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# ACT<sup>®</sup> Test

(Form Code 1163E)



## *Cambridge Navigator Plus:*

*The Complete Explanation Guide to the Retired Test*

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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.



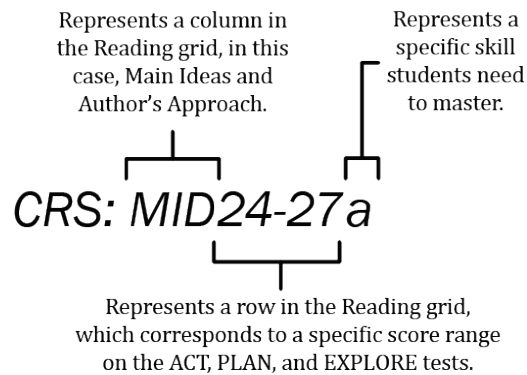
## Category Paths, College and Career Readiness Standards, and Common Core State Standards

Throughout these explanations, each item is categorized in three ways.\* First, each explanation includes a **Cambridge Category Path** which links the item to the Course Concept Outline in Cambridge's *Victory* series. For example:

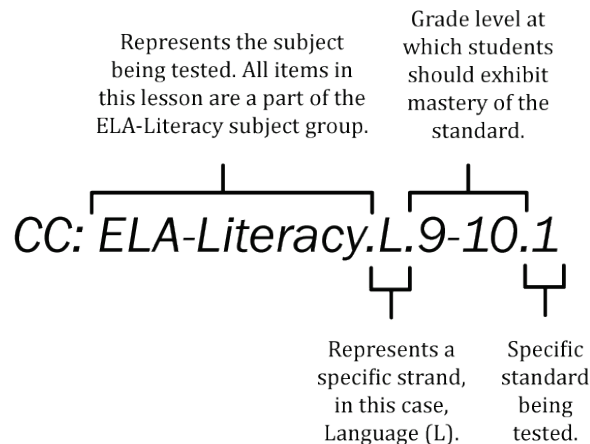
*Mathematics/Geometry/Triangles/Pythagorean Theorem*

An item with this particular category path is found in the Mathematics Test (based on Level 1 of the category path, mathematics) and tests students' knowledge of geometry (Level 2 of the category path), more specifically of triangles (Level 3), and even more specifically of the Pythagorean theorem (Level 4). The *Victory* Mathematics Lesson includes a section on the Pythagorean theorem, which you can find by referencing the Course Concept Outline at the beginning of the mathematics section in the *Victory* book. Additionally, you can find items testing geometry, triangles, or the Pythagorean theorem using the Item Index at the end of the *Victory* Student Text and Teacher's Guide.

Second, each explanation includes a **College and Career Readiness Standard (CCRS)** that references a specific standard in the College and Career Readiness Standards grid. College and Career Readiness Standards were developed by ACT, Inc. to indicate the skills represented within given score ranges. See the tables on the next page for an outline of the entire test sorted into the College and Career Readiness Standards. Here is an example of a College Readiness Standard reference:



Third, most explanations include a **Common Core Skill (CC)** which references a specific standard in the Common Core State Standards Initiative that the item tests.\* Here is an example of a Common Core skill reference:



\*Not every item corresponds directly to a Common Core State Standard. In such cases, a Common Core State Standard will not be listed.

The tables below provide an outline of the entire test sorted into College and Career Readiness Standards. The tables below sort items only into their respective cells, not the specific skills within each strand. These tables are designed to provide an overview of the structure of this particular test.

English								
		Items by Standard						
		1	2	3	4	5	6	Total
		<i>Topic Development in Terms of Purpose &amp; Focus</i>	<i>Organization, Unity, &amp; Coherence</i>	<i>Word Choice in Terms of Style, Tone, Clarity, &amp; Economy</i>	<i>Sentence Structure &amp; Formation</i>	<i>Conventions of Usage</i>	<i>Conventions of Punctuation</i>	
Items by Score Range	1 (13–15)							0
	2 (16–19)	18, 36		47	1, 27, 37, 38, 53, 73	20, 21, 25, 32, 43, 49, 70	3, 13	18
	3 (20–23)	45	4, 11	31	10, 17, 19, 28, 35, 39, 59	46, 56, 62	23	15
	4 (24–27)	2, 14, 15, 24, 60	26, 29, 40, 44, 57	5, 9, 33, 34, 41, 50, 67, 71	65	22	6, 8, 16, 52, 54, 58	26
	5 (28–32)	12, 30, 64, 68	7, 75	55	48, 61, 66, 69	72	42	13
	6 (33–36)		51		63		74	3
Total		12	10	11	19	12	11	75

