrect because Text 1 isn’t at all dismissive of Srivastava’s team’s findings; instead, Text 1 is optimistic about the EGR discovery, characterizing it as promising and exciting. There’s nothing in Text 2 to suggest that the author of Text 2 would say that Text 1’s praise for the discovery is dismissive, or disdainful.

## QUESTION 10

**Choice D** is the best answer because it most accurately states the main idea of the text. The speaker describes the experience of being “weary” and “tired” and going to bed to seek “dear repose” (that is, sleep), but instead of sleeping, the speaker is kept awake (“keep my drooping eyelids open wide”) by thoughts of a friend (“my thoughts... [Begin] a zealous pilgrimage to thee”).

**Choice A** is incorrect because the text makes it clear that the speaker isn’t asleep; thoughts about the friend are keeping the speaker awake (“keep my drooping eyelids open wide”). **Choice B** is incorrect because the speaker isn’t talking about taking a literal trip when referring to “a zealous pilgrimage.” Rather, the speaker is referring to the experience of thinking about the friend, of taking “a journey in my head.” **Choice C** is incorrect because the text indicates that the speaker and the friend aren’t in the same place and having a conversation. Rather, the speaker is at home and thinking of the friend, who is somewhere else (“from far where I abide”).



## QUESTION 11

**Choice D** is the best answer because it presents a statement about how the Lord Chancellor responds to the crowd that is supported by the text. The text indicates that the people in the crowd are roaring and shouting “Bread!” or “Taxes!” and presents them as not knowing what they really want. The Lord Chancellor’s response is to ask what their shouting means but also to observe that they’re shouting with “unanimity,” or total agreement. Clearly, this isn’t the case, which supports the statement that the Lord Chancellor describes the crowd as being united even though it’s not.

**Choice A** is incorrect because it isn’t supported by the text. Although the text indicates that the Lord Chancellor asks about the meaning of the crowd’s shouting, it doesn’t suggest that he knows what the crowd really wants. **Choice B** is incorrect because the text doesn’t suggest that the Lord Chancellor wants to speak to the crowd. Furthermore, the text doesn’t indicate that the crowd wants to hear from the Sub-Warden. Although the crowd roars when asked “Who roar for the Sub-Warden?” it’s unclear what the roaring means. **Choice C** is incorrect because the text doesn’t suggest that the Lord Chancellor knows of or sympathizes with the crowd’s demands. In addition, the text doesn’t indicate that the crowd’s shouting annoys the Lord Chancellor, just that it causes him to keep repeating “What can it all mean?”

## QUESTION 12

**Choice A** is the best answer because it presents the quotation that most directly illustrates the claim that Cather portrays Alexandra as having a deep emotional connection to her natural surroundings. This quotation states that the country meant a great deal to Alexandra and then goes on to detail several ways in which her natural surroundings affect her emotionally: the insects sound like “the sweetest music,” she feels as though “her heart were hiding” in the grass “with the quail and the plover,” and near the ridges she feels “the future stirring.”

**Choice B** is incorrect because the quotation doesn’t suggest that Alexandra had a deep emotional connection to her natural surroundings but instead describes how she interacts with the people around her to learn more about crops, poultry, and experiments with clover hay. **Choice C** is incorrect because the quotation doesn’t suggest that Alexandra has a deep emotional connection to her natural surroundings but instead describes her nighttime departure in a wagon. The quotation says nothing about Alexandra’s emotional state. **Choice D** is incorrect because the quotation doesn’t convey Alexandra’s deep emotional connection to her natural surroundings; instead, this quotation describes how well she understands the markets and livestock.

## QUESTION 13

**Choice B** is the best answer because it provides the most direct support from the table for the claim that two languages can convey similar amounts of information even if they’re spoken at different rates. The table shows the approximate rates at which five languages are spoken and the rates at which those five languages convey information. Vietnamese is spoken at around 5.3 syllables per second,

whereas Spanish is spoken at around 7.7 syllables per second, but the two languages convey information at very similar rates: Vietnamese at a rate of around 42.5 bits per second and Spanish at a rate of around 42.0 bits per second. Thus, the description of Vietnamese conveying information at around the same rate that Spanish does despite being spoken more slowly supports the claim in the text that languages can convey the same amount of information even if spoken at different rates.

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

## QUESTION 14

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

*Choice B* is incorrect because a finding about helpful participants using positive words to describe the trees and the building after the experiment was over wouldn't have any bearing on the researchers' claim that experiencing awe increases altruistic behavior. The text doesn't address the use of positive words to describe things or suggest any connection between using such words and having experienced awe, so that behavior wouldn't serve as evidence that experiencing awe played a role in promoting helpful behavior. *Choice C* is incorrect because a finding that participants who didn't help the experimenter were significantly more

likely than others to report having experienced awe whether they had looked at the building or the trees would weaken the researchers' claim that experiencing awe increases altruistic behavior by suggesting that the opposite might be true—that experiencing awe is in fact linked to choosing not to act in a way that benefits someone else. *Choice D* is incorrect because a finding about participants noticing that the experimenter had dropped the pens wouldn't have any bearing on the researchers' claim about people behaving altruistically. Being aware of a challenge or problem isn't necessarily beneficial on its own and isn't the same as offering help, so the finding wouldn't support the idea that experiencing awe increases altruistic behavior.

## QUESTION 15

**Choice A** is the best answer because it presents data from the table that most effectively complete the statement about the rates at which employment shifted in France and the United States. The text states that over the last two hundred years employment in the agricultural sector has declined while employment in the service sector has risen in both France and the US, and the data from the table reflect these trends. The text asserts, however, that the transition from agriculture to services “happened at very different rates in the two countries.” This assertion is best supported by a comparison of data from 1900 and 1950: the table shows that in those years, employment in agriculture went from 43% to 32% in France (a decline of 11 percentage points) and from 41% to 14% in the US (a decline of 27 percentage points), and that employment in services went from 28% to 35% in France (an increase of 7 percentage points) and from 31% to 53% in the US (an increase of 22 percentage points). In other words, the rate of change was greater in the US than in France for both sectors.

