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5 Ways to Increase Score Gains Using Cambridge's *Navigator Plus*

Navigator Plus is Cambridge's complete explanation guide to a previously administered test. It includes explanations for each item on the test, categorization for each item, an answer key, and more.

The following list provides suggestions for implementing the Navigator into your program to increase score gains.

- 1. Simulate test day as much as possible when proctoring tests.** Students will benefit from a testing experience that closely simulates what they will experience on test day. They will feel more confident if they know what to expect.
- 2. Follow up when you receive your data.** Use the reports you receive from Cambridge to cover the items your class struggled as a group to answer (see the Error Analysis report). Taking this step within two weeks of administering the test will ensure that your students haven't forgotten the items you cover and will be able to learn from their testing experiences.
- 3. Use the Pre-Assessment Item references in the *Victory* lesson to illustrate key points.** Your teacher's guide includes references to items on your pre-assessment that you can use as additional examples. Keep a copy of your pre-assessment test booklet handy so that you can cover these items with your students. Using pre-assessment items as additional examples helps students connect the concepts you are teaching with their test-day experiences.
- 4. Don't forget to review the wrong answers.** Many explanations in this Navigator packet include references to each wrong answer choice. Students will benefit from reviewing why each wrong answer is wrong so that they can recognize what makes the right answer correct and use the process of elimination to eliminate similar wrong answers in the future.
- 5. Pay attention to item categories.** Each item in this Navigator packet includes a category path that corresponds to the course concept outline in your *Victory* text as well as the categories listed in the Item Index of your *Victory* text. Use the Item Index to identify items students can use for further practice.

English Test Explanations

Tip



For items that test the main idea of a passage or paragraph, the Goldilocks Rule is often helpful. The correct answer will be neither too large (encompass more than the scope of the passage) nor too small (be a detail of only a part of the passage) but just right.

Tip



Sometimes finding the correct answer to an item requires reading further into the passage. Whether it's a few words, a sentence or two, or the rest of the passage, make sure you always read as far ahead as necessary for the context you need to find the right answer.

1. **(B) English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement and Usage and Mechanics/Sentence Structure/Fragments.** The sentence as currently written is a fragment without a verb, and the best place to insert one is in the underlined portion. Only (B) provides the necessary verb to complete the sentence.
2. **(F) English/Rhetorical Skills/Strategy/Appropriate Supporting Material.** The last sentence in the first paragraph functions as a sort of thesis statement that introduces the purpose of the passage. A quick scan of the passage's development shows us the passage discusses the history of the Kam Wah Chung building (paragraphs 2 and 3), some of the functions of the building (paragraphs 3 and 4), and reasons why it is culturally significant (paragraph 4). Although (G), (H), and (J) all incorporate details from the passage, (F) is the only choice that truly encompasses the scope of the passage.
3. **(C) English/Usage and Mechanics/Grammar and Usage/Verb Tense.** Paragraphs 2 and 3 of this passage detail some of the history of the Kam Wah Chung building. Since it is history, it is in the past and the past tense is needed. (C) provides the necessary tense. The other choices place the action in the future or in the present, which is not contextually appropriate.
4. **(G) English/Rhetorical Skills/Strategy/Appropriate Supporting Material.** The sentence after the place the writer wishes to add the information references "the men." However, there is nothing preceding this reference that gives us any idea of who these men were. Adding the information about Doc Hay and Lung On gives us crucial information that tells us who "the men" were: the people to whom the original owner sold the building. (G) best describes the importance of adding this information.
5. **(D) English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement.** The original sentence includes a list of verbs describing what the men did: "combined," "organized," "remains." However, the last verb in the list, "remains," is not parallel in tense to the other verbs. "Remains" needs to be changed to the past tense "remained" for the sake of parallelism, and (D) does this.
6. **(G) English/Usage and Mechanics/Sentence Structure/Faulty Parallelism.** This item has two errors. The first is the use of a nonidiomatic phrase—someone is famous *for* something, not famous *when* something. The second error is a lack of parallelism. The original sentence states that "Hay became famous . . . when he would make . . . diagnoses and curing patients." "Make" and "curing" are not parallel, and since "make" is underlined, that's the part to fix. The participle form "making" is needed here. (H) and (J) both fix the first error, but only (G) corrects both errors.
7. **(A) English/Usage and Mechanics/Grammar and Usage/Pronoun Usage.** The original sentence is correct. The use of the pronoun "whose" clearly determines who is receiving the treatments. (B) is wordy and redundant. (C) asserts incorrectly that it is the patients themselves who are the treatments. And the use of "of whom" in (D) creates an illogical sentence.
8. **(F) English/Rhetorical Skills/Strategy/Sentence-Level Structure.** The previous sentence gives some important details about Hay's herbal medicine clinic and the resulting fame that Hay achieved. Without that sentence, there seems to be nothing noteworthy about Hay—or the Kam Wah Chung building. The sentence should be kept, which eliminates (H) and (J) as possible right answers. As for (G), the sentence in question, while mentioning that Hay made diagnoses, does not give any examples of those diagnoses. That leaves (F) as the correct answer.

Tip



When in doubt, use process of elimination. If you can eliminate one or more answer choices, you give yourself a much better chance of getting the right answer—even if you have to guess.

9. (A) **English/Rhetorical Skills/Appropriate Supporting Material.** Process of elimination could be a good tool to use to find the right answer for this item. Let's look at each of the choices.

(A): The preceding sentence supplies a fairly lengthy list of wide-ranging services the building provided. Without the sentence, it would seem the building was no more than a supply shop and medical clinic—and it was clearly much more than that. (A) is a possible correct answer.

(B): While the preceding sentence does mention that the building became a social center, nothing in the sentence suggests that the social aspect of the building was the most important to visitors. Eliminate (B).

(C): The list of services supplied by the Kam Wah Chung & Co. building is very general. Nowhere in the sentence does it say that the list of services was a summary of only one person's experiences. Eliminate (C).

(D): At the beginning of the sentence, the writer uses the phrase "over time" but offers no more specifics than that as to how long the businesses lasted. Eliminate (D).

That leaves (A) as the only possible correct answer choice.

10. (J) **English/Usage and Mechanics/Grammar and Usage/Diction.** The original sentence begins with a list of prepositional phrases: "through the turn of the century" and "during the Great Depression." "Beginning the 1940s" should also be a prepositional phrase, but "beginning" is a participle, not a preposition. (H) has the same error as (F), and (G) uses the ambiguous singular pronoun "it" to refer (presumably) to the plural "businesses." Only (J) corrects the original error by using the preposition "into" to clearly show the prosperity of the businesses as time passed.
11. (C) **English/Usage and Mechanics/Grammar and Usage/Verb Tense.** Previously in the sentence, the writer uses the passive past tense verb "was restored." In keeping with the verb tense used, "has become" (an incorrect verb form anyway) needs to be in the past tense. (C) corrects this error by using the past tense "became."
12. (J) **English/Rhetorical Skills/Style/Conciseness.** "Called," (F); "with the appropriation of," (G); and "identified," (H), all have a meaning already stated in this sentence: "designated." (J) correctly eliminates all the excess verbiage to create a clear and concise sentence.
13. (D) **English/Rhetorical Skills/Strategy/Effective Concluding Sentence.** The original sentence uses a transitional word that doesn't make sense in context. "Besides" implies that something is being added to the first thought, but that isn't what should be happening here. Similarly, in (B), "in conclusion" doesn't create a logical transition between the two parts of the sentence. And in (C), the vague "in time" contradicts the very specific "in 2005" mentioned previously. That leaves (D), which is the correct answer because no transition word or phrase is needed here to keep the logical connection between the two parts of the sentence.
14. (J) **English/Rhetorical Skills/Organization/Paragraph-Level Structure.** The current position of Sentence 2 doesn't make sense. If the Kam Wah Chung building was still operating through the 1940s (as stated in Sentences 1 and 2), why would there be artifacts still preserved? Wouldn't they still be used by Hay and On? That eliminates (F) and (G) as possible answer choices. As for (H) and (J), a phrase in Sentence 5 is key to the proper placement of Sentence 2: the building "remained locked" for almost twenty years. A locked, unused building would certainly have preserved artifacts. Placing Sentence 2 after Sentence 5 would build on the significance of the locked building by adding rich detail, so (J) is the correct answer.
15. (C) **English/Rhetorical Skills/Strategy/Main Idea.** If the writer had intended to write an essay outlining what the state of Oregon did to restore the Kam Wah Chung & Co. building, this essay wouldn't have done a very good job. The state of Oregon isn't mentioned until the second-to-last sentence in the last paragraph of the essay. So the answer would be no, and that would eliminate (A) and (B) as possible answer choices. As for (D), there is nothing critical toward Hay and On in this passage; it is, as (C) correctly suggests, an historical description of the building and its uses.

16. (H) *English/Usage and Mechanics/Punctuation/Commas*. A quick look at the answer choices tells us this item tests comma usage. But where is the appropriate place to put a comma (or commas)? Well, in the original sentence, the comma incorrectly separates the subject (“a Renaissance fair”) from the verb (“looks”). (G) also includes a comma there, so it too can be eliminated. That leaves (H) and (J), and the use of a semicolon in (J) creates two sentence fragments, which leaves (H) as the correct answer since it eliminates the comma between the subject and verb and adds a comma after the introductory phrase “at first glance.”
17. (D) *English/Usage and Mechanics/Grammar and Usage/Diction*. Ah, the infamous they’re/there/their! “They’re” is a contraction for “they are,” and if that phrase is substituted in the original sentence, it doesn’t make sense: “moseying they are way past.” So (A) and (B) are incorrect. The only difference between (C) and (D) is “passed” (a verb) vs. “past” (a preposition), and the preposition is the appropriate word here to describe the direction of movement of the people. That means (D) is the correct answer.
18. (G) *English/Usage and Mechanics/Sentence Structure/Unintended Meanings*. “Being that” is an informal phrase that shouldn’t be used in an essay such as this one. The correct phrase to be used here is one that contrasts what you would normally expect a park’s attractions to be (“roller coasters and Ferris wheels”) with what the fair’s actual attractions are (“sights, sounds, and tastes inspired by sixteenth-century England”). (G) is the only choice that offers that contrast.
19. (A) *English/Usage and Mechanics/Punctuation/Commas*. “Carrying knights to a jousting match” is a restrictive phrase that clarifies which horses specifically are walking along the streets. Since the phrase is essential to the clarity of the sentence, no commas are required at any point in the underlined section. Adding commas would confuse the meaning of the sentence.
20. (G) *English/Usage and Mechanics/Grammar and Usage/Diction*. “Clip-clop,” (G), adds a specific sensory detail that all of the other choices, with only their mentions of movement, lack: the horses’ feet making a sound as they walk.
21. (D) *English/Usage and Mechanics/Sentence Structure/Misplaced Modifiers*. The original sentence suffers from the notorious (and often hilarious) misplaced modifier. As written, the sentence asserts that the vendors themselves range from turkey legs to suits of armor. Instead, the sentence means to say that the vendors peddle wares ranging from turkey legs to suits of armor. (D) is the only sentence that correctly places the modifier.
22. (G) *English/Rhetorical Skills/Strategy/Effective Opening Sentence*. The rest of the essay details the lengths the narrator and other Renaissance fair performers went to in order to create the most authentic experience possible for fairgoers. (G) summarizes this idea best and so provides the best transition to the rest of the essay.
23. (C) *English/Usage and Mechanics/Sentence Structure/Fragments*. Inserting a period between “speech” and “substituting” creates a fragment of the participial phrase beginning with “substituting,” which makes (A) incorrect. (D) has the same error, though with a different punctuation mark. (B) creates a comma splice. Only (C) correctly joins the participial phrase with the main clause using a comma.
24. (F) *English/Usage and Mechanics/Grammar and Usage/Verb Tense*. “Introduced” is the second part of a compound predicate joined by the conjunction “or”: “served . . . or introduced.” In the original item, “introduced” correctly keeps parallel with the past tense of “served.”
25. (D) *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage*. Who vs. whom—that bugaboo of the English language. In this case, the correct word to use would be “who,” since it is the subject of the relative clause “who lived in a different country and century.” That would make (D) the correct answer. (B) is the only other option that uses “who,” but it introduces another error: using the future tense “were” to describe portraying someone who lived in the past.

Tip



One trick you can use to help you determine whether to use “who” or “whom” is to rephrase the item as a question and see if you would answer it with the subjective he/she (use “who”) or the objective him/her (use “whom”). For example:

Who/whom had lived in a different country and century? *He* lived in a different country or century. So “who” would be the correct choice.

(Note: This isn’t going to work 100% of the time; sometimes rephrasing the clause as a question is harder than you would think. But it gives you at least a good starting point.)

26. (J) *English/Usage and Mechanics/Grammar and Usage/Nouns and Noun Clauses.* The word “because” introduces a dependent clause that needs a subject and a verb. The original sentence provides a subject—two subjects, in fact, that are incorrectly linked by only a comma. And the use of the preposition “of” in (G) and (H) reduces “costumes” to the object of the preposition and leaves the sentence without a subject at all. (J) omits the preposition and leaves “our costumes” as the subject and is the correct answer.
27. (C) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material.* Though theme parks are mentioned at the beginning of the essay, they aren’t discussed anywhere else. It wouldn’t make sense to suddenly insert a tidbit about theme parks here, so (A) and (B), as “yes,” can be eliminated. That leaves (C) and (D), and (D) is incorrect because nowhere else in this essay is the information in the sentence in question repeated. (C) provides the best answer: theme parks, though mentioned earlier, are only loosely related to the topics discussed at this point in the essay.
28. (H) *English/Rhetorical Skills/Style/Conciseness.* The original sentence is wordy and redundant. “Things that had come into existence” could be reduced down to a word or two, and “more recently” is implied later in the sentence with the phrase “after the sixteenth century.” (H) provides a clear and concise rendering of the underlined portion of the sentence. (J), while even shorter, uses the informal “stuff,” which isn’t appropriate for this essay.
29. (B) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence.* The best transitional word or phrase to use here would be one that expands upon a general idea mentioned in the previous sentence with a specific instance. “For example,” (B), provides the best transition. “One time,” (C) is perhaps the second-best answer, but its use contradicts with the auxiliary verb “would,” which suggests incidents with cameras happened more than one time. (“One time” would be appropriate if “would marvel . . . ask” was changed to “marveled . . . asked,” but that’s not an option.)
30. (J) *English/Rhetorical Skills/Style/Conciseness.* Earlier in the essay, we learned that the narrator worked at the Renaissance fair over the summer. The “three tiring months” mentioned in this last paragraph were, it is safe to assume, those summer months. Adding the underlined portion here is superfluous, given the information we already know. It is best simply to delete the underlined portion and end the sentence, as (J) states.
31. (A) *English/Usage and Mechanics/Punctuation/Commas.* The original sentence is correct. Adding the comma in (B) incorrectly separates the preposition “by” from its object. Adding the comma in (C) illogically separates “caused” from “by.” And adding the comma in (D) makes “caused . . . reservoir” a confusing nonrestrictive phrase that doesn’t include the necessary closing comma.
32. (J) *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage.* For any pronoun used (with the exceptions of idioms such as “It is raining”), you should be able to easily identify the antecedent. However, there is no plural antecedent for “they.” The most logical antecedent for something that “ripped a channel” through a state park would be the blast of water. “Blast” is singular, so the singular “it” in (J) is required. The other two choices create sentence fragments.
33. (B) *English/Usage and Mechanics/Punctuation/Apostrophes and Commas.* In the current sentence, the singular possessive “park’s,” instead of the plural “parks,” is needed to make it clear what has the beauty that is being marred (just one park, not many). That eliminates (A) and (C) as possible answer choices. As for the other two choices, a comma is needed after “time” in order to separate the introductory dependent clause from the main clause of the sentence, so (B) is the correct answer.