Mathematics										
		Items by Standard								
		1	2	3	4	5	6	7	8	Total
		<i>Basic Operations &amp; Applications</i>	<i>Probability, Statistics, &amp; Data Analysis</i>	<i>Numbers: Concepts &amp; Properties</i>	<i>Expressions, Equations, &amp; Inequalities</i>	<i>Graphical Representations</i>	<i>Properties of Plane Figures</i>	<i>Measurement</i>	<i>Functions</i>	
Items by Score Range	1 (13–15)							14		1
	2 (16–19)	25, 26	1, 9, 32	5, 18						7
	3 (20–23)	12, 13, 27		17	4, 7, 19, 21	10, 49	8	6, 11, 37, 39		15
	4 (24–27)		48		15, 16, 24, 29, 35, 47, 55	3, 36, 50, 58		2	23	14
	5 (28–32)		33, 34, 51	43	31, 38, 46, 57	45	20, 40	22, 28, 30	41, 42, 59	17
	6 (33–36)			44, 53, 54	52				56, 60	6
Total		5	7	7	16	7	3	9	6	60

Reading							
		Items by Standard					<b>Total</b>
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	
		<i>Main Ideas &amp; Author's Approach</i>	<i>Supporting Details</i>	<i>Sequential, Comparative, &amp; Cause-Effect Relationships</i>	<i>Meanings of Words</i>	<i>Generalizations &amp; Conclusions</i>	
Items by Score Range	<b>1</b> (13–15)					1	1
	<b>2</b> (16–19)					2	1
	<b>3</b> (20–23)		5, 6, 8, 20, 32		38	3, 7, 10, 11, 12, 14	12
	<b>4</b> (24–27)	16, 17, 31, 37	13, 19, 27, 29	15, 33	18	4, 9, 40	14
	<b>5</b> (28–32)		24, 25, 26, 35, 36	28, 34	23, 30	39	10
	<b>6</b> (33–36)	21, 22					2
	<b>Total</b>	6	14	4	4	12	<b>40</b>

Science					
		Items by Standard			<b>Total</b>
		<b>1</b>	<b>2</b>	<b>3</b>	
		<i>Interpretation of Data</i>	<i>Scientific Investigation</i>	<i>Evaluation of Models, Inferences, &amp; Experimental Results</i>	
Items by Score Range	<b>1</b> (13–15)	2			1
	<b>2</b> (16–19)	7, 11, 13	9	17	5
	<b>3</b> (20–23)	5, 22, 23, 30, 36	8, 12, 26	14, 15	10
	<b>4</b> (24–27)	1, 3, 6, 20, 21, 24, 25, 28, 31, 32, 34, 37	4, 29	10, 16, 18, 19, 33	19
	<b>5</b> (28–32)	40		27	2
	<b>6</b> (33–36)	35, 39		38	3
	<b>Total</b>	24	6	10	<b>40</b>







## ACT 1163E

NOTE: Some of the items do not have an equivalent Common Core State Standard. Only the College and Career Readiness Standard will be listed for such items.

### Test 1: English

1. (C) *English/Usage and Mechanics/Sentence Structure/Comma Splices*. CCRS: SSF 16–19a. CC: ELA-Literacy.L.9–10.1. The sentence contains a comma splice: two independent clauses are joined (spliced) by only a comma. The word grouping from the initial capital to the comma is an independent clause containing both a subject and a main verb: “Hernández bowed.” Everything following the comma is also an independent clause: “Viewers stood and applauded.” The two independent clauses cannot be joined using only a comma. One option is to establish each as its own sentence: “Hernández bowed. Viewers stood and applauded.” This is the option used by the correct answer, (C).

In addition to the change made by (C), the correct choice, another option would be to separate the two clauses using a semicolon:

Hernández bowed; viewers stood and applauded.

Or a comma and a coordinating conjunction:

Hernández bowed, and viewers stood and applauded.

Or a subordinating conjunction:

While Hernández bowed, the viewers stood and applauded.

All are equally correct, so the choice depends on what the writer prefers.

(B) is incorrect because eliminating the comma without making some other adjustment results in a run-on sentence: two or more independent clauses with no indication where one ends and the next begins.

(D) is incorrect because beginning a new sentence with “while” results in a sentence fragment:

While the viewers stood and applauded . . . .

“While” is a subordinating conjunction that is used to introduce a dependent clause, but a dependent clause, as the name implies, “depends” on another sentence element, in this case an independent clause. So a clause beginning with “while” that is unattached to an independent clause results in an incomplete fragment. The approach indicated by (D) could be corrected by attaching the “while” (dependent) clause to the main part of the sentence:

Hernández bowed, while the audience stood and applauded.