*Choice B* is incorrect because comparing the data for 1800 and 2012 would suggest a similar rate of change in the two countries, not very different rates: employment in agriculture went from 64% in 1800 to 3% in 2012 in France, which is close to the change from 68% in 1800 to 2% in 2012 in the US, while employment in services went from 14% in 1800 to 76% in 2012 in France, which is close to the change from 13% in 1800 to 80% in 2012 in the US. *Choice C* is incorrect because comparing the data for 1900 and 2012 would suggest a similar rate of change in the two countries rather than very different rates: employment in agriculture went from 43% in 1900 to 3% in 2012 in France, which is close to the change from 41% in 1900 to 2% in 2012 in the US, while employment in services went from 28% in 1900 to 76% in 2012 in France, which is close to the change from 31% in 1900 to 80% in 2012 in the US. *Choice D* is incorrect because comparing the data for 1800 and 1900 would suggest a similar rate of change in the two countries, not very different rates: employment in agriculture went from 64% in 1800 to 43% in 1900 in France, which is fairly close to the change from 68% in 1800 to 41% in 1900 in the US, while employment in services went from 14% in 1800 to 28% in 1900 in France, which is close to the change from 13% in 1800 to 31% in 1900 in the US.

## QUESTION 16

**Choice C** is the best answer because it presents a finding that, if true, would support the researchers' claim that archaeologists are unlikely to be replaced by certain computer models. The text explains that although archaeologists hold that categorizing pottery fragments relies on both objective criteria and instinct developed through direct experience, researchers have found that a computer model can categorize the fragments with the same degree of accuracy as the humans can—a finding that has caused some archaeologists to worry that their own work won't be needed any longer. If survey results indicate that categorizing pottery fragments limits the amount of time archaeologists can dedicate to other important tasks that only human experts can do, that would mean that computer models aren't able to do all of the important things archaeologists do, thus supporting the researchers' claim that computer models are unlikely to replace human archaeologists.

**Choice A** is incorrect because if it were true that the computer model could categorize the pottery fragments much more quickly than the archaeologists could, that would weaken the researchers' claim that archaeologists are unlikely to be replaced by certain computer models, since it would demonstrate that the models could conduct the archaeologists' work not only with equal accuracy but also at a faster pace. **Choice B** is incorrect because the inability of both the computer model and the archaeologists to accurately categorize all of the pottery fragments presented wouldn't support the researchers' claim that archaeologists are unlikely to be replaced by certain computer models. The text indicates that some archaeologists are worried because the computer model's accuracy is equal to their own, and that could be the case whether both were perfectly accurate or were unable to achieve complete accuracy. **Choice D** is incorrect because survey results showing that few archaeologists received special training in properly categorizing pottery fragments wouldn't support the researchers' claim that archaeologists are unlikely to be replaced by certain computer models. The amount of special training in categorizing pottery fragments that archaeologists have received has no direct bearing on whether computer models' success at categorizing fragments will lead to the models replacing the archaeologists.

## QUESTION 17

**Choice A** is the best answer because it presents the conclusion that most logically follows from the text's discussion of military veterans working in civilian government jobs in the United States. The text indicates that the proportion of military veterans working in civilian government jobs is considerably higher than the proportion of military veterans in the population as a whole. The text also notes that the unusually high representation of military veterans in these jobs may be a result of the organizational structures shared by civilian government entities and the military. Hence, it's reasonable to infer that it's the familiarity of the structures of civilian government that makes jobs there particularly attractive to military veterans.

*Choice B* is incorrect because the text doesn't address what a typical relationship between military service and later career preferences would be, and there's no indication that it's atypical for veterans to work in civilian government jobs after they've left the military. On the contrary, the text suggests that many military veterans are drawn to such jobs. *Choice C* is incorrect because the text is focused on the high representation of military veterans in civilian government jobs and doesn't address nonveterans or their possible interest in military service. *Choice D* is incorrect because the text conveys that military veterans may be particularly interested in civilian government jobs due to the familiarity of organizational structures that are already in place, but there's no reason to think that this interest would mean that more civilian government jobs will start to require military experience.

## QUESTION 18

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

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

## QUESTION 19

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

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

## QUESTION 20

**Choice B** is the best answer. The convention being tested is the coordination of main clauses within a sentence. This choice correctly uses a comma and the coordinating conjunction “but” to join the first main clause (“the Alvarez...out”) and the second main clause (“it left ... extinctions”).

*Choice A* 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 run-on sentence. The two main clauses are fused without punctuation and/or a conjunction. *Choice D* 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 21

**Choice C** is the best answer. The convention being tested is the use of finite and nonfinite verb forms within a sentence. The nonfinite present participle “forcing” is correctly used to form a participial phrase that supplements the main clause “those...cover,” describing the effects on monkeys of the lack of food sources.

*Choice A* is incorrect because the finite present tense verb “forces” can’t be used in this way to supplement the main clause (“those...cover”). *Choice B* is incorrect. While the nonfinite to-infinitive “to force” could be used to form a subordinate clause that supplements the main clause (“those...cover”), to-infinitives conventionally express purpose, and nothing in the sentence suggests that the food sources become unavailable for the purpose of forcing monkeys to hunt marine animals. *Choice D* is incorrect because the finite past tense verb “forced” can’t be used in this way to supplement the main clause (“those...cover”).

## QUESTION 22

**Choice D** is the best answer. The convention being tested is end-of-sentence punctuation. This choice correctly uses a question mark to punctuate the interrogative clause “could the blueberries thrive,” which asks a direct question at the end of the sentence.

*Choice A* is incorrect because a period can’t be used in this way to punctuate an interrogative clause, such as “could the blueberries thrive,” at the end of a sentence. *Choice B* is incorrect because the context requires an interrogative clause. The declarative clause “the blueberries could thrive” incorrectly indicates that it was known that the blueberries could thrive in alkaline soil, whereas Michel had yet to find this out. *Choice C* is incorrect because a question mark can’t be used in this way to punctuate a declarative clause, such as “the blueberries could thrive,” at the end of a sentence.

## QUESTION 23

**Choice D** is the best answer. The convention being tested is the use of verbs to express tense. In this choice, the present tense verb “is,” used in conjunction with the word “today,” correctly indicates that Paik is currently considered the first video artist.

*Choice A* is incorrect because the future-indicating verb “will be” doesn’t indicate that Paik is currently considered the first video artist. *Choice B* is incorrect because the past perfect tense verb “had been” doesn’t indicate that Paik is currently considered the first video artist. *Choice C* is incorrect because the past tense verb “was” doesn’t indicate that Paik is currently considered the first video artist.