34. (G) *English/Usage and Mechanics/Grammar and Usage/Diction*. “Specifically” in the original sentence doesn’t make sense. The raging water didn’t reveal specific examples of history; it ended up revealing over a billion years’ worth of history. And that idea is best reflected by “ultimately,” (G).
35. (C) *English/Usage and Mechanics/Grammar and Usage/Verb Tense*. The description of the formation of Johnson’s Shut-Ins State Park is written in past tense, so the simple past tense “began” is required here, (C). The original sentence makes an attempt to use “began,” but “had began” is not correct English. The past participle form is “had/have begun,” which is not correct in context.
36. (H) *English/Usage and Mechanics/Sentence Structure/Fragments and Punctuation/End-Stop Punctuation*. As currently written, the second sentence in the underlined part is a fragment. (G) creates a similar fragment, though with a different punctuation mark. (J) attempts to join the two sentences, but the loss of “when” creates a run-on sentence. (H) correctly joins the dependent clause beginning with “when” to the independent clause.
37. (D) *English/Rhetorical Skills/Style/Conciseness*. The idea of temperature is implicit in the word “cooled” or “cool” in (A), (B), and (C), so it’s not necessary to use “temperature.” (D) creates the clearest and most concise sentence.
38. (F) *English/Usage and Mechanics/Punctuation/Commas*. “Rhyolite rock” is a compound noun, with “rhyolite” specifying the type of rock. “Silica-rich” is an adjective that modifies that compound noun. It is incorrect to separate an adjective from its noun, (G); the parts of a compound noun from each other, (H); or a verb form (“to form”) from its object, (J). The original provides the correct punctuation.
39. (B) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. The name of the state park, Johnson’s Shut-Ins, is rather an odd one. The use of the parenthetical phrase “(or ‘shut-in’)” here provides some interesting information that sheds light onto why the park was named why it was, (B). It is not a description of how people feel, (A); inconsistent with the tone of the essay, (C); or an awkward interruption, (D).
40. (H) *English/Usage and Mechanics/Punctuation/Commas*. The original sentence has a compound predicate that is not parallel: “was confined . . . and creating.” The verbs would need to be parallel (“was confined . . . and created”), but that is not an option here. Instead, “creating” needs to become the start of a participial phrase that further explains what happened when the Black River was confined in low places. (G) and (H) both offer options, but (H) is the correct one; adding a semicolon instead of a comma, as in (G), would create a fragment of the participial phrase.
41. (A) *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage*. The original sentence is correct: the singular “its” agrees in number with the singular antecedent “surge,” and the idiomatic phrase here uses the pronoun “in,” not “on,” as (D) incorrectly suggests.
42. (J) *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement*. There is a compound predicate in this sentence: “Left behind is a channel . . . and contain.” However, the plural verb “contain” doesn’t agree in number with the singular noun “channel.” The plural “contains,” (J), is required here.
43. (C) *English/Rhetorical Skills/Style/Clarity of Meaning*. As written, the sentence seems to suggest—illogically—that the shut-ins are the ones that have returned to the park. But it isn’t possible for inanimate geologic formations to return somewhere. All of the other choices clarify that it is people, not rock formations, that are returning to the park, but only (C) uses a more formal tone consistent with the passage.

44. (J) *English/Rhetorical Skills/Style/Conciseness*. The idea of going “back” is inherent in the word “returned,” so it is not necessary to repeat “back,” as (F) and (G) do. Nor is it necessary to add the redundant “revisit,” as in (H). Simply ending the sentence with “returned,” as (D) suggests, creates a concise sentence that loses none of its meaning.
45. (A) *English/Usage and Mechanics/Punctuation/Commas and Colons*. The original sentence is correct. (B) creates an illogical nonrestrictive phrase of “peering through,” which, if removed, confuses the sentence: “I was an experienced astronomer light-polluted skies.” The colon in (C) suggests that everything after it will define or clarify “astronomer,” but that’s not the case here. And (D) incorrectly separates the pronoun “through” from its object, “skies.”
46. (H) *English/Usage and Mechanics/Sentence Structure/Problems of Coordination and Subordination*. The use of “being” in the original sentence creates a fragment of the second clause (“and the nebula . . . night sky”). The second clause needs a verb, and both (G) and (H) supply one: “is.” (G), however, adds the unnecessary and ambiguous “by them”; (H) is a much more concise and clear way of rendering the sentence.
47. (A) *English/Usage and Mechanics/Punctuation/Commas*. The phrase “in some mythologies” is nonessential, so it must be set off by a pair of commas, as the original sentence does correctly. A pair of commas is needed, not just one, so (C) is incorrect. The use of commas to create nonessential phrases in (B) and (D) results in sentences that, if the nonessential phrases are removed, don’t make sense.
48. (H) *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement*. The sentence suffers from a lack of subject-verb agreement: the plural “stars” does not agree in number with the singular “has,” (F), or the singular “is,” (J). (G) provides a plural verb, “were,” but “were being” is incorrect English. (J) provides the necessary, grammatical verb form: “are.”
49. (C) *English/Usage and Mechanics/Sentence Structure/Fragments*. As written, the original sentence is a fragment that lacks a verb. The dependent clause “When . . . collapse” is a dependent clause that needs an independent clause to link to, but “forming stars” is not such a clause. (C) provides the needed present-tense verb “form” to create an independent clause. Both of the other choices create fragments.
50. (J) *English/Usage and Mechanics/Punctuation/Commas*. This item is a little tricky. On first reading, it would seem the comma between “nebula” and “is” illogically separates the subject from the verb. However, there is already a verb (“is called”) that is not in the underlined portion of the sentence. That means that, since it is ungrammatical for a sentence to have a compound predicate separated only by a comma, something else needs to be done with the first “is.” Removing the “is” and changing “home to thousands of young stars” to an appositive that describes “nebula,” as (J) does, is a good way to fix the sentence. As for the other choices, (B) attempts to create a compound predicate, but it incorrectly adds a comma before “and” and separates the subject from the second part of the predicate. (H) correctly creates an appositive, but the addition of “and” creates an illogical sentence once the appositive is removed: “The nebula and is often called a galactic ‘nursery.’”
51. (D) *English/Rhetorical Skills/Organization/Paragraph-Level Structure*. The discussion of nebulas doesn’t happen until the sentence after Point C. Since that is the first sentence in which nebulas are introduced, it doesn’t make sense to put the added sentence anywhere before Point D, which makes (D) the correct answer.
52. (J) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence*. The best transition between the sentences is one that describes a continuation of the events of the paragraph: I looked through my eyepiece, I couldn’t see anything, so then I switched to a different eyepiece. “So,” (J), best fits the chronology and logic of the paragraph. All of the other choices create logically confusing transitions.

53. (A) *English/Usage and Mechanics/Grammar and Usage/Verb Tense*. The original sentence correctly uses two verb tenses to describe the action of the sentence. The past tense of “try” is required since it is consistent with what is happening in the rest of the paragraph. And “I’d read” (rather, “I had read”) is a correct use of the past perfect tense, which refers to something that was completed (the reading) before another past action (trying the trick). None of the other choices use both tenses correctly.
54. (G) *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage*. Two choices can be eliminated fairly quickly here. (H) uses the contracted form of “they are,” which doesn’t make sense when inserted in the sentence: “by looking to they are side.” And (J) incorrectly uses the possessive form of the singular pronoun “one,” whose antecedent is the plural noun “objects.” That leaves (F) and (G), and they are similar enough that choosing the correct answer choice requires careful reading. The implication in (F) is that you can see distant objects better by looking to one particular side of the object, whereas (G) suggests that you can look to any of the sides of the object. In context, (G) makes more logical sense.
55. (B) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. At the end of the preceding paragraph, the writer mentions the trick of using averted vision. If the sentence in question were to be deleted, one paragraph would end with a reference to averted vision and the next paragraph would abruptly begin with a description of what the narrator was doing. If a reader didn’t know what the principle of averted vision was, the narrator’s actions might not make sense. The sentence should definitely be kept, and (B) gives the best reason why. The author’s capability to use averted vision is not the issue, as (A) states incorrectly.
56. (H) *English/Usage and Mechanics/Grammar and Usage/Diction*. The original sentence suggests a comparison that doesn’t make sense in context: that peripheral and direct vision both yield better views, but peripheral vision yields more of the better view. That idea doesn’t really make sense here. The use of “farther” in (G) suggests that using peripheral vision enabled the narrator to see a greater distance, but that doesn’t make sense given what the writer has described of the principle of averted vision, which focuses on the clarity of distant objects, not on seeing farther. (J) also is incorrect because its use of a comma between “far” and “better” suggests that those adjectives are interchangeable when they’re not; it wouldn’t make sense to see “a better, far view.” (H) provides a correctly punctuated comparison that makes sense in context.
57. (A) *English/Usage and Mechanics/Grammar and Usage/Diction*. The original choice is correct. To illuminate means to light up, and that makes sense in context—the four bright stars lit up the Trapezium star cluster. It doesn’t make sense to say the stars spread out (emanated) from the cluster, (B); imitated (emulated) the cluster, (C); or got rid of (eliminated) the cluster, (D).
58. (F) *English/Usage and Mechanics/Punctuation/Apostrophes*. The original sentence correctly uses the possessive form of the plural “birds” to modify the plural “eggs” that describes the four bright young stars. As for the other choices, (H) is incorrect because the possessive form of “birds” is needed to modify “eggs.” (J) is incorrect because the possessive of the plural “eggs” doesn’t make sense here. (G) is perhaps the second-best answer, but in order to use the singular “bird,” an indefinite article is required (“a bird’s eggs”), and there is no such article here.
59. (A) *English/Rhetorical Skills/Strategy/Effective Concluding Sentence*. The opening paragraph of the essay discusses the narrator making plans to see the constellation Orion on a cold winter’s night. (A) is the only choice that references the winter aspect that was such a big part of the opening paragraph.

Tip



Items that have two yes and two no answers should be some of the easier English items to answer. If you can determine whether or not something is added appropriately (see #55) or if it accomplishes a goal (see this item), you can eliminate two answer choices and leave yourself with a 50/50 chance of getting the answer right, even if you have to guess. And we like those odds.

60. (G) *English/Rhetorical Skills/Strategy/Main Idea*. Does this essay recount a personal experience with astronomy? Well, the experience is clearly personal (the use of first-person narration) and the focus is on astronomy (using a telescope to see the Great Orion Nebula), so the answer must be yes. That eliminates (H) and (J) as answer choices. As for (F), the narrator only recounts one experience, not several. That leaves (G) as the correct answer choice.
61. (D) *English/Usage and Mechanics/Sentence Structure/Comma Splices*. The use of “they are” as a subject and verb makes the original sentence a comma splice—two independent clauses joined only by a comma. (B) contains the same error, and (C) changes the sentence into a run-on. (D) removes the subject and verb and changes the phrase “metaphors . . . events” into an appositive describing “distillations of emotion.”
62. (G) *English/Usage and Mechanics/Sentence Structure/Unintended Meanings and Punctuation/Dashes*. As the original sentence is written, it tells us that triangles and narrow rectangles are the *only* shapes painted in vibrant, contrasting hues. However, the item wants it to be clear that all shapes—not just a few—are painted that way. So “in vibrant, contrasting hues” (with a comma between the two adjectives) needs to clearly refer to shapes as a whole. Creating an appositive of “mostly triangles and narrow rectangles” that is set apart by a pair of dashes, as (G) does, is the best way to make that clear.
63. (B) *English/Usage and Mechanics/Punctuation/Commas*. “He says” is a nonessential phrase in this sentence. As such, it needs to be set apart from the rest of the sentence, and a good way to do that is with a pair of commas, as shown correctly in (B). (C) incorrectly makes “his subject” the nonessential phrase, which would make little sense of the rest of the sentence: “But he says is color.” And (D) neglects to add the necessary comma to close the nonessential phrase “he says.”
64. (H) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence*. The sentence the writer wishes to add doesn’t really have anything to do with the focus of the essay, which is about Little’s use of color in his paintings. As (H) correctly states, it adds information that, while referencing Little, only relates tangentially to the primary focus of the essay.
65. (D) *English/Rhetorical Skills/Style/Conciseness*. The preceding sentence states that Little uses “his own blends” of paints. Mentioning that he blended these paints himself is redundant. (D) provides the clearest and most concise statement of the sentence.
66. (J) *English/Rhetorical Skills/Style/Clarity of Meaning*. Since paintings are usually two dimensional, consisting of only height and length, “voluminous” (large in volume) is not really an appropriate word to use here. “Mountainous,” (H), similarly implies incorrectly a large object of three dimensions. And the paintings cannot be “immeasurable,” (G), since the measurements of the paintings are given later in the sentence. “Large,” (J), is the only choice that makes sense.
67. (B) *English/Rhetorical Skills/Style/Idiomatic Expression*. The description of Little’s painting *Bittersweet Victory* provides an example of how Little uses color and lines to “create sharp visual breaks and clean edges of color.” The phrase “for example,” (B), best shows how the painting relates to what has come before. None of the other choices provide a clear, idiomatic transition between the paragraphs.
68. (G) *English/Usage and Mechanics/Sentence Structure/Misplaced Modifiers*. The meanings of (F), (H), and (J) are all the same as that of the original sentence: there is a vertical beige line that cuts the canvas in two (bisects). However, the placement of the adverb “vertically” in (G) makes this sentence an unacceptable alternative. Unlike the other options, (G) asserts that the beige itself is vertical, not that the line is.