2. (H) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. CCRS: TOD 24–27b. CC: ELA-Literacy.L.11–12.3. This question asks about the effect of a new sentence on the development of the first paragraph. The first paragraph introduces the reader to Hernández: she is a dancer and leader of the Ballet Folklórico. The focus of the paragraph and the rest of the essay is on Hernández. Adding the suggested sentence at this point would shift the reader’s attention away from the intended focus.

**TIP** An important test-taking strategy with a question like this is to use all of the information available to you. You might not be sure, at first, whether the sentence should be included. When you read the

justifications provided by the choices, however, you should be able to eliminate all of the choices but (H). (H) provides the correct justification for not including the sentence.

(F) is wrong both because it would insert the sentence and in its justification for doing so. The focus of the essay is not “many famous ballet dancers of Mexico” but one dancer, Hernández, of the Ballet Folklórico.

(G) is wrong for two reasons. First, the sentence does not belong in the first paragraph. Second, the sentence does not show that dance is a difficult profession.

(J) is wrong because it provides the wrong justification for not including the sentence. The sentence, which states that the company produced many famous dancers, does not contradict anything said elsewhere in the essay.

3. **(B) English/Usage and Mechanics/Punctuation/Commas. CCRS: COP 16–19b. CC: ELA-Literacy.L.11–12.2.** The first problem with the original version of the sentence is that the comma following “up” disrupts the flow of the sentence. Read the sentence using the “breath test,” that is, pausing after “up”:

Growing up [pause] in Mexico in the 1920s Hernández believed she was born to dance.

There is no reason for the pause, and the pause makes it difficult to follow the logic of the sentence. Secondly, a comma is needed to mark the end of the introductory phrase:

Growing up in Mexico in the 1920s [pause] Hernández believed she was born to dance.

The comma tells the reader that the introductory material is over and the main part of the sentence is beginning.

(C) correctly adds the comma to mark the end of the introductory phrase, but it fails to delete the superfluous comma following “up.” As a result, the logic of the sentence is still unclear.

(D) is incorrect for two reasons. One, it fails to use a comma to separate the introductory phrase from the main body of the sentence. Two, putting a comma after “Mexico” disrupts the flow of the sentence. So in this respect, (D) is no better than the original and not very different.

**TIP** The “breath test” can be a helpful way of deciding where to place commas. As a general rule, commas often appear where a speaker would naturally slow down or pause.

4. **(G) English/Rhetorical Skills/Strategy/Effective Transitional Sentence. CCRS: ORG: 20–23a. CC: ELA-Literacy.L.9–10.1.** The original sentence here uses a prepositional phrase (“despite this”) that creates an illogical transition between one sentence and the next. “Despite this” suggests that the father’s decision was not influenced by the daughter’s continued demands. For example:

Most of the neighborhood’s residents were against closing the school. Despite the public’s opposition, the School Board reassigned the students to other schools and tore down the building.

In this example, the school board’s decision to close the school was not influenced by the public’s opposition. However, in the first passage, it is obvious that the father gave in because of his daughter’s persistence. (G) correctly expresses the connection between the two ideas.

(H) is incorrect because “in fact” is a conjunctive adverb that is usually used to show the contrast between a common misunderstanding or mistake and the actual fact:

Many people believe that the building was originally a shirt factory; in fact, the building was originally constructed as a warehouse used to store books.



“In fact” distorts the relation between the daughter’s persistence and the father’s agreement.

(J) is a conjunctive phrase that is used to signal a contrast between ideas:

A few people favor keeping the old school building open; on the other hand, the great majority of neighborhood residents favor closing the building and constructing a new school.

In this case, the daughter’s persistence ultimately changes her father’s mind. So the two are, in the final analysis, in agreement.

5. (D) *English/Rhetorical Skills/Style/Conciseness*. CCRS: WC 24–27a. CC: ELA-Literacy.L.9–10.3. The error of the original version is the needless repetition of the information neatly contained in the word “acquiesced.” “Acquiesced” means to give in or to agree, especially after initially resisting. So the phrase “when he thought about it and gave in” simply repeats what is already said by “acquiesce” without adding anything to the sentence. The best strategy is just to delete the unnecessary material.

(B) is incorrect because the alternative phrasing doesn’t in any way clarify the idea of “acquiesce” and, like the original, just repeats the meaning of “acquiesce.”