## QUESTION 24

**Choice C** is the best answer. The convention being tested is punctuation use between sentences. In this choice, the period is used correctly to mark the boundary between the first sentence (“The...adjustments”) and the second sentence (“Prior...days”). Because the adverbial phrase beginning with “prior” indicates when changing a spreadsheet required redoing the sheet by hand, that phrase belongs with the second sentence.

*Choice A* is incorrect because it results in a run-on sentence. Two sentences are fused without punctuation and/or a conjunction. *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 D* is incorrect. Without a comma preceding it, the conjunction “and” can’t be used in this way to join the sentences.



## QUESTION 25

**Choice B** is the best answer. The convention being tested is the use of finite and nonfinite verb forms within a sentence. The modal “would,” which indicates the future from a perspective in the past, should be accompanied by a nonfinite base form verb. In this choice, the nonfinite base form verb “create” is used correctly in conjunction with the nonfinite base form verb “increase” to describe what the lock would do.

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

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

## QUESTION 26

**Choice D** is the best answer. The convention being tested is subject-modifier placement. This choice ensures that the modifying phrase “despite being cheap, versatile, and easy to produce” appears immediately before the noun it modifies, “commercial plastics,” clearly establishing that the commercial plastics—and not another noun in the sentence—are being described as cheap, versatile, and easy to produce.

*Choice A* is incorrect because it results in a dangling modifier. The placement of the function word “there” immediately after the modifying phrase illogically and confusingly suggests that “there” is cheap, versatile, and easy to produce.

*Choice B* is incorrect because it results in a dangling modifier. The placement of the noun “two problems” immediately after the modifying phrase illogically suggests that the “problems” are cheap, versatile, and easy to produce. *Choice C* is incorrect because it results in a dangling modifier. The placement of the noun phrase “commercial plastics’ two associated problems” immediately after the modifying phrase illogically suggests that the “problems” are cheap, versatile, and easy to produce.

## QUESTION 27

**Choice C** is the best answer. The convention being tested is the use of punctuation between titles and proper nouns. No punctuation is needed to set off the proper noun “Yuree Lee” from the title that describes Lee, “plant cell biologist.” Because “Yuree Lee” is essential information identifying the “plant cell biologist,” no punctuation is necessary.

*Choice A* is incorrect because no punctuation is needed. *Choice B* is incorrect because no punctuation is needed. *Choice D* is incorrect because no punctuation is needed before or after the proper noun “Yuree Lee.” Setting the biologist’s name off with commas suggests that it could be removed without affecting the coherence of the sentence, which isn’t the case.

## QUESTION 28

**Choice D** is the best answer. “As a result” logically signals that the claim in this sentence—that spiders can cling to and climb almost any surface—is because of the previous information about the bonding properties of spiders’ spatulae.

**Choice A** is incorrect because “for instance” illogically signals that the claim in this sentence exemplifies the information in the previous sentences. Instead, the claim is because of the previous information about the bonding properties of spiders’ spatulae. **Choice B** is incorrect because “however” illogically signals that the claim in this sentence contrasts with the information in the previous sentences. Instead, the claim is because of the previous information about the bonding properties of spiders’ spatulae. **Choice C** is incorrect because “similarly” illogically signals that the claim in this sentence is similar to, but separate from, the information in the previous sentences. Instead, the claim is because of the previous information about the bonding properties of spiders’ spatulae.

## QUESTION 29

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

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

## QUESTION 30

**Choice C** is the best answer. “Similarly” logically signals that the activity described in this sentence (Nancy Tuttle Craig distributing Votes for Women Tea in her Los Angeles grocery stores) is like the activity described in the previous sentence (the Woman’s Suffrage Party selling Equality Tea at fairs in San Francisco). Together, the two examples support the preceding claim that “activists across the state sold tea to promote the cause of suffrage.”

**Choice A** is incorrect because “for example” illogically signals that the activity described in this sentence exemplifies the activity described in the previous sentence. Instead, the two activities are similar, and both support the preceding claim about selling tea to promote women’s right to vote. **Choice B** is incorrect because “to conclude” illogically signals that the activity described in this

sentence concludes or summarizes the information in the previous sentences. Instead, the activity is similar to the one described in the previous sentence, and both support the preceding claim about selling tea to promote women's right to vote. *Choice D* is incorrect because "in other words" illogically signals that the activity described in this sentence paraphrases the activity described in the previous sentence. Instead, the two activities are similar, and both support the preceding claim about selling tea to promote women's right to vote.

### QUESTION 31

**Choice B** is the best answer. The sentence compares the lengths of the two rail tunnels, noting that the Channel Tunnel (about 31 miles long) is slightly shorter than the Seikan Tunnel (roughly 33 miles long).

*Choice A* is incorrect. The sentence makes a generalization about the length of some rail tunnels; it doesn't compare the lengths of the two rail tunnels. *Choice C* is incorrect. The sentence describes a single rail tunnel; it doesn't compare the lengths of the two rail tunnels. *Choice D* is incorrect. While the sentence mentions the two rail tunnels, it doesn't compare their lengths.

### QUESTION 32

**Choice B** is the best answer because it provides both an explanation and an example of "flauna." The sentence explains that flauna, a combination of the words "flora" and "fauna," is a term used by Jon Ching to describe the plant-animal hybrids in his paintings. The sentence also mentions an example of Ching's flauna: a parrot with leaves for feathers.

*Choice A* is incorrect. While the sentence partially explains what "flauna" is, it doesn't provide a full explanation or specific example of Ching's flauna. *Choice C* is incorrect. While the sentence partially explains what "flauna" is and includes a title of a Ching painting, it doesn't provide a full explanation or specific example of Ching's flauna. *Choice D* is incorrect. While the sentence partially explains what "flauna" is and includes the titles of two Ching paintings, it doesn't provide a full explanation of Ching's flauna.

### QUESTION 33

**Choice D** is the best answer. By indicating that Taylor's book was the only Civil War memoir published by a Black woman, this sentence emphasizes the uniqueness, or one-of-a-kind nature, of Taylor's accomplishment.