69. (C) *English/Usage and Mechanics/Sentence Structure/Problems of Coordination and Subordination*. There are two errors with the original sentence. The first is the use of “which,” which introduces a confusing and illogical subordinating clause within the existing phrase. The second error is the use of the past tense “stretched” in a paragraph written in the present tense. (B) attempts to use a participle (“stretching”) to fix the second error but makes no attempt to fix the first. (D) corrects the first error, but the use of the present tense “stretches” by itself creates an independent clause that does not fit in grammatically with the rest of the sentence. (C) corrects both problems by changing “which stretched” to the participle “stretching,” thus clearly subordinating the participial phrase “each one . . . half.”
70. (J) *English/Rhetorical Skills/Style/Conciseness*. At the beginning of this sentence, the writer describes the lines and colors used “on the left half” in the canvas. Repeating “left half” here is redundant and can be removed, as (J) does nicely.
71. (C) *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement*. There is a lot of material inserted between the subject and the verb of this sentence. But a little bit of digging reveals that the subject is the plural “bands,” and the singular verb “cuts” doesn’t agree in number. In addition, the idiomatic expression would be either “cut through” or “cut across,” not “cut(s) crossed,” as (B) and (D) assert. (C) corrects the subject-verb error and uses an idiomatic expression.
72. (F) *English/Rhetorical Skills/Style/Idiomatic Expression*. The correct idiomatic expression is “lend X to Y,” as in (F). All of the other choices are either too wordy or use words and phrases that are not idiomatic.
73. (C) *English/Rhetorical Skills/Style/Clarity of Meaning and Conciseness*. If one thing is “much like” something else, the first thing would probably remind you of the second—two ideas that are repeated unnecessarily in (A). (B) suffers from a similar redundancy. (D) uses the unidiomatic expression “being like.” (C) provides the clearest and most concise comparison of the effect of Little’s work and a jazz collaboration.
74. (F) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. The sentence in question does not discuss the popularity of Little’s work at all, (G), or emphasize any specific goals Little had set and his methods for reaching them, (J). And since the next paragraph doesn’t reference any criticisms of Little’s work (though the word “assessment” is used), (H) is also incorrect. The only possible correct answer is (F), and the sentence nicely furthers the comparison of Little’s work with jazz that was hinted at with the phrase “rhythm and jazz” in the preceding sentence.
75. (B) *English/Rhetorical Skills/Strategy/Main Idea*. Is an artist discussed in this essay? Yes, the writer talks about James Little. Do simple elements convey large ideas? Color and lines are definitely simple elements, and in the last paragraph, the writer states that Little thinks “his paintings reflect what he considers the essence of our experiences as human beings.” So, yes, simple elements are used to convey large ideas. That eliminates (C) and (D) as possible right answers. Since the idea of Little’s paintings conveying optimism is mentioned only briefly in the last paragraph by one woman (not necessarily the writer), (A) can also be eliminated. And (B) is the correct answer.

Mathematics Test Explanations

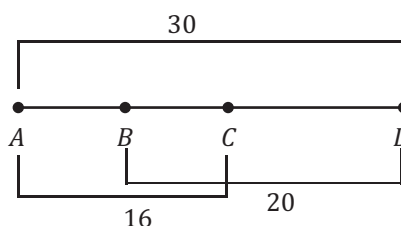
Testing
Tip

Include the units when writing expressions. This will help to fill in the expression as needed, and to double-check that your units are correct or whether additional conversions are needed.

- (C) Mathematics/Arithmetic/Common Arithmetic Items/Rates and Ratios.** The restaurant rotated 180° in $\frac{3}{4}$ of an hour. Create an expression for degrees per hour:

$$\frac{180^\circ}{\frac{3}{4} \text{ hour}} = 60^\circ(4) = 240^\circ \text{ per hour, (C).}$$
- (H) Mathematics/Arithmetic/Multi-Step Arithmetic Application Items.** Subtract the \$140 onetime fee from the \$500 check: $\$500 - 140 = \360 . If the monthly fee is \$40, \$360 pays for $\frac{\$360}{\$40/\text{mo.}} = 9$ months, (H). This item can also be approached by creating and solving a linear equation that describes the scenario: $\$500 = \$140 + \frac{\$40}{\text{months}}(x \text{ months}) \Rightarrow x = \frac{500 - 140}{40} = 9$ months. Note that both of these methods are actually the same, but you can reason through the steps, as in the first method, without explicitly creating the equation.
- (D) Mathematics/Arithmetic/Multi-Step Arithmetic Application Items and Common Arithmetic Items/Rates and Ratios.** Determine the total cost paid by the 27 passengers at a rate of \$9.25 per person: $\frac{\$9.25}{\text{person}}(27 \text{ people}) = \249.75 . Determine the cost at a rate of \$8.50 per person: $\frac{\$8.50}{\text{person}}(27 \text{ people}) = \229.50 . Subtract to find the difference: $\$249.75 - \$229.50 = \$20.25$, (D).
- (H) Mathematics/Statistics and Probability/Probability.** The item stem asks for the probability that Samara is chosen from a group of names that do NOT include any officers. There are 13 members, 3 of whom are officers. Therefore, $13 - 3 = 10$ members are not officers. The chance any one name—Samara, in particular—is chosen from a group of 10 names is $\frac{1}{10}$, (H).
- (D) Mathematics/Statistics and Probability/Averages and Algebra/Creating, Evaluating, and Interpreting Algebraic Equations and Functions/Creating Algebraic Expressions.** The average of the 6 tests is equal to the sum of the 5 known test scores, 429, plus the unknown score, s , divided by 6: $85 = \frac{429 + s}{6}$, (D).
- (F) Mathematics/Geometry/Lines and Angles.** The sum of the measures of the angles in a quadrilateral is 360° (a quadrilateral is two triangles, each of which has interior angle measures of 180° each). Therefore, $360^\circ = 100^\circ + 75^\circ + 65^\circ + \angle C \Rightarrow \angle C = 360^\circ - 240^\circ = 120^\circ$, (F).
- (C) Mathematics/Geometry/Triangles/Properties of Triangles.** The item stem states that the triangles are similar, so the ratio of their corresponding sides are in proportion. In $\triangle ABC$, the lengths of the two smaller sides are equal, so the same must be true of any triangle similar to $\triangle ABC$: the missing side length in $\triangle DEF$ is the same as the other shorter side, 3. The perimeter of $\triangle DEF$ is $3 + 3 + 5 = 11$, (C).

8. (G) **Mathematics/Arithmetic/Common Arithmetic Items/Absolute Value.** Perform the calculations indicated inside the absolute value symbols: $|3(-2) + 4| = |-6 + 4| = |-2|$. The absolute value of any nonzero number is positive: $|-2| = 2$, (G).
9. (A) **Mathematics/Algebra/Solving Quadratic Equations and Relations.** For the equation to be true, either of the terms in parentheses must be equal to 0: $x + a = 0$ or $x + b = 0$. Solve each for x : $x = -a$ and $x = -b$, (A).
10. (F) **Mathematics/Geometry/Circles and Lines and Angles.** Since \overrightarrow{JM} is tangent to the circle at point M , $\angle JMG = 90^\circ$, so $\angle MGJ < 90^\circ$ and $\angle MJL < 90^\circ$. The degree measure of an arc of a circle is equal to the measure of the central angle that intercepts that arc, so minor arc $\widehat{MK} < 90^\circ$ since $\angle MGJ < 90^\circ$. The diameter of the circle is \overline{LK} , so $\widehat{LM} + \widehat{MK} = 180^\circ$ and $\widehat{LM} > 90^\circ$. Since (F) is $\widehat{LM} > 90^\circ$, eliminate any choices that are equal to or less than 90° : (G), (H), and (K). Check (J): the intercepted arc for an angle inscribed in a semi-circle is 180° , so $\angle LHK = \frac{180^\circ}{2} = 90^\circ$. Therefore, \widehat{LM} , (F), is the only choice greater than 90° .
11. (B) **Mathematics/Statistics and Probability/Counting Methods.** Label the figure with the information given in the stem:



The overlapping section \overline{BC} is equal to the difference between the sum of the lengths of \overline{AC} and \overline{BD} and the length of \overline{AD} : $BC = (\overline{AC} + \overline{BD}) - \overline{AD} = (16 + 20) - 30 = 36 - 30 = 6$, (B).

12. (K) **Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Simple Equations.** To solve for x , first apply the distributive property to the right side of the equation: $12x = -8(10 - x) = -80 + 8x$. Subtract $8x$ from both sides: $12x - 8x = -80 \Rightarrow 4x = -80$. Divide by 4: $x = \frac{-80}{4} = -20$, (K).
13. (E) **Mathematics/Geometry/Rectangles and Squares.** The area of the aluminum foil that is exposed on the top surface of the cardboard is the difference between the area of the cardboard and the area of the cake. The area of the cake is $12(16) = 192$ square inches. The area of the cardboard, which extends beyond the edge of the cake on each side by 2 inches, is $(12 + 4)(16 + 4) = 16(20) = 320$. The difference between the two areas is $320 - 192 = 128$ square inches, (E).
14. (J) **Mathematics/Geometry/Solids.** The easiest solution to this item is to calculate the total volume of the cake and divide it by the total volume of each piece of cake. The total volume of the cake is $3(16)(12)$ cubic inches. The total volume of each cake piece is $2(2)(3)$ cubic inches. Therefore, the cake divides into $\frac{3(16)(12)}{2(2)(3)} = \frac{3(8)(4)}{2} = 3(8)(2) = 48$ pieces of cake, (J).

Testing
Tip



You should use your calculator for any arithmetic you can't do in your head easily or without possible error or when it will save test time.

Testing
Tip



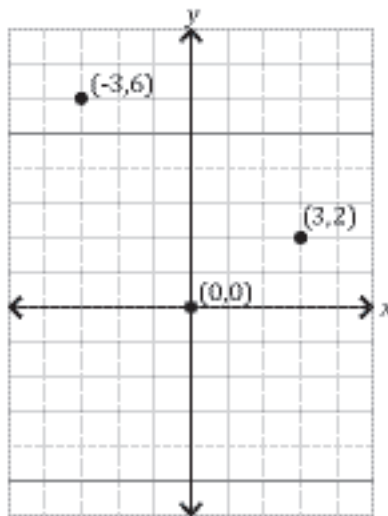
You don't need to use the midpoint formula to solve #16. You can sketch a coordinate plane with the given endpoints—counting the same units off each direction vertically and horizontally from each endpoint illustrates where the y -intercept must be.

15. (D) *Mathematics/Arithmetic/Multi-Step Arithmetic Application Items and Common Arithmetic Items/Percentages.* The total amount the club pays to Ken is \$5 for cake preparation, plus supplies, $\$1.73 + \2.67 , plus the tax on supplies, $0.05 (\$1.73 + \$2.67)$: $\$5 + (\$1.73 + \$2.67) + 0.05 (\$1.73 + \$2.67) = \$5 + 1.05 (\$1.73 + \$2.67) = \$9.62$, (D).

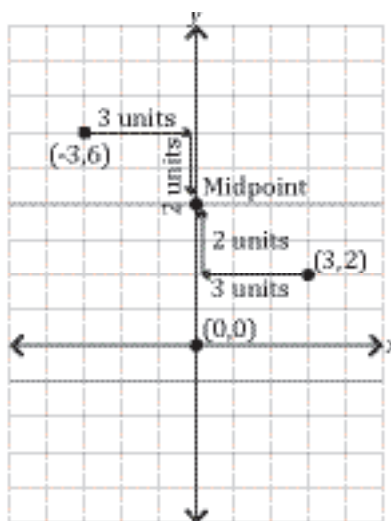
16. (H) *Mathematics/Coordinate Geometry/The Coordinate System, Distance and Midpoint Formulas, and Slope-Intercept Form of Linear Equations.* Since the x -coordinate of each endpoint is 3 units from the y -axis, the midpoint of the line corresponds to y -intercept.

You can determine the midpoint using the midpoint formula: the midpoint of a line with endpoints (x_1, y_1) and (x_2, y_2) has coordinates $\left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$. Therefore, the y -coordinate of the midpoint, which is the y -intercept, is $\frac{y_2 + y_1}{2} = \frac{2 + 6}{2} = 4$, (H).

You can also find the midpoint by sketching the given information on a coordinate graph. The points are at $(-3, 6)$ and $(3, 2)$:



The midpoint between the two points is halfway in between the points both horizontally and vertically:



Therefore, the y -intercept is 4, (H).

Testing
Tip



You'll be expected to know the slope-intercept form of a linear equation: $y = mx + b$, where m is the slope and b is the y -intercept.

You should also be familiar with the form of quadratic equations: $y = ax^2 + bx + c$, where a , b , and c are real numbers. Graphs of quadratics are parabolas. The direction of the parabola is indicated by a : if a is positive, the parabola opens upward; if a is negative, the parabola opens downward.

17. (D) **Mathematics/Arithmetic/Simple Manipulations.** The horizontal difference between the centers of the two holes is $11\frac{5}{8} - 2\frac{1}{16} - 4\frac{3}{4} = 11\frac{10}{16} - 2\frac{1}{16} - 4\frac{12}{16} = 10\frac{26}{16} - 2\frac{1}{16} - 4\frac{12}{16} = 4\frac{13}{16}$, (D).

18. (H) **Mathematics/Creating, Evaluating, and Interpreting Algebraic Equations and Functions/Creating Algebraic Equations, and Solving Algebraic Equations or Inequalities with One Variable/Simple Equations.** Create an equality between the depth of the first pond and the depth of the second pond after x weeks:

$$180 \text{ cm} - \frac{1 \text{ cm}}{\text{week}}(x \text{ weeks}) = 160 \text{ cm} - \frac{1}{2} \frac{\text{cm}}{\text{week}}(x \text{ weeks}) \Rightarrow 180 - x = 160 - \frac{1}{2}x$$

Solve the equation for x : $180 - 160 = x - \frac{1}{2}x \Rightarrow 20 = \frac{1}{2}x \Rightarrow x = 40$ weeks, (H).