(C) is incorrect because the new phrasing simply repeats a key element of the definition of “acquiesce.” While repetition is sometimes a useful rhetorical strategy, here it serves no purpose. For example, had the author spent several sentences describing the conflict between father and daughter and then concluded with “the father acquiesced,” then a phrase such as “at long last” or something similar might be appropriate. But that is not the case here.

6. (H) *English/Usage and Mechanics/Punctuation/Colons*. CCRS: COP 24–27d. CC: ELA-Literacy.L.11–12.2. The problem with the original version of the sentence is the inappropriate use of a colon. The most common uses of the colon are to call attention to an explanation or to introduce a series. For example:

After igniting the gas, adjust the temperature of the grill: 375°(F) for chicken.

The different colors signal different messages: green for safe, yellow for caution, and red for stop.

A good rule of thumb is that the word group preceding the colon must itself be a complete sentence. The colon then introduces additional information to clarify or make specific something in the independent clause. Thus, in the example above, “adjust the temperature of the grill” is a complete thought, and “colors signal messages” is a complete thought.

The problem with the original sentence is that the colon disrupts a prepositional phrase. You would not write, “He hired the finest teachers to instruct her in.” So the colon should be deleted.

The situation would be different if the sentence had been written:

He hired the finest teachers to instruct her in various forms of dance: modern, classical ballet, and jazz.

This version renders a complete thought before the colon, and the colon then introduces a series that specifies the forms of dance.

(G) is incorrect because the comma is superfluous and disrupts the prepositional phrase. In general, you should never have occasion to separate a preposition from its object using a comma.

(J) is incorrect because the comma is superfluous and disrupts the logical flow of the sentence. In general, you should not use a comma to separate a modifier from the word it modifies. (The one exception to this rule is a comma to mark multiple modifiers: the hairy, brown spider.)

7. (A) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence*. CCRS: ORG 24–27c. CC: ELA-Literacy.L.11–12.3. This paragraph is fairly straightforward: her father built a studio and hired teachers, but Amalia thought something wasn't quite right. So a good concluding sentence would continue the second thought, perhaps explaining what she sensed was wrong, and introduce the next paragraph, which discusses Amalia's actions. (A) fulfills both tasks: the music didn't move her in the same way that native folk music and dances did.

(B) is wrong because the sentence states that Amalia discontinued her dance studies. The very next paragraph, however, says clearly that she just shifted her focus to music and dance native to Mexico.

(C) is wrong because the sentence lacks any connection to or development of the important thought that "something was not right." Nor does it provide a transition to the next paragraph, which discusses her new studies. Also, there is nothing in the paragraph to support the suggestion that she liked the building but not the dance.

(D) is incorrect because this sentence directly contradicts later developments. Amalia did not want to continue concentrating on modern ballet. Rather, she wanted to explore native forms of dance.

8. (H) *English/Usage and Mechanics/Punctuation/Apostrophes*. CCRS: COP 24–27c. CC: ELA-Literacy.L.11–12.2. This item tests the use of the apostrophe. Many students make silly mistakes with the apostrophe when the rules for its use are quite simple:

Use an apostrophe plus "s" to show possession for singular nouns and pronouns:

Mike's bicycle  
Elaine's book  
someone's quarter

Use an apostrophe following the "s" to show possession for plural nouns:

the cats' food bowl  
the players' bus

Be careful, however, with possessive pronouns, as these do not use an apostrophe. The "possession" is already contained in the pronoun itself:

Return his book. (Not: his' book)  
The ball is hers. (Not: hers')

The original version of the sentence is wrong because "folklore" belongs to the "country." So the word "country" requires an apostrophe plus an "s":

country's

(G) cannot be correct. The plural possessive is indicated with an apostrophe following the final "s," but "countries" is not the correct plural form of "country." The plural of "country" is formed by dropping the "-y" and adding "-ies." (This is the rule for many words ending in "-y.")

(J) is incorrect because the noun lacks an apostrophe. "Countries" is indeed the correct plural of "country," but to show a characteristic belonging to several countries would require an apostrophe following the final "s": the countries' capitals.

9. (A) *English/Rhetorical Skills/Style/Clarity of Meaning*. CCRS: WC 24–27c. CC: ELA-Literacy.L.11–12.6. This item tests word meaning. In the original, the word "fusion" suggests a mixing of several elements. When used to describe a physical process, the word implies a melting process so that the various



components are combined fairly thoroughly and lose their original identities even while contributing to the new substance. “Combination,” “blend,” and “mixture” have similar connotations. “Grouping,” however, suggests that the original components retain their separate identities, are lumped together rather than mixed thoroughly. So the word that is least acceptable would be “grouping,” (A).