*Choice A* is incorrect. While the sentence describes some of Taylor's accomplishments, it doesn't emphasize the uniqueness of them. *Choice B* is incorrect. While the sentence describes some of Taylor's accomplishments, it doesn't emphasize that they were unique. *Choice C* is incorrect. While the sentence provides information about Taylor's book, it doesn't emphasize what made the book unique.

# Math

## Module 1 (27 questions)

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### QUESTION 1

**Choice B** is correct. 10% of a quantity means  $\frac{10}{100}$  times the quantity. Therefore, 10% of 470 can be represented as  $\frac{10}{100}(470)$ , which is equivalent to  $0.10(470)$ , or 47. Therefore, 10% of 470 is 47.

*Choice A* is incorrect. This is 10% of 370, not 10% of 470. *Choice C* is incorrect. This is 90% of 470, not 10% of 470. *Choice D* is incorrect. This is  $470 - 10$ , not 10% of 470.

### QUESTION 2

**Choice C** is correct. Subtracting 6 from both sides of the given equation yields  $4x = 12$ , which is the equation given in choice C. Since this equation is equivalent to the given equation, it has the same solution as the given equation.

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

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

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

### QUESTION 3

**Choice D** is correct. The cost of the rental fee depends on the number of hours the surfboard is rented. Multiplying  $t$  hours by 10 dollars per hour yields a rental fee of  $10t$  dollars. The total cost of the rental consists of the rental fee plus the 25 dollar service fee, which yields a total cost of  $25 + 10t$  dollars. Since the person intends to spend a maximum of 75 dollars to rent the surfboard, the total cost must be at most 75 dollars. Therefore, the inequality  $25 + 10t \leq 75$  represents this situation.

*Choice A* is incorrect. This represents a situation where the rental fee, not the total cost, is at most 75 dollars. *Choice B* is incorrect and may result from conceptual

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

## QUESTION 4

**Choice A** is correct. It's given that  $g(x) = x^2 + 9$ . Substituting 25 for  $g(x)$  in this equation yields  $25 = x^2 + 9$ . Subtracting 9 from both sides of this equation yields  $16 = x^2$ . Taking the square root of each side of this equation yields  $x = \pm 4$ . It follows that  $g(x) = 25$  when the value of  $x$  is 4 or  $-4$ . Only 4 is listed among the choices.

*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 5

**Choice A** is correct. The total number of possible outcomes for rolling a fair 14-sided die is 14. The number of possible outcomes for rolling a 2 is 1. The probability of rolling a 2 is the number of possible outcomes for rolling a 2 divided by the total number of possible outcomes, or  $\frac{1}{14}$ .

*Choice B* is incorrect. This is the probability of rolling a number no greater than 2.

*Choice C* is incorrect. This is the probability of rolling a number greater than 2.

*Choice D* is incorrect. This is the probability of rolling a number other than 2.

## QUESTION 6

The correct answer is 2,520. There are 60 minutes in one hour. At a rate of 42 posters per minute, the number of posters produced in one hour can be determined by  $\left(\frac{42 \text{ posters}}{1 \text{ minute}}\right)\left(\frac{60 \text{ minutes}}{1 \text{ hour}}\right)$ , which is 2,520 posters per hour.

## QUESTION 7

The correct answer is 30. The value of  $f(x)$  when  $x = 4$  can be found by substituting 4 for  $x$  in the given equation  $f(x) = 7x + 2$ . This yields  $f(4) = 7(4) + 2$ , or  $f(4) = 30$ . Therefore, when  $x = 4$ , the value of  $f(x)$  is 30.

## QUESTION 8

**Choice D** is correct. Since  $x$  represents the number of 1-point questions and  $y$  represents the number of 3-point questions, the assignment is worth a total of  $1 \cdot x + 3 \cdot y$ , or  $x + 3y$ , points. Since the assignment is worth 70 points, the equation  $x + 3y = 70$  represents this situation.

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

## QUESTION 9

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

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

## QUESTION 10

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

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

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

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

## QUESTION 11

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

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

## QUESTION 12

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

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

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

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

## QUESTION 13

The correct answer is 41. The number of cupcakes Vivian bought can be found by first finding the amount Vivian spent on cupcakes. The amount Vivian spent on cupcakes can be found by subtracting the amount Vivian spent on party hats from the total amount Vivian spent. The amount Vivian spent on party hats can be found by multiplying the cost per package of party hats by the number of packages of party hats, which yields  $\$3 \cdot 10$ , or  $\$30$ . Subtracting the amount Vivian spent on party hats,  $\$30$ , from the total amount Vivian spent,  $\$71$ , yields  $\$71 - \$30$ , or  $\$41$ . Since the amount Vivian spent on cupcakes was  $\$41$  and each cupcake cost  $\$1$ , it follows that Vivian bought 41 cupcakes.

## QUESTION 14

The correct answer is either 2 or  $-12$ . The left-hand side of the given equation can be rewritten by factoring. The two values that multiply to  $-24$  and add to 10 are 12 and  $-2$ . It follows that the given equation can be rewritten as  $(z+12)(z-2)=0$ . Setting each factor equal to 0 yields two equations:  $z+12=0$  and  $z-2=0$ . Subtracting 12 from both sides of the equation  $z+12=0$  results in  $z=-12$ . Adding 2 to both sides of the equation  $z-2=0$  results in  $z=2$ . Note that 2 and  $-12$  are examples of ways to enter a correct answer.

## QUESTION 15

**Choice D** is correct. Let  $y$  represent the number of cells per milliliter  $x$  hours after the initial observation. Since the number of cells per milliliter doubles every 3 hours, the relationship between  $x$  and  $y$  can be represented by an exponential equation of the form  $y = a(b)^{\frac{x}{k}}$ , where  $a$  is the number of cells per milliliter during the initial observation and the number of cells per milliliter increases by a factor of  $b$  every  $k$  hours. It's given that there were 300,000 cells per milliliter during the initial observation. Therefore,  $a = 300,000$ . It's also given that the number of cells per milliliter doubles, or increases by a factor of 2, every 3 hours. Therefore,  $b = 2$  and  $k = 3$ . Substituting 300,000 for  $a$ , 2 for  $b$ , and 3 for  $k$  in the equation  $y = a(b)^{\frac{x}{k}}$  yields  $y = 300,000(2)^{\frac{x}{3}}$ . The number of cells per milliliter there will be 15 hours after the initial observation is the value of  $y$  in this equation when  $x = 15$ . Substituting 15 for  $x$  in the equation  $y = 300,000(2)^{\frac{x}{3}}$  yields  $y = 300,000(2)^{\frac{15}{3}}$ , or  $y = 300,000(2)^5$ . This is equivalent to  $y = 300,000(32)$ , or  $y = 9,600,000$ . Therefore, 15 hours after the initial observation, there will be 9,600,000 cells per milliliter.