19. (E) **Mathematics/Coordinate Geometry/Graphs of Linear Equations and Graphs of Quadratic Equations and Relations.** The equation of a line in the coordinate plane has the form $y = mx + b$. Therefore, the highest power on the x -variable in a linear equation is 1. This eliminates (A), (B), (C), and (D) because all of these equations have a power of x equal to 1. Only (E) has the x -variable raised to a power other than 1: $y = 5 - x^2$. Indeed, an equation with the x -variable squared represents a parabola in the xy -coordinate plane.

20. (G) **Mathematics/Trigonometry/Definitions of the Six Trigonometric Functions.** Define the basic trigonometric ratios for the given triangle. Start with the sine of A :

$$\sin A = \frac{\text{side opposite } A}{\text{hypotenuse}} = \frac{12}{13}$$

This is the expression given in (G), so (G) must be correct.

$$\text{Indeed, } \cos A = \frac{\text{side adjacent } A}{\text{hypotenuse}} = \frac{5}{13}, \text{ so (F) and (J) are incorrect; and}$$

$$\tan A = \frac{\text{side opposite } A}{\text{side adjacent } A} = \frac{12}{5}, \text{ so (H) is incorrect. And (K) is incorrect for the same reason that (G) is correct.}$$

21. (D) **Mathematics/Coordinate Geometry/The Coordinate System and Distance and Midpoint Formulas.** The item stem asks for the coordinates of the midpoint between point D and point B relative to point A . If point A is placed at the origin of the coordinate plane, the coordinates of point D are $(7, 9)$ and the coordinates of point B are $(10, 0)$. The midpoint of these two points is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{7 + 10}{2}, \frac{9 + 0}{2}\right) = \left(\frac{17}{2}, \frac{9}{2}\right) = \left(8\frac{1}{2}, 4\frac{1}{2}\right)$. Therefore, the fountain is $8\frac{1}{2}$ units to the right, or east, and $4\frac{1}{2}$ units up, or north, (D).

22. (H) **Mathematics/Algebra/Solving Quadratic Equations and Relations and Creating, Evaluating, and Interpreting Algebraic Equations and Functions/Functions as Models.** Set the function given for y as less than or equal to 150 and simplify: $\frac{3(x^2 + 10x)}{40} \leq 150 \Rightarrow x^2 + 10x \leq \frac{150(40)}{3} \Rightarrow x^2 + 10x - 2,000 \leq 0$. This is a quadratic, so factor the left side of the inequality: $x^2 + 10x - 2,000 = (x + 50)(x - 40)$. The inequality is true for $x = -50$ and $x = 40$, but speed can't be negative, so $x = 40$, (H), represents the maximum value for x that satisfies the inequality.

Testing
Tip



Use the SOH-CAH-TOA mnemonic to remember the definitions of the three basic trigonometric ratios:

$$\underline{s} \sin \alpha = \frac{\text{side opposite } \alpha}{\text{hypotenuse}}$$

$$\underline{c} \cos \alpha = \frac{\text{side adjacent } \alpha}{\text{hypotenuse}}$$

$$\underline{t} \tan \alpha = \frac{\text{side opposite } \alpha}{\text{side adjacent } \alpha}$$

Testing Tip



If it's not immediately evident how to factor the quadratic, you can use the quadratic formula to solve for x : for $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

This problem can also be solved using the “test-the-test” strategy. Start with the middle value, (H): substitute 40 for x in the given function, and evaluate. Since

$$\frac{3(40^2 + 10(40))}{40} = 3(40) + 10 = 130, \text{ this is less than 150. The question asks for the}$$

maximum value of x , so check the next larger value for x , 50: $\frac{3(50^2 + 10(50))}{40} = 225$, which is greater than 150. Therefore, (H) is the maximum possible value for x .

23. (A) *Mathematics/Algebra/Creating, Evaluating, and Interpreting Algebraic Equations and Functions/Function Notation.* First, evaluate $g(x) = \sqrt{x}$ for $x = 4$ and $f(x) = x^2 + x + 5$ for $x = 1$: $g(4) = \sqrt{4} = 2$ and $f(1) = 1^2 + 1 + 5 = 7$. Therefore, $\frac{g(4)}{f(1)} = \frac{2}{7}$, (A),

24. (K) *Mathematics/Statistics and Probability/Counting Methods.* The total number of combinations is equal to the product of the number of junior possibilities and the number of senior possibilities: $(125)(100) = 12,500$, (K).

25. (B) *Mathematics/Coordinate Geometry/Slope-Intercept Form of a Linear Equation and Statistics and Probability/Data Representation/Scatterplots.* The standard form of a linear equation is $y = mx + b$, where m is the slope and b is the y -intercept. According to the graph, the y -intercept of the line of best fit is 10, so eliminate (A) and (E). The data shows a decreasing relationship, so the slope is negative: eliminate (D). To choose between (B) and (C), calculate the slope. Choose two data points from the line that are easy to read, say (0,10) and (3,1): the slope is the change in y -values divided by the corresponding change in x -values: $m = \frac{\Delta y}{\Delta x} = \frac{1 - 10}{3 - 0} = \frac{-9}{3} = -3$. The slope in (B) is -3 and the slope in (C) is -2 , so (B) is the correct choice.

26. (F) *Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Inequalities Involving Absolute Value and Arithmetic/Common Arithmetic Items/Absolute Value.* Rather than solving the inequality, apply a little common sense and the test-the-test strategy. The absolute value of the difference between two numbers is the distance between the numbers on a number line. According to the given inequality, the distance between t and 24 must be at least 0 and no more than 30. Check the answer choices. Start with (F): the distance between -10 and 24 on a number line is 34, which is greater than 30, so (F) must be the correct choice.

To solve the item algebraically, determine the minimum and maximum values for t . To do this, solve the equation $|t - 24| = 30$ by setting the expression in the absolute value as equal to both -30 and 30 : $t - 24 = -30 \Rightarrow t = -6$ and $t - 24 = 30 \Rightarrow t = 54$. Therefore, the minimum and maximum values for t are -6 and 54 , respectively. Of the answer choices, only (F) is not in this range.

27. (D) *Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Simple Inequalities and Creating, Evaluating, and Interpreting Algebraic Equations and Functions/Creating Algebraic Equations.* Translate the given information into an inequality: $15 - 5n \geq 0$. Solve the inequality for n : $15 - 5n \geq 0 \Rightarrow 15 \geq 5n \Rightarrow n \leq \frac{15}{5} = 3$. Therefore, the possible values for n are all numbers greater than 3, (D).

Testing Tip



Rather than bothering with the algebra and factoring quadratic equations, test-the-test by substituting the answer choice values into the given equation—only the correct choice will work.

Testing Tip



The Fundamental Counting Principle states that if one event has m possible outcomes and a second independent event has n possible outcomes, then there are $(m)(n)$ possible outcomes for the two events together. The principle expands to include any number of independent events.

Testing
Tip:



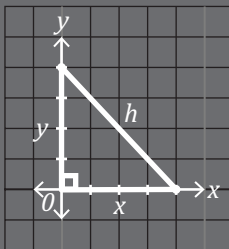
The advice to start with the middle choice when testing-the-test doesn't apply to items with thought-reversers, since only the incorrect choice will not work in the equation or inequality.

Testing
Tip



Let the expressions guide you. When presented with algebraic expressions and asked for equivalent expressions, look to the item stem expression, as well as the answer choice expressions, for ideas about simplification and the direction to take.

Testing
Tip

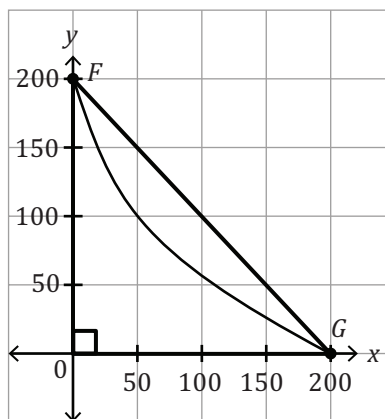


Know the
Pythagorean
theorem:
 $x^2 + y^2 = h^2$

28. (F) **Mathematics/Algebra/Solving Quadratic Equations and Relations and Manipulating Algebraic Expressions/Factoring Expressions.** Since both the numerator and the denominator of the expression include polynomial factors and quadratic expressions, it's likely that the factors of one or both of the quadratics will match and cancel. Start by factoring out the matching factor to see if a second factor can be found. Indeed, the factors work:

$$\frac{(x^2 + 8x + 7)(x - 3)}{(x^2 + 4x - 2)(x + 1)} = \frac{(x + 1)(x + ?)(x - 3)}{(x - 3)(x + ?)(x + 1)} = \frac{(x + 1)(x + 7)(x - 3)}{(x - 3)(x + 7)(x + 1)} = 1, \text{ (F).}$$

29. (B) **Mathematics/Statistics and Probability/Measures of Center and Spread.** The median of an odd numbered data set is equal to the middle value when the numbers are arranged in order. The addition of 2 data values less than the median and 2 data values more than the median will have no change on the median value—the middle value remains the same, (B).
30. (K) **Mathematics/Geometry/Circles and Complex Figures.** The area of the shaded region is the difference between the area of the larger circle and the area of the smaller circle. The area of a circle is πr^2 , where r is the radius, so the area of the larger circle is $\pi(10)^2 = 100\pi$ square centimeters and the area of the smaller circle is $\pi\left(\frac{10}{2}\right)^2 = \pi(5)^2 = 25\pi$ square centimeters. Therefore, the shaded area is $100\pi - 25\pi = 75\pi$ square centimeters, (K).
31. (E) **Mathematics/Arithmetic/Common Arithmetic Items/Properties of Numbers and Statistics and Probability/Averages.** The average of two numbers is the sum divided by 2: $\frac{+|a| + (-|b|)}{2} = \frac{|a| - |b|}{2}$. Whether this expression is positive or negative depends on whether $|a| > |b|$ or $|a| < |b|$. Therefore, the sign cannot be determined without additional information, (E).
32. (G) **Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Concepts of Domain and Range.** To determine the y -coordinate, substitute 20 for x in the given function for y and evaluate: $y = 0.005x^2 - 2x + 200 = 0.005(20)^2 - 2(20) + 200 = 162$, (G).
33. (D) **Mathematics/Geometry/Triangles/Pythagorean Theorem and Coordinate Geometry/The Coordinate System.** The length of \overline{FG} is the hypotenuse of a right triangle with sides of 200 units each:



Apply the Pythagorean theorem to determine the length of \overline{FG} : the square of the hypotenuse is equal to the sum of the squares of the sides. Therefore, $FG^2 = 200^2 + 200^2 = 40,000 + 40,000 \Rightarrow FG = \sqrt{80,000} \approx 283$, (D).

Testing Tip



Know the difference between mean, median, and mode.

Mean is the average of a data set, which is the sum of the values divided by the number of values.

Median is the middle value of a data set when arranged in order. If there is an even number of values, the median is the average of the two middle values.

Mode is the value in a data set with the greatest frequency. A data set can have no mode, a single mode, or multiple modes.

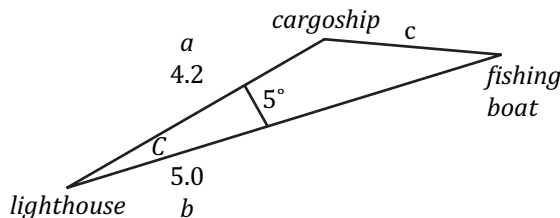
Testing Tip



You should use your calculator to do any arithmetic that isn't easy to do in your head.

34. (F) **Mathematics/Geometry/Triangles/Properties of Triangles.** Based on the figure, the shaded area under the curve is less than the area of the triangle with hypotenuse \overline{FG} . The area of the triangle is 20,000 square units, so the area of the shaded area is less than 20,000 square units because the curve lies under \overline{FG} , (F).

35. (B) **Mathematics/Trigonometry/Trigonometric Relationships and Algebra/Manipulating Algebraic Expressions/Evaluating Algebraic Expressions.** This item requires you to identify a , b , and C in the given figure, and to substitute these values into the given function. To use the law of cosines, identify C in the figure. Since the angle at the lighthouse is the only angle with a measure, identify this angle as C . The side opposite C is c , and the remaining two sides are a and b :



$$\text{Therefore, } c^2 = a^2 + b^2 - 2ab \cos C \Rightarrow c = \sqrt{(4.2)^2 + (5.0)^2 - 2(4.2)(5.0) \cos 5^\circ}, \text{ (B).}$$

36. (F) **Mathematics/Algebra/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents.** The item asks for c in terms of a , so eliminate the b variable between the two equations by applying the rules of exponents: $a^3 = b$ and $b^2 = c$, so $b = \sqrt{c}$ and $a^3 = \sqrt{c} \Rightarrow c = (a^3)^2 = a^6$, (F).

37. (B) **Mathematics/Algebra/Creating, Evaluating, and Interpreting Algebraic Equations and Functions/Creating Algebraic Equations and Arithmetic/Multi-Step Arithmetic Application Items.** According to the given information, the cost

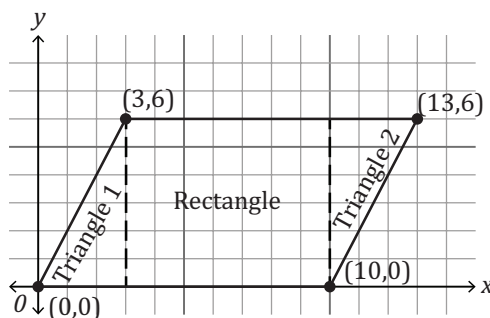
at Sea Horse is $\frac{\$50}{\text{day}}(2 \text{ days}) + \frac{\$0.25}{\text{mile}}(x \text{ miles})$ and the cost at Ocean Blue is

$\frac{\$60}{\text{day}}(2 \text{ days}) + \frac{\$0.20}{\text{mile}}(x \text{ miles})$. Set each equal to \$255 and solve for x , the number of miles:

$$255 = 100 + 0.25x \Rightarrow x = 4(155) = 620 \text{ and } 255 = 120 + 0.2x \Rightarrow x = 5(135) = 675.$$

Therefore, the rental at Ocean Blue allows for $675 - 620 = 55$ more miles, (B).