(B), (C), and (D) are all acceptable substitutions. Like “fusion,” “combination,” “blend,” and “mixture” all suggest a thorough mixing of components.

10. (G) *English/Usage and Mechanics/Sentence Structure/Faulty Parallelism*. CCRS: SSF 20–23a. CC: ELA-Literacy.L.11–12.3. The fatal error in the original version of this sentence is a lack of parallelism. In general, the elements in a series should be of the same form. Here you have the series “life, death, and to have a rebirth.” The first two elements (“life,” “death”) are nouns, but the third is an infinitive phrase. The third element should be conformed to the other two: “life, death, and rebirth.” (G) makes the needed change.

(H) fails to make the needed correction. “To be reborn” is a phrase that is not parallel to the first two elements of “life” and “death.”

(J) also fails to make the needed change. “To have rebirth” is an awkward phrase that lacks parallelism to “life” and “death.”

11. (D) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence*. CCRS: ORG 24–27a. CC: ELA-Literacy.L.11–12.3. “However” is a conjunctive adverb that is used to signal a contrast between two ideas:

Jeremy disliked crowds. However, he attended the rally at Myra’s insistence.

In this paragraph, “however” is out of place because the author does not intend to contrast two ideas. Instead, the author describes the traditional songs and dances and then states that Hernández used the subject matter to create a new form of dance. The one concept flows from the other. None of the other choices provides an acceptable connection, so the best option is just to avoid using any conjunctive adverb.

(B) is incorrect because “nevertheless” has pretty much the same meaning as “despite” and, like “however,” shows a contrast:

Jeremy disliked crowds. Nevertheless, he attended the rally.

(C) is wrong because “instead,” like “however,” is used to create a contrast:

Jeremy did not attend the rally. Instead, he wrote a letter to the newspaper supporting the protesters.

12. (F) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. CCRS: TOD 28–32b. CC: ELA-Literacy.L.11–12.3. This item asks whether it would be appropriate to add further detail at this point. The original sentence states that Hernández began to develop a program for her new troupe. The author might want to mention how the small troupe grew into a larger company. Or the author might mention an early work, a later work, and a very late work to show the direction of the development. Or the author might want to mention a number such as “forty ballets” to show the magnitude of Hernández’s accomplishments. Of course, the author is not required to do any of these things, and the question asks whether the third suggestion is acceptable. The answer is “yes” for the reason articulated by (F).

(G) reaches the right conclusion but gives the wrong reason. “Yes,” it would be appropriate (though not required) to include the additional clause. But the additional information, which simply recites a number, would say nothing about the nature of the ballets.

(H) is wrong because it reaches the conclusion that the clause should definitely be left out. While there is no necessity for the writer to include the proposed addition, the author has the option for the reason given by (F). Additionally, it would be wrong to leave the information out for the reason given by (H). The purpose of the paragraph is not to describe Hernández’s work at the Institute of Fine Arts but rather to describe the beginning and development of her own dance company.

(J) is wrong because it concludes the clause should definitely be left out. The author might decide against including the information but not for the reason given by (J). The information provided by the proposed clause develops the discussion of Hernández’s role.

- 13. (C) English/Usage and Mechanics/Punctuation/Dashes. CCRS: COP 24–27d. CC: ELA-Literacy.L.11–12.2.** Dashes can be used to set off a parenthetical remark such as an aside or an appositive, and the general rule for dashes is that, like wheels on a bicycle, there should be two of them. The exception to the rule is when the end of the aside coincides with the end of the sentence and a period rather than a second dash is used. For example:

The Rockies—a rugged range of geologically young mountains—form the Continental Divide.

When the first explorers reached the edge of the Great Plains, they found their progress impeded by the Rockies—a rugged range of geologically young mountains.

In this case, a colon and a dash will not tell the reader that the material in between the two marks is an aside. The reader will see the colon and expect further explanation or a series, neither of which is provided. (See item 6, above, on the use of the colon.)

So (C) provides the leading dash and is the correct answer.

(B) is incorrect because the comma and the dash are paired incorrectly. The aside must be set off by either a pair of commas or a pair of dashes, not one of each.

(D) is wrong because the reader will expect that the single dash sets off a remark that ends with the period. The sense of the sentence, however, does not support this reading.

- 14. (G) English/Rhetorical Skills/Strategy/Effective Concluding Sentence. CCRS: TOD 24–27c. CC: ELA-Literacy.L.9–10.3.** This item asks you to choose an idea that will help readers to appreciate the significance (legacy) of the company. The preceding paragraph explains that the company was named an “official cultural ambassador” and visited countries all around the world. (G) nicely summarizes that idea. You will notice that (G) mentions a detail that specifically applies to the Ballet Folklórico: Mexico’s cultural heritage.