*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 16

**Choice C** is correct. Since each term of the given expression has a common factor of  $6x^2y^2$ , it may be rewritten as  $6x^2y^2(x^6) + 6x^2y^2(2)$ , or  $6x^2y^2(x^6 + 2)$ .

**Choice A** is incorrect. This expression is equivalent to  $12x^8y^2$ , not  $6x^8y^2 + 12x^2y^2$ .

**Choice B** is incorrect. This expression is equivalent to  $6x^6y^2$ , not  $6x^8y^2 + 12x^2y^2$ .

**Choice D** is incorrect. This expression is equivalent to  $6x^6y^2 + 12x^2y^2$ , not  $6x^8y^2 + 12x^2y^2$ .

## QUESTION 17

**Choice A** is correct. It's given that a neighborhood consists of a 2-hectare park and a 35-hectare residential area and that the total number of trees in the neighborhood is 3,934. It's also given that the equation  $2x + 35y = 3,934$  represents this situation. Since the total number of trees for a given area can be determined by taking the number of hectares times the average number of trees per hectare, this must mean that the terms  $2x$  and  $35y$  correspond to the number of trees in the park and in the residential area, respectively. Since  $2x$  corresponds to the number of trees in the park, and 2 is the size of the park, in hectares,  $x$  must represent the average number of trees per hectare in the park.

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

## QUESTION 18

**Choice B** is correct. The graph shown is a line passing through the points  $(0, 40)$  and  $(60, 0)$ . Since the relationship between  $x$  and  $y$  is linear, if two points on the graph make a linear equation true, then the equation represents the relationship. Substituting 0 for  $x$  and 40 for  $y$  in the equation in choice B,  $8x + 12y = 480$ , yields  $8(0) + 12(40) = 480$ , or  $480 = 480$ , which is true. Substituting 60 for  $x$  and 0 for  $y$  in the equation  $8x + 12y = 480$  yields  $8(60) + 12(0) = 480$ , or  $480 = 480$ , which is true. Therefore, the equation  $8x + 12y = 480$  represents the relationship between  $x$  and  $y$ .

**Choice A** is incorrect. The point  $(0, 40)$  is not on the graph of this equation, since  $40 = 8(0) + 12$ , or  $40 = 12$ , is not true. **Choice C** is incorrect. The point  $(0, 40)$  is not on the graph of this equation, since  $40 = 12(0) + 8$ , or  $40 = 8$ , is not true.

**Choice D** is incorrect. The point  $(0, 40)$  is not on the graph of this equation, since  $12(0) + 8(40) = 480$ , or  $320 = 480$ , is not true.

## QUESTION 19

**Choice D** is correct. The area of a circle can be found by using the formula  $A = \pi r^2$ , where  $A$  is the area and  $r$  is the radius of the circle. It's given that the radius of circle A is  $3n$ . Substituting this value for  $r$  into the formula  $A = \pi r^2$  gives  $A = \pi(3n)^2$ , or  $9\pi n^2$ . It's also given that the radius of circle B is  $129n$ . Substituting this value for  $r$  into the formula  $A = \pi r^2$  gives  $A = \pi(129n)^2$ , or

$16,641\pi n^2$ . Dividing the area of circle  $B$  by the area of circle  $A$  gives  $\frac{16,641\pi n^2}{9\pi n^2}$ , which simplifies to 1,849. Therefore, the area of circle  $B$  is 1,849 times the area of circle  $A$ .

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

## QUESTION 20

The correct answer is 14. The maximum value is the largest value in the data set. The frequency refers to the number of times a data value occurs. The given frequency table shows that for this data set, the data value 6 occurs three times, the data value 7 occurs three times, the data value 8 occurs eight times, the data value 9 occurs eight times, the data value 10 occurs nine times, the data value 11 occurs eleven times, the data value 12 occurs nine times, the data value 13 occurs zero times, and the data value 14 occurs six times. Therefore, the maximum data value in the data set is 14.

## QUESTION 21

The correct answer is 5. The standard form of an equation of a circle in the  $xy$ -plane is  $(x-h)^2 + (y-k)^2 = r^2$ , where  $h$ ,  $k$ , and  $r$  are constants, the coordinates of the center of the circle are  $(h,k)$ , and the length of the radius of the circle is  $r$ . It's given that an equation of the circle is  $(x-2)^2 + (y-9)^2 = r^2$ . Therefore, the center of this circle is  $(2,9)$ . It's given that the endpoints of a diameter of the circle are  $(2,4)$  and  $(2,14)$ . The length of the radius is the distance from the center of the circle to an endpoint of a diameter of the circle, which can be found using the distance formula,  $\sqrt{(x_1-x_2)^2 + (y_1-y_2)^2}$ . Substituting the center of the circle  $(2,9)$  and one endpoint of the diameter  $(2,4)$  in this formula gives a distance of  $\sqrt{(2-2)^2 + (9-4)^2}$ , or  $\sqrt{0^2 + 5^2}$ , which is equivalent to 5. Since the distance from the center of the circle to an endpoint of a diameter is 5, the value of  $r$  is 5.

## QUESTION 22

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

radians, by  $\frac{180}{\pi}$ . This yields  $\frac{13\pi}{12} \times \frac{180}{\pi}$ , which is equivalent to 195 degrees.

Therefore, the measure of angle  $T$  is 195 degrees.

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

## QUESTION 23

**Choice D** is correct. Since the number of yards in 1 mile is 1,760, the number of square yards in 1 square mile is  $(1,760)(1,760) = 3,097,600$ . Therefore, if the area of the town is 4.36 square miles, it is  $4.36(3,097,600) = 13,505,536$ , in square yards.

*Choice A* is incorrect and may result from dividing the number of yards in a mile by the square mileage of the town. *Choice B* is incorrect and may result from multiplying the number of yards in a mile by the square mileage of the town. *Choice C* is incorrect and may result from dividing the number of square yards in a square mile by the square mileage of the town.