38. (G) **Mathematics/Coordinate Geometry/The Coordinate System and Geometry/Rectangles and Squares.** Even if you don't remember that the area of a parallelogram is the product of the base and the height, you can see this in the figure by breaking the parallelogram into a rectangle and two triangles:



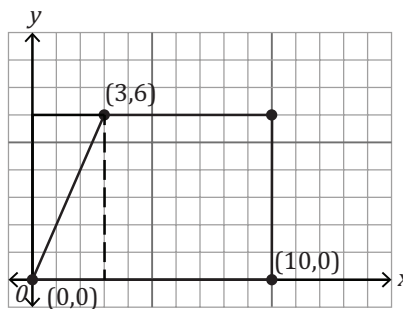
Testing Tip



You should be familiar with different sets of numbers:

Natural: all positive whole numbers plus zero
 Integers: all negative and positive whole numbers, plus zero
 Rational: all numbers that can be written as a ratio (fraction)
 Real numbers: all rational and irrational numbers
 Complex numbers: all real and imaginary numbers

The two triangles have equal area: from this, you can see that the area of the parallelogram is the same as the area of a rectangle with the same base and height:



The parallelogram has a height of 6 units and a base of 10 units: the area is $6(10) = 60$ square units, (G).

39. (E) **Mathematics/Arithmetic/Common Arithmetic Items/Properties of Numbers.** The set of natural numbers includes all positive integers. The addition of two natural numbers is also a natural number. Since every other set of numbers includes the set of natural numbers, (E) is correct.
40. (G) **Mathematics/Arithmetic/Simple Manipulations.** The perfect square in question is between 1,000 and 9,999. To ease calculations, work with 1,000 and 10,000. If n represents the number, then $\sqrt{1,000} < \sqrt{n} < \sqrt{10,000} \Rightarrow \sqrt{10(100)} < \sqrt{n} < \sqrt{10(1,000)} \Rightarrow 10 < \sqrt{n} < 10\sqrt{10}$. The square root of 10 is less than 10, so \sqrt{n} must have two digits, (G).
41. (C) **Mathematics/Statistics and Probability/Probability and Data Representation/Tables.** The expected number of rooms that will be occupied is equal to the sum of the products of each room occupancy and the probability of that occupancy. The table gives the occupancy rates, so the occupancies are the rates times the capacity, 80: $(0.2)(0.6)(80) + (0.4)(0.7)(80) + (0.3)(0.8)(80) + (0.1)(0.9)(80) = (0.12 + 0.28 + 0.24 + 0.09)(80) = (0.73)(80) \approx 58$, (C).
42. (F) **Mathematics/Arithmetic/Common Arithmetic Items/Matrices and Vectors.** To multiply matrices, the number of columns in the first matrices must be equal to the number of rows in the second matrix. The dimensions of the resulting product is determined by the number of rows in the first matrix, l , and the number of columns n in the second matrix: $[l \times m][m \times n] = [l \times n]$. The matrices in the item stem are 3×1 and 1×3 , so the resulting product has size 3×3 , which eliminates (H), (J), and (K). To multiply two matrices, multiply the elements of each row of the first matrix by the elements of each column in the second matrix and add the products. In this case, there's no addition necessary:
$$\begin{bmatrix} a \\ 2a \\ 3a \end{bmatrix} \begin{bmatrix} 1 & 0 & -1 \end{bmatrix} = \begin{bmatrix} a & 0 & -a \\ 2a & 0 & -2a \\ 3a & 0 & -3a \end{bmatrix}, \text{ (F)}$$
43. (D) **Mathematics/Geometry/Lines and Angles.** The angle measure of a straight line is 180° , so $(4x + 6)^\circ + 2x^\circ = 180^\circ \Rightarrow 6x^\circ + 6^\circ = 180^\circ \Rightarrow x^\circ + 1^\circ = 30^\circ \Rightarrow x^\circ = 29^\circ$. Therefore, the measure of the smaller angle is $2x^\circ = 2(29^\circ) = 58^\circ$, (D).

Testing Tip



Don't work out the entire matrix product. After eliminating (H), (J), and (K), you only need check any of the elements in either matrix that are not identical in both. For example, multiply the second row element in the first matrix by the first column element in the second matrix: $2a$. This is enough to determine the answer is (F).

Testing Tip



Use units in equations and expressions. As long as you include units so that like units cancel, leaving the expression with the correct units, you can be sure you've set up the expressions correctly.

44. (F) Mathematics/Algebra/Manipulating Algebraic Expressions/Evaluating Expressions.

According to the given information, the new value of b is the original b minus 1 and the new value of c is the old value plus 2. Reevaluate the expression for a using these new values for b and c : $a = 2(b - 1) + 3(c + 2) - 5 = 2b - 2 + 3c + 6 - 5 = 2b + 3c - 1$. Since the original expression for a is $2b + 3c - 5$, the change in a between the two expressions is $+4$, an increase of 4, (F).

45. (C) Mathematics/Arithmetic/Common Arithmetic Items/Proportions and Direct-Inverse Variation. Create a proportion between the unknown amount of fertilizer, in gallons, per 0.5 acres and the given rate of 1 ounce fertilizer per 40 square feet:

$$\frac{x \text{ gallons}}{0.5 \text{ acres}} = \frac{1 \text{ ounce}}{40 \text{ sq. ft.}} \Rightarrow x \text{ gallons} = \frac{1 \text{ ounce}}{40 \text{ sq. ft.}} (0.5 \text{ acres})$$

Use the unit conversions to make the right side units match the left side units:

$$x \text{ gallons} = \frac{1 \text{ ounce}}{40 \text{ sq. ft.}} (0.5 \text{ acres}) \left(\frac{434,560 \text{ sq. ft.}}{1 \text{ acre}} \right) \left(\frac{1 \text{ gallon}}{128 \text{ ounces}} \right) \Rightarrow x = \frac{0.5(434,560)}{40(128)}, \text{ in units of gallons, (C).}$$

Testing Tip



Draw a figure to help visualize the given scenario.

46. (J) Mathematics/Statistics and Probability/Counting Methods. This problem is simplified by sketching the scenario. All the booths are occupied by at least one person, so draw 10 booths with 1 person in each:

$$\frac{X}{1} \quad \frac{X}{2} \quad \frac{X}{3} \quad \frac{X}{4} \quad \frac{X}{5} \quad \frac{X}{6} \quad \frac{X}{7} \quad \frac{X}{8} \quad \frac{X}{9} \quad \frac{X}{10}$$

Now, we want the greatest number of booths to have 4 people each, so of the remaining 10, 3 groups of 3 each can be added to the first 3 booths, leaving 1 person to be added to the next booth:

$$\frac{XXXX}{1} \quad \frac{XXXX}{2} \quad \frac{XXXX}{3} \quad \frac{XX}{4} \quad \frac{X}{5} \quad \frac{X}{6} \quad \frac{X}{7} \quad \frac{X}{8} \quad \frac{X}{9} \quad \frac{X}{10}$$

Therefore, the greatest number of booths with 4 people each is 3, (J).

Testing Tip



Remember this mnemonic to recall the signs of the trigonometric ratios in the four quadrants: **All Students Take Cambridge**

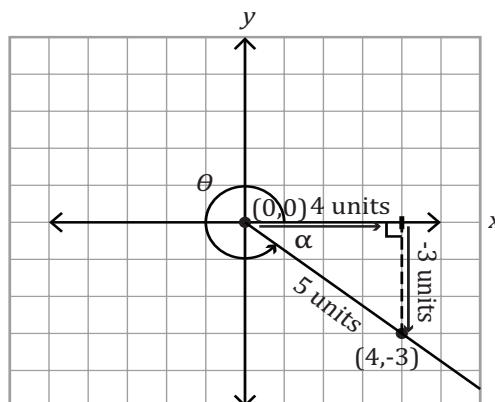
This means that **All** the ratios are positive in the first quadrant, **Sine** (and secant) is positive in the second quadrant, **Tangent** (and cotangent) is positive in the third quadrant, and **Cosine** (and cosecant) is positive in the fourth quadrant.

47. (D) Mathematics/Statistics and Probability/Probability. The probability that two independent event occur is the product of the individual probabilities. The item stem defines $P(A)$ as the probability that Event A occurs, and $P(A \cap B)$ as the probability that both A and B occur. Therefore, if $P(B)$ denotes the probability that Event B occurs, $P(A \cap B) = P(A) \cdot P(B)$, (D).**48. (J) Mathematics/Trigonometry/Determining Trigonometric Values.** To determine the value of $\cos \theta$, which is in Quadrant IV, find the value of the reference angle. The reference angle is the smallest angle made from the terminal side of an angle with the x -axis. Mark the reference angle as α , paying attention to the signs of the x - and y -coordinates:

Testing
Tip

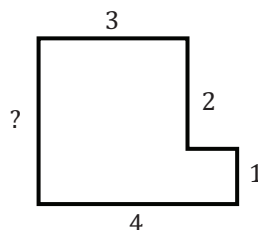


Know the Pythagorean triples. A Pythagorean triple is a set of three integers, a , b , and c , that form the sides of a right triangle. Common triples are 3-4-5, 5-12-13, and 8-15-17.



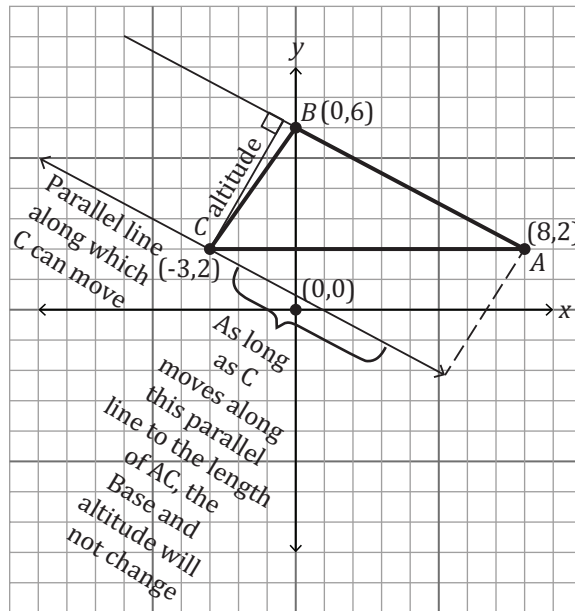
$$\text{Therefore, } \cos \alpha = \frac{\text{side adjacent } \alpha}{\text{hypotenuse}} = \frac{4}{5}, \text{ (J)}$$

49. (A) **Mathematics/Arithmetic/Common Arithmetic Items/Properties of Numbers and Absolute Value.** The expression in statement I is equal to the absolute value of x , since the square root of a number squared is the absolute value of the original number: $\sqrt{(-x)^2} = |x|$. The expression in statement II is also equal to the absolute value of x : $|-x| = |x|$. So, I and II are equal. As for statement III, this value is always negative, so it cannot be equal to statements I or II, both of which are always positive. Therefore, the correct answer is (A).
50. (K) **Mathematics/Geometry/Lines and Angles.** Check each answer choice. (F) is true because \overline{AB} is perpendicular to \overline{AD} , which is perpendicular to \overline{EF} , so \overline{AB} is parallel to \overline{EF} . (G) is true because $\angle DEB = 90^\circ$, so \overline{DE} must be perpendicular to \overline{BE} . (H) is true because the vertical angles formed by intersecting lines \overline{BE} and \overline{AD} must be equal, so $\angle ACB$ is congruent to $\angle FCE$. (J) is true because $\angle BAC = \angle CFE$ and $\angle ACB = \angle ECF$, so $\angle ABC = \angle CEF$ and $\triangle BAC$ is similar to $\triangle EFC$. Therefore, by the process of elimination, (K) must be false. Indeed, \overline{CE} is only congruent to \overline{ED} if $\angle ECF = \angle EDF$, and nothing in the figure makes this true.
51. (D) **Mathematics/Geometry/Rectangles and Squares.** There are two lengths missing from the perimeter of the figure:



Since the line segments are all either horizontal or vertical, the missing left side length is equal to the sum of the right side lengths: $2 + 1 = 3$. Similarly, the missing horizontal length is equal to the difference between the two other horizontal lengths: $4 - 3 = 1$. Therefore, the perimeter of the figure is $3 + 2 + 1 + 1 + 4 + 3 = 14$, (D).

52. (F) *Mathematics/Coordinate Geometry/Coordinate Geometry/Slope of a Line and Geometry/Triangles/Properties of Triangles.* The area of $\triangle ABC$, which is half the product of the base and the altitude, doesn't change as long as the base and altitude of the triangle don't change. For the base and altitude of the triangle not to change regardless of where point C is, the altitude must be perpendicular from point C to the base \overline{AB} (or extension thereof). Therefore, as long as point C moves along a line parallel to length \overline{AB} , the base and the altitude do not change:



The line on which point C can move without changing the area of $\triangle ABC$ is parallel to the base AB , so it has the same slope as the base: $\frac{\Delta y}{\Delta x} = \frac{2-6}{8-0} = \frac{-4}{8} = -\frac{1}{2}$, (F).

53. (D) *Mathematics/Algebra/Evaluating Sequences.* The simplest solution to this item is to work through the numbers by hand. Since Marshall made 24 calls the first day, and 5 more on each consecutive day for 20 days, list the calls each day: 24, 29, 34, 39, 44, 49, 54, 59, 64, 69, 74, 79, 84, 89, 94, 99, 104, 109, 114, and 119. Notice that the sum of 24 and 119 is 143, the sum of 29 and 114 is 143, and so on through the list of numbers:

$$\begin{array}{llll} 24 + 119 = 143 & 39 + 104 = 143 & 54 + 89 = 143 & 69 + 74 = 143 \\ 29 + 114 = 143 & 44 + 99 = 143 & 59 + 84 = 143 & \\ 34 + 109 = 143 & 49 + 94 = 143 & 64 + 79 = 143 & \end{array}$$

Therefore, the sum of the values is $10(143) = 1,430$, (D).

54. (K) *Mathematics/Coordinate Geometry/Graphs of Quadratic Equations and Relations, Graphs of Linear Equations, and Algebra/Expressing and Evaluating Algebraic Functions/Concepts of Domain and Range.* Each of the graphs in the answer choices includes a parabola and two straight lines. A quick comparison of the graphs indicates a lot of overlap between the straight lines, but the parabolas all have distinct endpoints at $x = 1$. So, ignore the linear equations and focus on the quadratic $x^2 - 2$, which corresponds to the parabola. Substitute 1 for x and evaluate: $f(1) = 1^2 - 2 = -1$. Check the answer choices: only the parabola in (K) equals -1 for $x = 1$.