(F) is incorrect because “outstanding dance company” could be a phrase used to describe any company of some importance. The unique feature of Ballet Folklórico was the blending of various uniquely Mexican elements.

(H) is incorrect because “well-known” could apply to any widely recognized group of dancers. What makes the Ballet Folklórico unique is the fusing of Mexican influences. (H) misses this point altogether.

(J) is incorrect because it fails to respond to the question asked. The question asks about contributions made by the company. Saying that the company will continue in the future says nothing about what it has accomplished in the past.

**TIP** The wrong choices point to a peculiar feature of the multiple-choice format. In a classroom discussion of a question such as “What other information could be added here?”, any one of the



wrong answers has some appeal. The question actually asked, however, is for a statement that would highlight “contributions made.” Remember to read carefully and to answer the specific question that is asked.

**15. (B) English/Rhetorical Skills/Strategy/Main Idea. CCRS: TOD 24–27a. CC: ELA-Literacy.L.11–12.3.**

Although it may not be entirely clear from the structure of the question, this item is essentially asking, “What is the main point of the essay?” The test-writer asks the question in a roundabout way: “If . . . were supposed to be the main point of the essay, did the author succeed?” You answer “yes” if the suggested main point and real main point are the same and “no” if they are not.

(B) is the correct answer because the main point of the essay is to show how Hernández’s culture influenced the dances she created.

(A) gives the correct answer but the wrong reason. The main point of the essay is not awards and honors. That Hernández won prizes is incidental to the main point of describing her roots.

(C) is wrong because the suggested justification for saying “no” is, in fact, the main point of the essay. So the “no” provided by (C) is wrong. Additionally, (C) gives an implausible explanation. In order to write an essay showing how an artist’s roots could be important, it would not be necessary to discuss all artists. Instead, choosing one example would allow a writer to demonstrate this thesis.

(D) is wrong because the idea suggested by the question is, in fact, a part of the essay. Additionally, it is difficult to understand how the reason suggested by (D) would prevent the writer from achieving the purpose set forth in the question.

**16. (F) English/Usage and Mechanics/Punctuation/Apostrophes. CCRS: COP 24–27c. CC: ELA-Literacy.L.11–12.2.** The original version of the underlined part correctly forms the possessive of the singular pronoun “someone else.” The possessive is required since the purpose is to show ownership of the pens, and the addition of the apostrophe and “s” is the correct procedure. (See also item 8, above.)

(G) is incorrect because the suggested alternative uses the procedure for forming the plural possessive: add “s” and an apostrophe, e.g., “the students’ records.”

(H) is wrong because the suggested alternative lacks the apostrophe. The apostrophe is required for nouns and indefinite pronouns to show possession. (Possessive pronouns are different and show possession by their case, e.g., his, hers, ours. Possessive pronouns do not take an apostrophe.)

(J) is wrong because the suggested alternative would result in a pronoun with no logical function in the sentence. The “someone else” would not modify “pen” because it is not possessive, and it would not be a subject or an object either. It would just sit there, out of place.

**17. (C) English/Usage and Mechanics/Grammar and Usage/Nouns and Noun Clauses and Pronoun Usage. CCRS: SSF 20–23a. CC: ELA-Literacy.L.9–10.1.** “Which” is a relative pronoun, so called because it “relates” an idea to some other idea in the main part of the sentence. Typically, a “which” clause (relative clause) modifies or describes a word in the main part of the sentence. For example:

The recipe suggests using dandelion greens, which we find growing wild in our backyard.

The “which” here refers to “dandelion greens” and explains that they grow wild in the backyard. Grammatically, the “which” functions as a direct object of the verb in the relative clause.

The problem with the original version of the sentence is that “which” has no useful function to serve in the additional clause. “Which” is not the subject of the verb in the clause; “I” is the subject. It is not the object of the verb; the noun clause introduced by “that” is the object.” So “which” is a useless appendage that just clutters up the sentence and disrupts the logical flow.

A good way to smooth out the logical flow of the sentence is to get rid of the “speed bump”: delete the “which” and created two separate sentences, as (C) does.

Some students might choose (B) thinking that this item presents an issue of restrictive versus nonrestrictive clauses, so that is an issue worth discussing.

What is a nonrestrictive clause or phrase? A popular grammar reference book defines the terminology as follows: nonrestrictive clauses and phrases are not essential to the meaning of the main clause and may be omitted. Why, then, don’t we just call them “essential” and “nonessential”? That is a good question, and we don’t have a good answer except to say that many authorities do use “essential” and “nonessential,” so we will too.