## QUESTION 24

**Choice D** is correct. The equation of line  $h$  can be written in slope-intercept form  $y = mx + b$ , where  $m$  is the slope of the line and  $(0, b)$  is the  $y$ -intercept of the line. It's given that line  $h$  contains the points  $(18, 130)$ ,  $(23, 160)$ , and  $(26, 178)$ .

Therefore, its slope  $m$  can be found as  $\frac{160-130}{23-18}$ , or 6. Substituting 6 for  $m$  in the equation  $y = mx + b$  yields  $y = 6x + b$ . Substituting 130 for  $y$  and 18 for  $x$  in this equation yields  $130 = 6(18) + b$ , or  $130 = 108 + b$ . Subtracting 108 from both sides of this equation yields  $22 = b$ . Substituting 22 for  $b$  in  $y = 6x + b$  yields  $y = 6x + 22$ . Since line  $k$  is the result of translating line  $h$  down 5 units, an equation of line  $k$  is  $y = 6x + 22 - 5$ , or  $y = 6x + 17$ . Substituting 0 for  $y$  in this equation yields  $0 = 6x + 17$ . Solving this equation for  $x$  yields  $x = -\frac{17}{6}$ . Therefore, the  $x$ -intercept of line  $k$  is  $(-\frac{17}{6}, 0)$ .

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

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

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

## QUESTION 25

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

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

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

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

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

## QUESTION 26

**Choice B** is correct. The two given equations are equivalent because the second equation can be obtained from the first equation by multiplying each side of the equation by 5. Thus, the graphs of the equations are coincident, so if a point lies on the graph of one of the equations, it also lies on the graph of the other equation. A point  $(x, y)$  lies on the graph of an equation in the  $xy$ -plane if and only if this point represents a solution to the equation. It is sufficient, therefore, to find the point that represents a solution to the first given equation. Substituting the  $x$ - and  $y$ -coordinates of choice B,  $-\frac{3r}{2} + \frac{7}{2}$  and  $r$ , for  $x$  and  $y$ , respectively, in the first equation yields  $2\left(-\frac{3r}{2} + \frac{7}{2}\right) + 3r = 7$ , which is equivalent to  $-3r + 7 + 3r = 7$ , or  $7 = 7$ . Therefore, the point  $\left(-\frac{3r}{2} + \frac{7}{2}, r\right)$  represents a solution to the first equation and thus lies on the graph of each equation in the  $xy$ -plane for the given system.

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

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

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

## QUESTION 27

The correct answer is 104. An equilateral triangle is a triangle in which all three sides have the same length and all three angles have a measure of  $60^\circ$ . The height of the triangle,  $k\sqrt{3}$ , is the length of the altitude from one vertex. The altitude divides the equilateral triangle into two congruent 30-60-90 right triangles, where the altitude is the side across from the  $60^\circ$  angle in each 30-60-90 right triangle. Since the altitude has a length of  $k\sqrt{3}$ , it follows from the properties of 30-60-90 right triangles that the side across from each  $30^\circ$  angle has a length of  $k$  and each hypotenuse has a length of  $2k$ . In this case, the hypotenuse of each 30-60-90 right triangle is a side of the equilateral triangle; therefore, each side length of the equilateral triangle is  $2k$ . The perimeter of a triangle is the sum of the lengths of each side. It's given that the perimeter of the equilateral triangle is 624; therefore,  $2k + 2k + 2k = 624$ , or  $6k = 624$ . Dividing both sides of this equation by 6 yields  $k = 104$ .

# Math

## Module 2

(27 questions)

### QUESTION 1

**Choice A** is correct. It's given that Tilly earns  $p$  dollars for every  $w$  hours of work. This can be represented by the proportion  $\frac{p}{w}$ . The amount of money,  $x$ , Tilly earns for  $39w$  hours of work can be found by setting up the proportion  $\frac{p}{w} = \frac{x}{39w}$ . This can be rewritten as  $39pw = xw$ . Dividing both sides by  $w$  results in  $x = 39p$ .

**Choice B** is incorrect. This is the amount of money Tilly earns in dollars per hour, not the amount of money Tilly earns for  $39w$  hours of work. **Choice C** is incorrect. This is the amount of money Tilly earns for  $w$  hours of work plus 39, not the amount of money Tilly earns for  $39w$  hours of work. **Choice D** is incorrect. This is the amount of money Tilly earns for  $w$  hours of work minus 39, not the amount of money Tilly earns for  $39w$  hours of work.

### QUESTION 2

**Choice D** is correct. It's given that Juan rides his bike at an average rate of 5.7 minutes per mile. The number of minutes it will take Juan to ride  $x$  miles can be determined by multiplying his average rate by the number of miles,  $x$ , which yields  $5.7x$ . Therefore, the function  $m(x) = 5.7x$  models the number of minutes it will take Juan to ride  $x$  miles.

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

### QUESTION 3

**Choice B** is correct. Adding the second equation in the given system to the first equation in the given system yields  $3x + (-3x + y) = 12 + (-6)$ , which is equivalent to  $y = 6$ .

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 4

**Choice D** is correct. In the given equation,  $s$  is the speed, in miles per hour, of a certain car  $t$  seconds after it began to accelerate. Therefore, the speed of the car, in miles per hour, 5 seconds after it began to accelerate can be found by substituting 5 for  $t$  in the given equation, which yields  $s = 40 + 3(5)$ , or  $s = 55$ . Thus, the speed of the car 5 seconds after it began to accelerate is 55 miles per hour.

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

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

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

## QUESTION 5

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

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

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

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

## QUESTION 6

The correct answer is 40. Subtracting 5 from both sides of the given equation yields  $4x = 160$ . Dividing both sides of this equation by 4 yields  $x = 40$ . Therefore, the solution to the given equation is 40.

## QUESTION 7

The correct answer is 7. It's given that the  $x$ -intercept of the graph shown is  $(x, 0)$ .

The graph passes through the point  $(7, 0)$ . Therefore, the value of  $x$  is 7.