Testing Tip



Know the formula for ordered combinations.

When a combination of n objects depends on the order, and the objects are selected r at a time, the number of combinations is $\frac{n!}{(n-r)!}$.

Testing Tip



Don't be intimidated by items requiring you to evaluate expressions involving complex numbers. Treat the i terms as variables, apply the rules for working with algebraic equations, and replace any i^2 terms with -1 .

55. (D) **Mathematics/Statistics and Probability/Counting Methods.** Since each selection of 5 objects depends on the previous selection (since those 5 objects are no longer available to be chosen), the combination is ordered. For ordered combinations, the number of permutations of n objects taken r at a time is $\frac{n!}{(n-r)!}$. In this case, $n = 15$ and $r = 5$, so

$$\frac{n!}{(n-r)!} = \frac{15!}{(15-5)!}, \text{ (D)}$$

56. (K) **Mathematics/Arithmetic/Common Arithmetic Items/Complex Numbers and Algebra/Basic Algebraic Expressions/Evaluating Expressions.** To move the radical term and the complex number out of the denominator of the fraction, multiply both the numerator

$$\text{and the denominator by the complex conjugate of the denominator: } \frac{i}{\sqrt{x}-i} \cdot \frac{\sqrt{x}+i}{\sqrt{x}+i} = \frac{i(\sqrt{x}+i)}{(\sqrt{x}-i)(\sqrt{x}+i)} = \frac{i\sqrt{x}+i^2}{x-i^2} = \frac{i\sqrt{x}-1}{x+1} \text{ (K)}$$

57. (E) **Mathematics/Arithmetic/Common Arithmetic Items/Matrices and Vectors.** In unit vector notation, the coefficient of the \mathbf{i} term is the change in x over the length of the vector and the coefficient of the \mathbf{j} term is the corresponding change in y . For vector \overrightarrow{AB} , the coordinates of point A are $(-6, 2)$ and the coordinates of point B are $(3, 4)$, so the unit vector notation is $(3 - (-6))\mathbf{i} + (4 - 2)\mathbf{j} = 9\mathbf{i} + 2\mathbf{j}$. For vector \overrightarrow{CD} , the coordinates of points C and D are $(4, -2)$ and $(4, 3)$, respectively, so the unit vector notation is $(4 - 4)\mathbf{i} + (3 - (-2))\mathbf{j} = 5\mathbf{j}$. To add the vectors, add similar terms: $9\mathbf{i} + 2\mathbf{j} + 5\mathbf{j} = 9\mathbf{i} + 7\mathbf{j}$, (E).

58. (J) **Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Functions as Models, Manipulating Algebraic Expressions/Evaluating Expressions, and Arithmetic/Common Arithmetic Items/Rates and Ratios.** Solve the given equation for the length of the string as a function of time t : $t = 2\pi\sqrt{\frac{L}{32}} \Rightarrow \sqrt{\frac{L}{32}} = \frac{t}{2\pi} \Rightarrow L = 32\left(\frac{t}{2\pi}\right)^2$. Create a ratio of the length of Pendulum 1 to the length of Pendulum 2: $\frac{L_1}{L_2} = \frac{32\left(\frac{t_1}{2\pi}\right)^2}{32\left(\frac{t_2}{2\pi}\right)^2} = \frac{t_1^2}{t_2^2}$. Since the time for Pendulum 1 is 3 times that of Pendulum 2, $t_1 = 3t_2$ and $\frac{L_1}{L_2} = \frac{t_1^2}{t_2^2} = \frac{(3t_2)^2}{t_2^2} = 9$. Therefore, the length of Pendulum 1 is 9 times the length of Pendulum 2, (J).

59. (A) **Mathematics/Algebra/Manipulating Algebraic Expressions/Logarithmic Expressions.** A logarithm represents the power to which the base must be raised to produce a given number. In other words, logarithms are the inverse of exponentials: $y = b^x$ is equivalent to $\log_b y = x$. The item stem asks for $\log_a (xy)^2 = ?$, which is the same as $a^? = (xy)^2$. Rewrite the given logarithms as the inverse exponentials: $\log_a x = s \Rightarrow a^s = x$ and $\log_a y = t \Rightarrow a^t = y$. Therefore, $(xy)^2 = (a^s)^2 (a^t)^2 = a^{2s} a^{2t} = a^{2s+2t} = a^{2(s+t)}$ and $a^? = (xy)^2 = a^{2(s+t)} \Rightarrow ? = 2(s+t)$, (A).

60. (F) **Mathematics/Arithmetic/Common Arithmetic Items/Percentages.** If x represents the distance in 1990, a 10% increase in 1991 makes the distance in 1991 equal to $1.1x$. Similarly, a 20% increase in 1992 makes the distance in 1992 equal to $1.2(1.1x) = 1.32x$. Therefore, the distance in 1992 is 1.32 times the distance from 1990, x , which is a 32% increase, (F).

Reading Test Explanations

1. **(A) Reading/Prose Fiction/Application.** This question asks you to apply an idea separate from the passage to the passage itself. If it were assumed that Germans were “tidy, meticulous, and industrious,” the passage overall would support this stereotype. The passage details Crown’s necessity of order (lines 20–23), accuracy, or meticulousness (lines 28–31), and industriousness, or modernity (lines 47–52), so the correct answer is (A). (B), (C), and (D) are all incorrect because they indicate some part of the passage weakens the assumed stereotype.
2. **(H) Reading/Prose Fiction/Implied Idea.** This question asks you to identify the chronological order of appointments. The first paragraph states Crown was preparing for a meeting Friday; the second meeting in question can be found in the third paragraph: “[H]e had an appointment at twelve for the weekly trim” (lines 17–18). It can be inferred that this appointment occurs that day, while the first appointment will happen Friday, so (H) is the correct answer.
3. **(B) Reading/Prose Fiction/Implied Idea.** Stefan Zwick is Crown’s chief clerk, who “originally resisted Joe’s suggest that he learn to operate a typewriter,” because “a quill pen” is better suited for him (lines 61–64). It’s only when Crown decides to hire a woman to operate the typewriter that Zwick obliges. Zwick’s reluctance to learn new technology indicates that he is not as open to it as Crown, (B).
4. **(F) Reading/Prose Fiction/Implied Idea.** Zwick’s response to Crown’s suggestion of hiring a woman to use the typewriter ignites a “blanch” from Zwick whose questions, “A woman? In my office” expresses his incredulity and opposition to the solution Crown proposed, so (F) “indignation” over the solution is the best answer. While Zwick’s questions can be inferred as panic, the visitor would not be a surprise as Crown clearly gives warning, so (G) is incorrect. (C) is wrong because Zwick has no problem speaking up about not wanting to learn the typewriter (lines 63–64), and (D) is wrong because if he was more concerned with the company’s image, he wouldn’t have protested learning the technology to begin with.
5. **(D) Reading/Prose Fiction/Explicit Detail.** As the wording of the question indicates, the answer can be found in the opening paragraph. Crown was a “worried man” about many things, the “most immediate being a civic responsibility” (lines 2–4), so (D) is the correct answer.
6. **(G) Reading/Prose Fiction/Explicit Detail.** This is an Explicit Detail item that asks you to find specific information about the type of student Crown was. The answer can be found in lines 33–34: “Though a mediocre student in most school subjects, at ciphering he was a prodigy,” so (G) is the correct answer.
7. **(C) Reading/Prose Fiction/Application.** This question tests your ability to apply information from the passage to a related scenario. The passage gives several examples of the types of questions Crown asked his employees in lines 42–46: “What is the exact temperature? How large is the population that is the market? How many barrels did we ship last week? What’s the cost, per square foot, of this expansion?” All of these questions concern accuracy, or specific numbers. Using these questions as a guide, it can be assumed Crown would not ask his employees about their weekend or brainstorming ideas, so both (A) and (D) can be eliminated. While (B) does ask about a specific detail, it concerns repair, not accuracy. Only (C) asks a question that would have to be answered with a specific number, just like the questions he asks of his employees in the passage.

8. **(H) Reading/Prose Fiction/Implied Idea.** The answer to this question can be found in the details provided about Crown's third principle, modernity. Crown's insistence on using the typewriter (lines 65–71) shows that the typewriter is considered new, so (F) can be eliminated. Line 58 makes specific mention of a "mechanical adding machine" that was a "pleasing ratchet," so (G) can be eliminated. While Crown does have an abacus in his office, described as an "ancient counting device" (line 39), he keeps it sitting on a low cabinet within reach, which indicates Crown doesn't see the device becoming obsolete, so (J) is incorrect. Only (H) is explicitly shown to be increasingly obsolete as it "makes Crown's look old-fashioned" (lines 66–67).
9. **(A) Reading/Prose Fiction/Development.** This question asks you to first identify the metaphor used to describe Crown's three principles, which can be found in lines 76–78: "Every solid house or building was supported by a strong foundation; and so there was a foundation on which Joe Crown's three principles rested." The comparison to buildings and foundation are tied to architecture, the designing of buildings, (A).
10. **(H) Reading/Prose Fiction/Explicit Detail.** This question requires you to identify the details provided in the passage that show Crown has been in business for a length of time. (F) can be eliminated because while the passage does state he had new refrigerators installed, this detail is given in the context of his commitment to modernity, so "new" here does not mean the previous refrigerators were old. (G) can also be eliminated because the cross-stitched phrase was a present from his wife could have been made at any time, and (J) is wrong because the only "bell" mentioned in the passage is associated with the typewriter—a new technology at the time. Only (H) provides a detail that indicates Crown's business is not new: "photographs of annual picnics," indicating that each year the company has these picnics.
11. **(D) Reading/Social Science/Development.** The best answer to this question is (D); the passage ends with Caroline's discovery and verification of it, but no information is provided about William's feelings toward it.
12. **(J) Reading/Social Science/Explicit Detail.** This is an Explicit Detail question that asks you to identify a specific comparison. The answer can be found in line 14: "The forty-foot would be higher than a house." This is a direct comparison to the 40-foot octagon tube in line 6, so the correct answer is (J), a house.
13. **(B) Reading/Social Science/Development.** This question asks about the development of the passage. The first four paragraphs discuss William Herschel and his work. The fifth paragraph starts with a description of the house, which build into how Caroline used the house for her work. The remaining paragraphs focus on Caroline's work, not Williams, so (B) is the best answer. (A) is incorrect because the fifth paragraph doesn't explain the methods she used for her comet sweeps, only where she did them. (C) is incorrect because the adjustments Caroline made for the telescope are in the sixth paragraph, not the fifth, and (D) is wrong because Caroline's techniques for observation are not being described here, but where she performed those observations.
14. **(H) Reading/Social Science/Development.** The passage provides an excerpt from Caroline's "Book of Work Done," so this question asks you to understand why the quote is being provided. The excerpt itself is about the comet, and the introduction of the excerpt shows her "growing excitement" about it, so (H) is the correct answer. (F) is wrong because the excerpt doesn't talk about her process, (G) is wrong because nothing in the passage indicates that she kept this book for William, and (J) is wrong because the excerpt doesn't say Dr. Blagden or Mr. Aubert had roles in finding it, only that she wanted to write to them about it.

Tip



Read questions carefully. In the previous question, you're asked specifically about a metaphor used to describe Crown's three principles. It would be easy to assume, based off what Crown's principles are, that "business" is a logical answer; however, once the metaphor or figurative comparison is identified, you see that's not the answer at all. Especially on questions that ask specifically about a literary term or device, find that term or device before answering the question.

15. (A) *Reading/Social Science/Vocabulary*. This item asks you to look at the context around a word to determine its meaning. “Finest” in line 12 is used in reference to adjustments to the large telescope William used for observations. The second paragraph says the telescope was so massive that it would have to be mounted by two workmen, but it would also have to be so precise that it could be adjusted in “fine” ways, (A). (B) is wrong because “fairest” is usually used to denote lightness, and the color of the telescope is not important, here. (C) is wrong because “finest” is used to indicate precision, and it would not make sense to describe that kind of accurateness as “thin.” (D) is incorrect because “great” refers to excellence or size, and the context of “finest” is used to show precision.
16. (J) *Reading/Social Science/Implied Idea*. This question asks you to infer an idea based of specific detail in the passage. The third paragraph states Caroline “would have to be shut in a special booth below to avoid light pollution, where she would have her desk and lamp” (lines 18–19). It can be inferred that the light of her lamp would “pollute” or interfere with William’s view of the night sky, (J). (F), (G), and (H) are incorrect because there is no evidence in the passage to support them.
17. (B) *Reading/Social Science/Explicit Detail*. Lines 25–27 states that William decided his project with the telescope “required a new house with larger ground for constructing and erecting” it. To meet these needs, the moved to the Grove, and the rest of the passage chronicles the discoveries made at that house, so (B) is the correct answer. (A) is incorrect because the passage doesn’t discuss William’s motivation to start his project. (C) is wrong because the passage doesn’t state why Caroline couldn’t calculate the coordinates; it only shows what she did because she couldn’t do the calculations. (D) is wrong because the passage doesn’t give details on how long it took Caroline’s comet to be confirmed, only that it happened quickly.
18. (F) *Reading/Social Science/Implied Idea*. A lot of detail is provided in the description of the telescope: “40 foot long and five feet in diameter,” it will need two, maybe three mirrors, it has to be mounted by two workmen (lines 6–10), it would be higher than a house, and William would have to climb several ladders to get to a viewing platform (lines 14–16). All of these details related to the telescope’s large size, so (F) is the correct answer. (G) can be eliminated because the telescope was so large it wouldn’t need a smaller frame. It could be reasonably assumed that because the telescope was so large it would have more magnifying power, but there are no details given about its power of observation, so (H) and (J) are wrong.
19. (C) *Reading/Social Science/Explicit Detail*. The answer to this question can be found in the description of the comet’s appearance, where it originally had been spotted moving through Ursa Major (lines 62–63). In lines 64–66: “It appeared to be descending, but barely perceptibly, towards a triangulation of stars in the beautifully named constellation Coma Berenices.” Only (C) captures this location.
20. (F) *Reading/Social Science/Implied Idea*. The answer to this question can be found in lines 67–70: “To find something so quickly, and in such a familiar place...seemed wildly unlikely,” suggesting that because how quick it was found in such a familiar place made it unlikely, (F).
21. (B) *Reading/Humanities/Main Idea*. The first two paragraphs of Passage A tell short stories about the disappointment readers of the author’s book faced when they realized that both the author herself, and her mother, were not exactly like the characters in the book. The rest of the passage discusses the difficulty of merging reality with writing, so (B) is the correct answer. While the stories do show that people wanted to meet the author after reading the book, that detail is not important to the main idea of the passage of authors’ realities in literature, so (A) can be eliminated. (C) is incorrect because while these anecdotes can

indicate frustration, the author “understood perfectly” (line 14) her reader’s reaction, and (D) is wrong because passage is concerned with showing the way reality affects nonfiction, not the classification of the categories.