As the terminology implies, “essential” means necessary and “nonessential” means optional. When the distinction is applied to relative clauses, it has an important implication for a writer’s choice of relative pronoun and punctuation:

A nonessential clause is introduced by “which” and set off by a comma.

An essential clause is introduced by “that” and is not set off by a comma.

“Who” can introduce either type of clause, and the difference is signaled by the use (nonessential) or omission (essential) of the comma.

Examples:

*White Fang*, which was written by Jack London, is on the summer reading list. (The “which” information is not considered by the writer or speaker to be essential; “*White Fang*” is sufficient to identify the work.)

One book that was written by Jack London is on the summer reading list. (The “that” information is essential to identifying the book in question.)

Jack London is the author and magazine journalist who wrote *White Fang*. (The information is essential to identifying the journalist, Jack London.)

Jack London, who wrote *Call of the Wild*, *White Fang*, and other outdoor novels, was a pioneer in magazine fiction writing. (The information set off by commas is not considered by the writer or speaker to be essential.)

These are the traditional rules. Today, the distinction between “which” and “that” is often ignored and the difference between essential and nonessential elements established by the use or omission of commas.

Examples:

The book that Jack London wrote is on the table.

The book which Jack London wrote is on the table.

Technically, the first sentence is preferable to the second, but usage changes over time.

As noted, (B) is not, technically speaking, correct. Also, (B) fails because it does not solve the problem of the original version. Simply substituting “that” for “which” leaves us with a word that has no function to serve in the sentence.





(D) is wrong because simply deleting the “which” leaves you with two independent clauses jammed together: “This is not a deliberate act I just unconsciously assume that . . .” This error is called a fused or run-on sentence.

**TIP** In terms of your being prepared for the ACT test, shifting usage is usually not tested by the exam, so while you should strive in your own writing to observe the rules, you *probably* will not need to know them for the test.

18. (F) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. CCRS: TOD 16–19a. CC: ELA-Literacy.L.9–10.3. This question asks whether you understand the contribution to the meaning of the paragraph made by the three italicized words. Taken together, they are meant to imply that the writer does not take pens intentionally but unconsciously and then later feels embarrassed at the oversight. (F) correctly summarizes this point.

(G) is incorrect because the writer does not intend to deceive. Taking the pens is an oversight.

(H) is incorrect because there is no suggestion that the writer feels threatened. “Sheepishly” means in an embarrassed manner, not in response to a perceived threat.

(J) is incorrect for two reasons. First, the three words simply do not have this connotation. Second, the writer acts decisively and returns the pen immediately when the owner points out that the writer has taken it.

19. (D) *English/Usage and Mechanics/Sentence Structure/Faulty Parallelism and Grammar and Usage/Verb Tense*. CCRS: SSF 20–23a. CC: ELA-Literacy.L.9–10.1. The difficulty with the original version of the sentence is the structural distortion created by the use of the participle “being.” Although it is not entirely clear, it seems as though the writer might have meant to say, “Being a writer, I never really feel comfortable. . . .” In this rendering, “being” creates an adjective phrase to modify “I.” In any case, the original version is not acceptable. (D) is an acceptable alternative. (D) converts the participle to a conjugated verb (“am”), which is parallel to the other verb (“feel”) in the sentence.

(B) fails to eliminate the structural problem of the original. As a matter of structure, (B) would have been better had it read, “Being that I’m a writer, I never . . . .” The difficulty with this version is that “being that” is informal usage and unacceptable in formal writing.

(C) is wrong because “my being a writer” is a gerund phrase (and therefore a noun) that has no logical place in the sentence. It doesn’t modify “I” because it is a noun phrase. To correct (C), it would be necessary to substitute a conjugated form for “being,” say “am.” That is the strategy of the correct answer, (D).

20. (H) *English/Usage and Mechanics/Grammar and Usage/Diction*. CCRS: COU 16–19a. CC: ELA-Literacy.L.9–10.1. The sentence is acceptable as written, and “a large number,” “a handful,” and “a lot” could replace the underlined part. “Many,” however, would not be acceptable because the preposition “of” coupled with “many” creates a non-idiomatic phrase: I carry “many of pens.”

(F), (G), and (J) create idiomatic expressions: “a large number of pens,” “a handful of pens,” and “a lot of pens.” All are acceptable alternatives to the original.

21. (D) *English/Usage and Mechanics/Grammar and Usage/Diction*. CCRS: SSF 20–23a. CC: ELA-Literacy.L.11–12.4. The key to this item is knowing that the phrase “feel better to know” is simply not idiomatic English. The correct phrasing is “feel better knowing.” There is no important grammatical difference between the two. The “to know” is an infinitive, and infinitives are used to complete phrases such as the one here.