## QUESTION 8

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

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

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

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

## QUESTION 9

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

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

## QUESTION 10

**Choice A** is correct. The solution to a system of equations is the ordered pair  $(x, y)$  that satisfies all equations in the system. It's given by the first equation in the system that  $x + 7 = 10$ . Substituting 10 for  $x + 7$  into the second equation yields  $10^2 = y$ , or  $y = 100$ . The  $x$ -coordinate of the solution to the system of equations can be found by subtracting 7 from both sides of the equation  $x + 7 = 10$ , which yields  $x = 3$ . Therefore, the ordered pair  $(3, 100)$  is a solution to the given system of equations.

*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 11

**Choice A** is correct. Applying the distributive property, the given expression can be written as  $7x^3 + 7x - 6x^3 + 3x$ . Grouping like terms in this expression yields  $(7x^3 - 6x^3) + (7x + 3x)$ . Combining like terms in this expression yields  $x^3 + 10x$ .

*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 12

**Choice A** is correct. It's given that  $p(n) = 7n^3$ . Substituting 56 for  $p(n)$  in this equation yields  $56 = 7n^3$ . Dividing each side of this equation by 7 yields  $8 = n^3$ . Taking the cube root of each side of this equation yields  $2 = n$ . Therefore, when  $p(n)$  is equal to 56, the value of  $n$  is 2.

*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 13

The correct answer is 70. Based on the figure, the angle with measure  $110^\circ$  and the angle vertical to the angle with measure  $x^\circ$  are same side interior angles. Since vertical angles are congruent, the angle vertical to the angle with measure  $x^\circ$  also has measure  $x^\circ$ . It's given that lines  $s$  and  $t$  are parallel. Therefore, same side interior angles between lines  $s$  and  $t$  are supplementary. It follows that  $x + 110 = 180$ . Subtracting 110 from both sides of this equation yields  $x = 70$ .

### QUESTION 14

The correct answer is 10. The mean of a data set is calculated by dividing the sum of the data values by the number of data values in the data set. For this data set, the mean can be calculated as  $\frac{6+8+16+4+17+26+8+5+5+5}{10}$ , which is equivalent to  $\frac{100}{10}$ , or 10.

### QUESTION 15

**Choice A** is correct. For an exponential function of the form  $E(t) = a(b)^t$ , where  $a$  and  $b$  are constants, the initial value of the function—that is, the value of the function when  $t = 0$ —is  $a$  and the value of the function increases by a factor of  $b$  each time  $t$  increases by 1. Since the function  $E(t) = 5(1.8)^t$  gives the estimated number of employees at a restaurant and  $t$  is the number of years since the restaurant opened, the best interpretation of the number 5 in this context is the estimated number of employees when  $t = 0$ , or when the restaurant opened.

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

### QUESTION 16

**Choice B** is correct. For a quadratic function defined by an equation of the form  $g(x) = a(x - h)^2 + k$ , where  $a$ ,  $h$ , and  $k$  are constants and  $a > 0$ , the minimum value of the function is  $k$ . In the given function,  $a = 1$ ,  $h = 0$ , and  $k = 55$ . Therefore, the minimum value of the given function is 55.

**Choice A** is incorrect. This is the value of  $x$  for which the given function reaches its minimum value, not the minimum value of the function. **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 C** is correct. Because the value of the investment increases each year, the function that best models how the value of the investment changes over time is an increasing function. It's given that each year, the value of the investment increases by 0.49% of its value the previous year. Since the value of the investment changes by a fixed percentage each year, the function that best

models how the value of the investment changes over time is an exponential function. Therefore, the function that best models how the value of the investment changes over time is an increasing exponential function.

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

## QUESTION 18

**Choice C** is correct. Let  $x$  be the 2015 population of Greenville. It's given that the population increased by 7% from 2015 to 2016. The increase in population can be written as  $(0.07)x$ . The 2016 population of Greenville is given as the sum of the 2015 population of Greenville and the increase in population from 2015 to 2016. This can be rewritten as  $x + (0.07)x$ , or  $1.07x$ . Therefore, the value of  $k$  is 1.07.

*Choice A* is incorrect. This is the percent, represented as a decimal, that the population increased from 2015 to 2016, not the value of  $k$ . *Choice B* is incorrect and may result from conceptual or calculation errors. *Choice D* is incorrect. This is the value of  $k$  if the population increased by 70%, not 7%, from 2015 to 2016.

## QUESTION 19

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

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

## QUESTION 20

The correct answer is 16. The total cost of the party is found by adding the onetime fee of the venue to the cost per attendee times the number of attendees. Let  $x$  be the number of attendees. The expression  $35 + 10.25x$  thus represents the total cost of the party. It's given that the budget is \$200, so this situation can be represented by the inequality  $35 + 10.25x \leq 200$ . The greatest number of attendees can be found by solving this inequality for  $x$ . Subtracting 35 from both sides of this inequality gives  $10.25x \leq 165$ . Dividing both sides of this inequality by 10.25 results in approximately  $x \leq 16.098$ . Since the question is stated in terms of attendees, rounding  $x$  down to the nearest whole number, 16, gives the greatest number of attendees possible.

## QUESTION 21

The correct answer is 28. The given absolute value equation can be rewritten as two linear equations:  $4x - 4 = 112$  and  $-(4x - 4) = 112$ , or  $4x - 4 = -112$ . Adding 4 to both sides of the equation  $4x - 4 = 112$  results in  $4x = 116$ . Dividing both sides of this equation by 4 results in  $x = 29$ . Adding 4 to both sides of the equation  $4x - 4 = -112$  results in  $4x = -108$ . Dividing both sides of this equation by 4 results in  $x = -27$ . Therefore, the two values of  $x - 1$  are  $29 - 1$ , or 28, and  $-27 - 1$ , or  $-28$ . Thus, the positive value of  $x - 1$  is 28.

Alternate approach: The given equation can be rewritten as  $|4(x - 1)| = 112$ , which is equivalent to  $4|x - 1| = 112$ . Dividing both sides of this equation by 4 yields  $|x - 1| = 28$ . This equation can be rewritten as two linear equations:  $x - 1 = 28$  and  $-(x - 1) = 28$ , or  $x - 1 = -28$ . Therefore, the positive value of  $x - 1$  is 28.