22. (F) **Reading/Humanities/Explicit Detail.** The party guests was disappointed that the author was not like the narrator of the novel, as she had expected after reading the book, and the author and the narrator of the book are “not exactly the same” (line 16). The party guest was not upset that Gornick was more like her mother, so (G) can be eliminated; the “complicated insight” in the story refers to what Gornick had hoped to accomplish in her memoir, and the guest was disappointed in the difference between the narrator and the author, so both (H) and (J) are wrong.
23. (B) **Reading/Humanities/Explicit Detail.** The answer to this question can be found in lines 31–32: “At the heart of my memoir lay a revelation: I could not leave my mother because I had become my mother.” The author believes she has become her mother, which is the “heart” of her memoir, so (B) is the correct answer.
24. (J) **Reading/Humanities/Explicit Detail.** In the last paragraph of Passage A, the author states memoirs belong to literature, not journalism, because it is a “misunderstanding to read a memoir as though the writer owes the reader the same record of literal accuracy that is owed in newspaper reporting or historical narrative,” so (J) is the correct answer. (F) and (H) can be eliminated because the author uses these genres to show where memoirs do *not* belong, and (G) is wrong because there is no mention of personal diaries.
25. (C) **Reading/Humanities/Explicit Detail.** The author says Hemingway’s books are autobiographical nature as “his protagonists are often conscious projections and explorations of the self” (lines 55–56), so (C) is the correct answer. The emphasis on the autobiographical nature of Hemingway’s books indicates that his characters were rarely completely made up, so (D) can be eliminated, and while the author does discuss Hemingway’s friends, they are not attributed to his protagonists, so (A) and (B) are also wrong.
26. (F) **Reading/Humanities/Implied Idea.** Hemingway seemingly had an agenda to *A Moveable Feast* to “justify himself, for he felt that he had been unfairly portrayed by some of his contemporaries” (lines 66–68) which makes accuracy of the facts difficult as he was reinforcing a pattern he created: “an idealized self portrayal” (lines 82–83), so (F) is the correct answer.
27. (B) **Reading/Humanities/Application.** The last paragraph of Passage B states it is “impossible to verify” everything in *A Moveable Feast* and that Hemingway “clearly overlooked a great deal of material, distorted some, and generally selected the episodes so that they would show him as innocent, honest, dedicated, and thoroughly enjoying life”—reinforcing a particular view he wanted people to have of himself. Hemingway’s clear agenda makes it difficult to determine what is fact and what is fiction. (B) is the only choice that depicts this complexity.
28. (J) **Reading/Humanities/Implied Idea.** Both passages’ main idea is with the difficulty of shaping autobiographical accounts that often blur the lines between fact and fiction, using Gornick and Hemingway to demonstrate they each used select material from their lives to tell their memoirs, (J). (F) is wrong because the situations in their memoirs were not entirely made up, and (G) and (H) can be eliminated because they can only be attributed to Hemingway, not Gornick.
29. (C) **Reading/Humanities/Implied Idea.** This question asks you to infer an idea based on the overall idea of both passages. There is no evidence in either passage to suggest that authors should have the same creative freedom when writing memoirs as they do when writing novels, so (A) can be eliminated. There is also no evidence in either passage that supports writers should leave out events if they can’t remember them, or should only include details

Tip



Whenever you see a set of passages as you begin a section, try to make connections to themes and overall ideas between the passages as you read them. A basic understanding of how the two are similar and different will make it easier to answer questions that ask you to compare, contrast, or connect the passages.

that can be proved with evidence, so (B) and (D) are wrong. Only (B) captures the essence of both writers' plights: the art of finished product is more important than the details of the facts.

30. **(G) Reading/Humanities/Application.** This question asks you to apply your understanding of the passages to a quote from a different source. Passage A explores the complexity of trying to mold what really happened into what the memoirist makes of what happened, and Passage B delves into Hemingway's agenda into portraying himself in a certain light in his memoir, *A Moveable Feast*. The quote from another author echoes the idea that real life is not a story; a memoir—or what the author makes of real life—is, so (G) is the correct answer.
31. **(D) Reading/Natural Science/Main Idea.** The passage covers Suarez's research on colonizing ants and his observations about certain species of these ants, so (D) is the best answer. (A) is incorrect because the passage doesn't describe events that led to the discovery of Argentine ants; it details Suarez's research in finding them. (B) is wrong because Argentine ants aren't compared to other insects, and (C) is wrong because technology used by scientists to study ants is not emphasized in the passage.
32. **(G) Reading/Natural Science/Development.** This question asks you to make inferences about the language used in the passage. Suarez studies were done "the hard way" (lines 3–4), Suarez and Ward were the "guru of ant gurus" (line 27), and certain species "made bank"—all of which are idiomatic expressions or colloquial phrases that parallel a more causal, conversation-type tone, not often seen in scientific writing, so (G) is the correct answer.
33. **(C) Reading/Natural Science/Development.** This question asks about the chronological development of the passage. Suarez found the jars, then Suarez and Holway began classifying the ants, then Case started working with Holway and Suarez to study ant aggression, and the ants were brought together in 2009, a full decade after the initial finding of the jars. Suarez's discovery of the jars happened before anything else could, so (C) is the correct answer.
34. **(G) Reading/Natural Science/Main Idea.** This question tests your overall understanding of the fifth paragraph, and the first line of that paragraph gives the purpose of it: the possible future when pioneering groups start living somewhere new. The rest of the paragraph lists the possible futures, so (G) is the best answer.
35. **(D) Reading/Natural Science/Implied Idea.** The "strange thing" discussed in these lines is that the ants "accept each other" (line 58) and very few will "fight" (line 60). Because this is strange, it can be assumed that other colonies will fight or not get along, (D). (A) is incorrect because the lines in question do not deal with supercolonies. (B) is wrong because, in these lines, California Argentine ants are not being compared to other Argentine ants, and (C) is wrong because the ecosystem of California is not discussed in these lines.
36. **(F) Reading/Natural Science/Explicit Detail.** The answer to this question can be found in the first lines of the passage: "Like many biologists, Andrew V. Suarez struggled for years with the question of which colonizing organisms fail and which succeed" (lines 1–3). Only (F) shows that many biologists struggled with this plight.
37. **(D) Reading/Natural Science/Explicit Detail.** This question asks specifically about the ant samples Suarez found in the Smithsonian. These details can be found in the second paragraph when at "the museum" Suarez found few samples but what he found "besides them" was more interesting: "jars were jammed with vials of ants collected at the ports of entry in the eastern U.S.," (D). (A) is wrong because the second paragraph states very few samples were Argentine ants. (B) is wrong because Suarez didn't start working with Ward and Holway until after he found the jars at the museum, and (C) is wrong because there is no evidence in the passage to suggest the ants he found were an unidentified species, only "distinct species."

38. **(F) Reading/Natural Science/Explicit Detail.** The answer to this question can be found in line 52: Argentine ants are “squishy, small, and stingless wimps,” (F). (G) can be eliminated because the ants are described as “ecologically dominant” but they are also small, so they cannot be “physically dominant.” (H) is wrong because Suarez found the ants at the Smithsonian, not discovered them himself, and (J) is wrong because line 87 indicates the ants combined with colonies from Japan, but offers no evidence that they did not thrive.
39. **(B) Reading/Natural Science/Implied Idea.** When comparing the peaceful nature of the Argentine ants to other more aggressive ants in lines 69–71, the aggressive ants “wasted energy fighting (and dying), and so gathered less food and fared poorly, in general, so (B) is the best answer. Both (A) and (D) can be eliminated because lines 69–71 state aggressive ants died often fighting, which would make their colonies smaller, not larger and not make them a “survivor species,” and (C) is wrong because the passage doesn’t indicate that aggressive ants are less likely to live in a colony.
40. **(G) Reading/Natural Science/Explicit Detail.** The answer to this question is explicitly stated in the beginning of the last paragraph: “Ants flash chemical badges identifying their home nest,” (G). (F) is wrong because without the chemical markers, the ants can’t distinguish between friend and enemy, resulting in “peace” that makes it difficult to ascertain “colonies” as they turn into “supercolonies.” (H) is wrong because emphasis on the absence of chemical markers that result in swapping ants or combining colonies is used to show it is strange, or not normal, and (J) is wrong because the passage doesn’t state this supercolony is the largest in the world, only that a supercolony like this can exist and expand.

Testing Tip:



Before you answer the questions, first preview the passage. Don't bother reading the passage and graphs too thoroughly—just preview enough to get the gist of what's presented and where.

Testing Tip:



Don't oversolve. When you've found the correct choice, based on the stated conditions, don't bother checking the remaining choices. Make your selection and move on!

OUTSIDE KNOWLEDGE ALERT!



This item requires basic understanding of genetic heredity and chromosomes. Females have two X chromosomes and males have one X and one Y chromosomes. With sex-linked traits, affected females pass the trait to all their sons.

Science Test

Passage I: The passage summarizes a model for illustrating the inheritance of Trait G in a family. The introductory information describes how the trait is inherited and the figure illustrates the inheritance expression in four generations.

1. **(B) Science/Data Representation/Comprehension.** Each level in the figure shows another generation (as indicated by the connection between “mating” and “offspring” in the legend), so there are a total of four generations, (B).
2. **(G) Science/Data Representation/Analysis.** Compare the symbols of the individuals listed in each answer choice—the pair with the greatest genetic similarity will be in the same generation and both will have Trait G (black) or both will not have Trait G (white). Eliminate (F) because Individual 3 is white while Individual 4 is black. As for (G), both Individuals 12 and 13 are white, so they both are without Trait G, and (G) is the correct choice. Indeed, the individuals in (H) are in different generations and they don't match in (J).
3. **(D) Science/Data Representation/Application.** According to the passage, Trait G is a recessive trait. Offspring may or may not inherit a recessive trait if only one parent has it, but if both parents have the recessive trait, the offspring will inherit the trait. This is also shown in the figure: the only set of offspring that all inherit Trait G are the children of Individuals 9 and 10, who both have Trait G. Since Individuals 23 and 24 both have Trait G, all four children will have Trait G, (D).
4. **(H) Science/Data Representation/Comprehension.** According to the figure, the grandchildren of Individuals 1 and 2 are Individuals 10, 11, 12, 13, 15, 16, and 17. Of these, two have Trait G: Individuals 10 and 16, (H).
5. **(D) Science/Data Representation/Application.** This item tests application of basic genetics knowledge. Genes that are carried by either sex chromosome, X or Y, are sex-linked. Therefore, a sex-linked trait is one that is always passed from a mother to her sons. According to the figure, Individual 4 with Trait G did not pass it to her son, so Trait G is not a sex-linked trait, (D).
6. **(J) Science/Data Representation/Comprehension.** This item tests comprehension of what is stated in the passage and the figure. According to the passage, the Gene G genotype of Individual 21 is Gg , and according to the figure, Individual 21 does not have Trait G. This eliminates (F) and (G). The passage also states that Trait G is a recessive trait, so the correct choice is (J).

Passage II: The passage describes a study investigating the effects of different pollination treatments (described in Table 1) on fruit production (Figure 1) and seed mass (Figure 2) of a clonal Amazonian herb.

7. **(A) Science/Research Summary/Comprehension.** This item tests your understanding of the tools and functions of the tools used in this experiment. Figure 2 shows the average mass per seed, in milligrams. Of the answer choices, only a balance, (A), is used to measure mass. A pH meter, (B), is used to measure the pH of a solution. A telescope, (C), is an optical instrument used to make distance objects appear closer. And a thermometer, (D), is used to measure temperature.
8. **(G) Science/Research Summary/Comprehension.** The study investigates the effects of different pollination treatments, such as self-pollination and cross-pollination, as described in Table 1, on the percent of flowers that produced fruit (Figure 1) and the average seed mass (Figure 2), (G).

9. (A) **Science/Research Summary/Comprehension.** According to Table 1, Group 1 was self-pollinated, which means each flower was pollinated with pollen from its removed anthers. Therefore, the pollen received by each Group 1 flower was from the same plant as the flower, which is enough to choose (A). Indeed, according to Table 1, each Group 2 flower receives pollen from a different plant.
10. (H) **Science/Research Summary/Comprehension.** The data in Figure 1 are the percent of flowers that produced fruit for each group. Percentage is the ratio of the number of specified outcomes out of the total number of possible outcomes multiplied by 100, or in this case, $\frac{\text{number of flowers producing fruit}}{\text{total number of flowers}} \times 100$, (H).

11. (B) **Science/Research Summary/Analysis.** According to Table 1, the self-pollinated group of flowers were pollinated with pollen from its removed anthers. It can be inferred that the anthers were removed from the flowers in all of four groups so that the flowers wouldn't spontaneously self-pollinate, (B).
12. (G) **Science/Research Summary/Analysis.** If the nylon bags were successful in preventing the normal pollinators from pollinating the flowers, then the group that received no pollination—Group 4—would not produce any fruit. Indeed, Figures 1 and 2 confirm that the flowers in Group 4 were not pollinated by the normal pollinators, (G).
13. (D) **Science/Research Summary/Analysis.** The data in Figure 2 are the average mass per seed for each group. In order to determine the total mass of the seeds, the number of seeds must be known. While the number of flowers in each group is known (100 flowers per group), no information is given about the number of seeds produced per flower. Therefore, the answer cannot be determined based on the given information, (D).

Passage III: The passage describes a study investigating the emissions by aerobic and anaerobic bacteria in wetland bog and fen soil samples after different amounts of water were added to produce three water table levels (+1 cm, -10 cm, and -20 cm). The gas emission data from the bog soil samples are presented in Figure 1; the gas emission data from the fen soil samples are presented in Figure 2.