## QUESTION 22

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

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

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

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

## QUESTION 23

**Choice B** is correct. The standard form of an equation of a circle in the  $xy$ -plane is  $(x - h)^2 + (y - k)^2 = r^2$ , where the coordinates of the center of the circle are  $(h, k)$  and the length of the radius of the circle is  $r$ . For the circle in the  $xy$ -plane with equation  $(x - 5)^2 + (y - 3)^2 = 16$ , it follows that  $r^2 = 16$ . Taking the square root of both sides of this equation yields  $r = 4$  or  $r = -4$ . Because  $r$  represents the length of the radius of the circle and this length must be positive,  $r = 4$ . Therefore, the radius of the circle is 4. The diameter of a circle is twice the length of the radius of the circle. Thus,  $2(4)$  yields 8. Therefore, the diameter of the circle is 8.

**Choice A** is incorrect. This is the radius of the circle. **Choice C** is incorrect. This is the square of the radius of the circle. **Choice D** is incorrect and may result from conceptual or calculation errors.

## QUESTION 24

**Choice C** is correct. For the form of the function in choice C,  $f(x) = 128(1.6)^{x-1}$ , the value of  $f(1)$  can be found as  $128(1.6)^{1-1}$ , which is equivalent to  $128(1.6)^0$ , or 128. Therefore,  $k = 128$ , which is shown in  $f(x) = 128(1.6)^{x-1}$  as the coefficient.

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

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

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

## QUESTION 25

**Choice B** is correct. Since the model estimates that the number of squirrels in the population increased by a fixed percentage, 150%, each year, the model can be represented by an exponential equation of the form  $n = a\left(1 + \frac{p}{100}\right)^t$ , where  $a$  is the estimated number of squirrels in the population at the end of 2015, and the model estimates that at the end of each year, the number is  $p\%$  more than the number at the end of the previous year. Since the model estimates that at the end of each year, the number was 150% more than the number at the end of the previous year,  $p = 150$ . Substituting 150 for  $p$  in the equation  $n = a\left(1 + \frac{p}{100}\right)^t$  yields  $n = a\left(1 + \frac{150}{100}\right)^t$ , which is equivalent to  $n = a(1 + 1.5)^t$ , or  $n = a(2.5)^t$ . It's given that the estimated number of squirrels at the end of 2016 was 180. This means that when  $t = 1$ ,  $n = 180$ . Substituting 1 for  $t$  and 180 for  $n$  in the equation  $n = a(2.5)^t$  yields  $180 = a(2.5)^1$ , or  $180 = 2.5a$ . Dividing each side of this equation by 2.5 yields  $72 = a$ . Substituting 72 for  $a$  in the equation  $n = a(2.5)^t$  yields  $n = 72(2.5)^t$ .

*Choice A* is incorrect. This equation represents a model where at the end of each year, the estimated number of squirrels was 150% of, not 150% more than, the estimated number at the end of the previous year. *Choice C* is incorrect. This equation represents a model where at the end of each year, the estimated number of squirrels was 150% of, not 150% more than, the estimated number at the end of the previous year, and the estimated number of squirrels at the end of 2015, not the end of 2016, was 180. *Choice D* is incorrect. This equation represents a model where the estimated number of squirrels at the end of 2015, not the end of 2016, was 180.

## QUESTION 26

**Choice B** is correct. Two lines are perpendicular if their slopes are negative reciprocals, meaning that the slope of the first line is equal to  $-1$  divided by the slope of the second line. Each equation in the given pair of equations can be written in slope-intercept form,  $y = mx + b$ , where  $m$  is the slope of the graph of the equation in the  $xy$ -plane and  $(0, b)$  is the  $y$ -intercept. For the first equation,  $5x + 7y = 1$ , subtracting  $5x$  from both sides gives  $7y = -5x + 1$ , and dividing both sides of this equation by  $7$  gives  $y = -\frac{5}{7}x + \frac{1}{7}$ . Therefore, the slope of the graph of this equation is  $-\frac{5}{7}$ . For the second equation,  $ax + by = 1$ , subtracting  $ax$  from both sides gives  $by = -ax + 1$ , and dividing both sides of this equation by  $b$  gives  $y = -\frac{a}{b}x + \frac{1}{b}$ . Therefore, the slope of the graph of this equation is  $-\frac{a}{b}$ . Since the graph of the given pair of equations is a pair of perpendicular lines, the slope of the graph of the second equation,  $-\frac{a}{b}$ , must be the negative reciprocal of the slope of the graph of the first equation,  $-\frac{5}{7}$ . The negative reciprocal of  $-\frac{5}{7}$  is  $\frac{7}{5}$ , or  $\frac{1}{\left(-\frac{5}{7}\right)}$ . Therefore,  $-\frac{a}{b} = \frac{7}{5}$ , or  $\frac{a}{b} = -\frac{7}{5}$ . Similarly, rewriting the equations in choice B in slope-intercept form yields  $y = -\frac{10}{7}x + \frac{1}{7}$  and  $y = -\frac{a}{2b}x + \frac{1}{2b}$ . It follows that the slope of the graph of the first equation in choice B is  $-\frac{10}{7}$  and the slope of the graph of the second equation in choice B is  $-\frac{a}{2b}$ . Since  $\frac{a}{b} = -\frac{7}{5}$ ,  $-\frac{a}{2b}$  is equal to  $-\left(\frac{1}{2}\right)\left(-\frac{7}{5}\right)$ , or  $\frac{7}{10}$ . Since  $\frac{7}{10}$  is the negative reciprocal of  $-\frac{10}{7}$ , the pair of equations in choice B represents a pair of perpendicular lines.

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

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

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

## QUESTION 27

The correct answer is 289. A quadratic equation of the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are constants, has no real solutions when the value of the discriminant,  $b^2 - 4ac$ , is less than 0. In the given equation,  $x^2 - 34x + c = 0$ ,  $a = 1$  and  $b = -34$ . Therefore, the discriminant of the given equation can be expressed as  $(-34)^2 - 4(1)(c)$ , or  $1,156 - 4c$ . It follows that the given equation has no real solutions when  $1,156 - 4c < 0$ . Adding  $4c$  to both sides of this inequality yields  $1,156 < 4c$ . Dividing both sides of this inequality by 4 yields  $289 < c$ , or  $c > 289$ . It's given that the equation  $x^2 - 34x + c = 0$  has no real solutions when  $c > n$ . Therefore, the least possible value of  $n$  is 289.