14. (H) **Science/Research Summary/Analysis.** Since the point of the study is to investigate the gas emissions by both aerobic and anaerobic bacteria as they break down organic matter, the researchers would conduct the study at a time when the bacteria break down matter fastest. The research is conducted in summer, so it can be inferred that both aerobic and anaerobic bacteria break down organic matter more rapidly in summer than in winter, (H).
15. (A) **Science/Research Summary/Analysis.** This item requires analysis of the relationships between the data in the four graphs. According to the left-hand graphs in Figure 1 and Figure 2, the total CO₂ emissions by the soil sections increase with decreasing water tables. This eliminates (B) and (D). According to the right-hand graphs, the CH₄ emissions decrease with decreasing water tables. Therefore, the correct choice is (A).
16. (F) **Science/Research Summary/Comprehension.** This item tests your understanding of the methods used in the study. The soil sections and water were kept in closed tanks that each contained an instrument for measuring the gas emissions. Over the course of three months, the emissions were measured, and ultimately the total emissions were graphed as a function of water table level. It can be inferred that the tanks were sealed for the entire period to ensure that minimum amounts of gas leaked from the tanks, (F).

OUTSIDE
KNOWLEDGE
ALERT!

You should be familiar with the basic tools and functions of those tools used in experiments: balance, thermometer, stop watch, pH meter, Bunsen burner, voltage meters, etc. Any uncommon tools will be described in the passage.

Testing
Tip

Don't oversolve. Once you've determined the first part of the answer choice, and this is enough to eliminate all but the correct choice, don't bother with the rest of the answer choice. Make your selection and move on!

17. (D) **Science/Research Summary/Analysis.** Gas is produced as the aerobic and anaerobic bacteria break down the organic matter. It's inferable that the greater the level of nutrients in the matter, the greater the gas emissions produced by the bacteria. Compare the left-hand graphs in Figures 1 and 2: the CO₂ emissions by the aerobic bacteria are higher from the fen soil sections than from the bog soil sections. Compare the right-hand graphs: the CH₄ emissions by the anaerobic bacteria are also higher from the fen soil sections. Therefore, the correct choice is (D).

18. (F) **Science/Research Summary/Analysis.** The water table level refers to where the water level is relative to the top of the soil section—the soil sections are completely submerged for the +1 cm water table levels only. According to the passage introduction, aerobic bacteria produce CO₂ when they break down organic matter. The left-hand graphs for both of the soil sections show total CO₂ emissions greater than zero for the +1 cm water table level, so aerobic bacteria were present in those sections, (F).

19. (C) **Science/Research Summary/Analysis.** The item stem asks for the average CO₂ emission per month and directs you to the lower left-hand graph—the -10 cm water table level in particular, for which the CO₂ reading is approximately 48 mol C/m². The first sentence of the last paragraph of the passage states that the study was performed for

3 months. Therefore, the average emission per month is $\frac{48}{3} = 16$ mol C/m², (C).

20. (J) **Science/Research Summary/Comprehension.** (F) and (G) are both wrong because the tanks are sealed—the amount of precipitation or the types of plants present outside the tank would not affect the results. (H) is wrong because the volume of soil is fixed in each of the tanks, so the volume of soil has nothing to do with placing the tank near the outdoor site. Therefore, by the process of elimination, (J) must be correct. Indeed, the hours of daylight that the tanks are exposed to would affect the activity of the bacteria, so placing them near the wetlands would ensure that they receive a similar amount of daylight.

Passage IV: The passage describes three studies in which students calculated the average vertical, horizontal, and net forces per hinge for a variety of doors as a function of distance between the hinges. Figure 1 reports the average horizontal and vertical forces per hinge for one door; Figure 2 reports the average net force per hinge for three doors of various weights; Figure 3 reports the average net force per hinge for three doors of various widths.

21. (B) **Science/Research Summary/Comprehension.** The mass of the door in Studies 1 and 3 was 61 lb. Study 2 investigated three doors of three different masses—the greatest mass was 76 lbs. Therefore, Study 2 tested the door with the greatest mass, (B).

22. (F) **Science/Research Summary/Comprehension.** In Study 2, the mass of the door, W , was varied (and D held constant), which eliminates (G) and (J). In Study 3, the width of the door, D , was varied (and W held constant), so (F) is the correct choice.

23. (D) **Science/Research Summary/Analysis.** According to Figure 2, for a given S , $F_{n,av}$ increases for increasing door mass. A door of mass 90 lb would have a $F_{n,av}$ value greater than the corresponding value for $W = 56$ lb at $S = 50$ in, which is slightly more than 45 lb. Therefore, the answer is greater than 45 lb, (D).

24. (H) **Science/Research Summary/Analysis.** According to Figure 1, for S less than 30 in, the $F_{h,av}$ value is greater than the $F_{v,av}$ value; for S greater than 30 in, the $F_{h,av}$ value is less than the $F_{v,av}$ value. Therefore, the correct choice is (H).

Testing
Tip



Skim the passage. This passage has a lot of parts and figures, so don't get bogged down in the details. Preview the passage and figures to get a general idea of what's presented and where.

**OUTSIDE KNOWLEDGE ALERT!**

A chemical equation is the symbolic representation of a chemical reaction—the reactants are on the left side of the arrow and the products are on the right side of the arrow. In a balanced equation, the number of atoms of each element are equal before and after the reaction.

**Testing Tip**

This passage is mostly just data presentations. Don't bother with spending much time on the passage at all—the items will direct you to the relevant information.

**Testing Tip**

Don't solve for more information than is actually needed to answer an item. Previewing the answer choices can help you strategize your solution so you can answer as quickly as possible.

25. **(B) Science/Research Summary/Analysis.** In Figure 2, the lowest $F_{n,av}$ value is for $W = 51$ lb, $D = 30$ in, and $S = 70$ in—the value is slightly more than 25 lb. In Figure 3, the lowest $F_{n,av}$ value is for $W = 61$ lb, $D = 24$ in, and $S = 70$ in—the value is slightly less than 35 lb. Therefore, the lowest $F_{n,av}$ value is for $W = 51$ lb, $D = 30$ in, and $S = 70$ in, (B).
26. **(J) Science/Research Summary/Analysis.** In Figure 1, the $F_{v,av}$ values are the same regardless of the S value. Therefore, $F_{v,av}$ is independent of S because as S increased, $F_{v,av}$ remained constant, (J).
27. **(C) Science/Research Summary/Analysis.** According to Figure 3, the $F_{n,av}$ value is greater than 57 lb for one door combination: $S = 20$ in and $D = 36$ in, (C).

Passage V: This passage describes a chemistry demonstration in which a glass tube—containing a fixed volume of air and steel wool—is heated and the total volume of air in the tube decreases by 20%. Each viewpoint describes which gas in the air sample (and how much) reacted with the iron (Fe) in the steel wool, and which gas (and how much) was left in the sample after the reaction. A brief chart helps summarize the viewpoints:

Student	Fe reacts with...	Gas by volume in air sample (before reaction)	Gas by volume in air sample (after reaction)
1	all N_2	about 20% N_2 ; 80% O_2	mostly O_2
2	some O_2	about 80% O_2	about 75% O_2 ; 25% N_2
3	all O_2	about 20% O_2	mostly N_2
4	all CO_2	about 20% CO_2	mostly O_2

28. **(J) Science/Conflicting Viewpoints/Analysis.** In each of the viewpoints, the stated percentages of gas in the air sample are all approximations—"about 20% N_2 by volume," etc. Each of the viewpoints could still be true, even if the air sample contained less than 1% by volume, so it doesn't weaken any of the viewpoints, (J).
29. **(A) Science/Conflicting Viewpoints/Comprehension.** The demonstration involves heating the quartz tube, which is connected to the syringes by the silicone hoses. Since the quartz tube is heated, it's important that the connecting hoses are resistant to heat (Property I). Furthermore, the results of the experiment are based on the chemical reaction between the air in the tube and the steel wool, so it's important that any other equipment used in the demonstration doesn't react—in other words, the connecting tubes should have low chemical reactivity (Property II). Solubility in water (Property III), refers to the ability of water to permeate the tubing, but water isn't involved in the demonstration, so Property III isn't relevant. Therefore, the correct choice includes Properties I and II only, (A).
30. **(J) Science/Conflicting Viewpoints/Analysis.** Student 4 believes that the Fe in the steel wool reacts with all the CO_2 in the air sample, leaving mostly O_2 in the apparatus. Therefore, according to Student 4, the percent CO_2 by volume in the apparatus decreases, and the percent O_2 by volume increases, (J).
31. **(C) Science/Conflicting Viewpoints/Analysis.** Students 1 and 2 both believe that air is about 80% O_2 by volume, so they would both agree that air contains more O_2 than any other gas, including N_2 . Student 3 believes that air is only 20% O_2 by volume, and that after the reaction in the demonstration, the air sample was mostly N_2 , so Student 3 would disagree that air contains more O_2 than N_2 . Conversely, Student 4 believes that air is only 20% CO_2 by volume, and that after the reaction, the air sample was mostly O_2 , so it's likely that Student 4 would agree that air contains more O_2 than N_2 . Therefore, the correct choice is Students 1, 2, and 4 only, (C).

Testing Tip



Don't oversolve. If you've eliminated three choices, the answer must be the remaining choice. Don't waste time double-checking the last choice. Make your selection and move on!



OUTSIDE KNOWLEDGE ALERT!

Item #37 requires that you know the electric charge on a proton is +1. The only other option for the charge given in the answer choices is 0, which is the charge on a neutron, which is electrically neutral.

32. (H) **Science/Conflicting Viewpoints/Application.** Student 3 believes that the Fe in the steel wool reacted with the O_2 in the air sample, so both Fe and O_2 need to be on the left side of a chemical equation representing the chemical reaction. (H) is the only choice that has both Fe and O_2 on the left side of the chemical equation, so (H) must be correct.
33. (B) **Science/Conflicting Viewpoints/Analysis.** Students 1 and 4 both believe that after the demonstration, the air sample was mostly O_2 by volume. Student 2 believes it was at least 25% N_2 and Student 3 believes it was mostly N_2 . Therefore, only Students 2 and 3 would likely agree that after the demonstration, the air sample was at least 20% N_2 by volume, (B).
34. (G) **Science/Conflicting Viewpoints/Application.** According to the item stem, a limiting reactant is in shortest supply and thus limits the amount of products produced in the chemical reaction. If the iron in the steel wool were the limiting agent, then the other reactants would be in greater supply, so after the reaction there would still be some of the other reactants left. Students 1, 3, and 4 believe that the Fe reacted with all of the reactant gas in the air sample. Student 2 believes that the Fe reacted with only some of the O_2 in the air sample, so Student 2 would likely agree that the Fe is the limiting agent.

Passage VI: The passage presents a description of the quark model for baryons and information about six quarks (Table 1) and six baryons (Table 2).

35. (C) **Science/Data Representation/Application.** This item gives additional information and requires you to apply that information to determine the spins of two baryons based on the data in Table 2. A quick glance at the answer choices indicates that each choice gives a different value for the spin of the Λ^0 baryon. According to Table 2, the spins of the three quarks that comprise the Λ^0 baryon are up, down, and up. The spin of the spin-down quark cancels with the spin of one of the spin-up quarks, leaving the baryon to have the spin of the remaining up-quark, $+\frac{1}{2}\hbar$. (C) must be correct because it's the only choice with $+\frac{1}{2}\hbar$ as the spin for the Λ^0 baryon. Indeed, the Δ^0 baryon has three up-spin quarks, so its total spin is $3\left(+\frac{1}{2}\hbar\right) = +\frac{3}{2}\hbar$.
36. (G) **Science/Data Representation/Analysis.** The item stem states that the baryon has only two quark spins oriented in the same direction, so immediately eliminate (H) and (J), since both of these show three quark spins oriented in the same direction. For the baryon to be electrically neutral, the electric charge of the quarks comprising it must sum to zero. The three quarks in (F) are u , c , and t , which according to Table 1, each have a charge of $+\frac{2}{3}$, so (F) is not electronically neutral. Therefore, by the process of elimination, (G) must be the correct choice. Indeed, the three quarks in (G) are u , d , and s , corresponding to charges of $+\frac{2}{3}$, $-\frac{1}{3}$, and $-\frac{1}{3}$, respectively, which sum to zero.
37. (D) **Science/Data Representation/Analysis.** The charge on a proton is +1. According to Table 2, a proton is comprised of two u quarks and one d quark. According to Table 1, the total charge on these three quarks is $+\frac{2}{3} + \frac{2}{3} - \frac{1}{3} = \frac{4}{3} - \frac{1}{3} = \frac{3}{3} = 1$. This matches the charge on a proton, which is +1, so (D) is correct.

OUTSIDE
KNOWLEDGE
ALERT!



To answer this item, you must know that atomic nuclei refers to the nucleus of an atom, which is comprised of protons and neutrons. The positively charged nucleus is surrounded by electrons, which are negatively charged. Most of the mass in an atom, which is the smallest unit of matter that has chemical properties, is concentrated in the nucleus.

Testing
Tip



The word “NOT” is capitalized, turning the item stem inside-out, so to speak. Read the item stem carefully--the correct answer is the one for which the statement is not true.

38. (F) **Science/Data Representation/Analysis.** According to Table 2, a Ω^- baryon is comprised of three s quarks. According to Table 1, the total charge on these three quarks is $-\frac{1}{3} + -\frac{1}{3} + -\frac{1}{3} = -1$. Find the charge on the quark combinations in the choices, starting with (F): the total charge on a dsb combination is $-\frac{1}{3} + -\frac{1}{3} + -\frac{1}{3} = -1$, which is the same as the charge on a Ω^- baryon. So, (F) must be correct and the remaining choices do not need to be evaluated.
39. (A) **Science/Data Representation/Application.** This item requires application of information not included in the passage: the nucleus of an atom consists of protons and neutrons. According to Table 2, protons and neutrons are comprised of u and d quarks, (A).
40. (F) **Science/Data Representation/Application.** Notice that the three generations correspond to the three divisions in Table 1. The item stem includes the thought-reverser “NOT,” so the correct answer choice will be the generation (if any) for which positively charged quarks are less massive than negatively charged quarks. Compare the single-quark masses for each of the pairs in the three divisions in Table 1: the positively charged u quark is less massive than the negatively charged d quark for Generation 1, (F).