Examples:

It is better to know the answer than to guess.

I feel honored to count her as a friend.

And in many instances, the gerund or “-ing” form cannot be used:

We were anxious returning to the dock before dark. (Substitute “to return.”)

The teacher hoped meeting each parent personally. (Substitute “to meet.”)

So the choice is not a matter of applying a grammatical rule but of knowing what is idiomatic usage and what is not.

(B) is incorrect because the addition of “that” does not correct the underlying problem, which is the use of the non-idiomatic infinitive instead of the gerund.

(C) is wrong because “known” is the past participle of “know” and cannot be used as a noun in any case. So while it is possible to use “to know” (infinitive) and “knowing” (gerund) as nouns, you cannot use “known” as a noun.

**TIP** One point may require clarification here. “Knowing” is also the form of the present participle of “know.” The “-ing” participle and the “-ing” gerund must be distinguished by their role in a particular sentence:

Knowing the day and time of the attack gave the enemy a great advantage. (Gerund used as the subject of the sentence.)

A knowing smile told us that Peter already understood that we were planning to be married. (Participle used as an adjective to modify “smile.”)

**22. (G) English/Rhetorical Skills/Style/Clarity of Meaning. CCRS: WC 24–27b. CC: ELA-Literacy.L.11–12.4.**

The problem here is a straightforward failure of agreement between a pronoun and its antecedent. The pronoun “they” is intended to refer to “pen” in the previous sentence. “Pen” is singular, but “they” is plural. “They” must somehow be made singular. (G) does this by using the singular “the one” to substitute for “pen.”

(H) is wrong because “something” creates a logical problem. To be sure, “something” is singular and solves the agreement problem, but then the logic of the sentence is destroyed. The writer is concerned that the pen will run out of ink, not that some thing, any old thing, will run out.

(J) is wrong because “either one” is used when there are exactly two alternatives. In this case, the writer refers to a “fistful of pens.” So “either one” is logically inconsistent with the earlier part of the paragraph.

**23. (C) English/Usage and Mechanics/Punctuation/Commas. CCRS: COP 24–27a. CC: ELA-Literacy.L.11–12.2.** One common use of commas is to set off nonessential information such as an aside or a parenthetical remark. For example:

German, the quintessential skeptic about everything, at first scoffed but eventually came to see the possibility that the plan could actually work.

Our school system, the smallest in the entire county, has only 750 students in grades 1 through 12, but we are always an athletic powerhouse.



Barb waved from the top of the stairs leading to the small plane, a final good-bye to the host family she had grown to love as her own.

You will notice that in the first two examples, the commas come in pairs, one to mark the beginning of the parenthetical material and the other to mark the end. In the third case, the parenthetical remark comes at the end of the sentence, so one comma introduces the material and the period closes it.

(See also item 13, above.)

Here (C) is correct. You need a comma to introduce the aside.

(B) is incorrect. The semicolon cannot substitute for one of the pairs of commas. The reader expects two commas and without the parallelism will not appreciate the significance of the enclosed material. Additionally, the semicolon has other jobs to do. A semicolon here will mislead the reader into expecting that this is the end of one clause and the beginning of a second clause.

(D) is wrong because a colon would create the wrong impression for the reader. A colon is used to introduce an explanation or a series. (See item 6, above.)

24. (F) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. CCRS: TOD 24–27c. CC: ELA-Literacy.L.9–10.3. The question asked is whether it would be a good idea or not to add the suggested sentence. The answer is “yes.” In this paragraph, the writer is talking about how the obsession with pens carries over into the room where he sleeps. The impression created is that there are pens everywhere, so the point about finding pens under the pillow reinforces this idea.

**TIP** The wording of this question is a little misleading. The question asks whether the writer “should” add the sentence. Technically, that decision is up to the writer, and when you write, it is your decision what detail to add. Probably the question should have been worded: would it be appropriate to add this sentence? And the answer is “yes.” It is not required, but acceptable. This is an important point to keep in mind when you write. You don’t have to include everything you know. Pick and choose the details to make a presentation that creates the impression that you want to create.

(G) reaches the right conclusion about the sentence but gives an illogical explanation. The preceding sentence says that pens gather on the nightstand. Finding them under a pillow doesn’t explain how they got on the table.

(H) is wrong because the sentence can be included. It would not distract the reader but would provide additional detail that most readers would find entertaining as well as informative.

(J) is incorrect because it reaches the wrong conclusion for the wrong reason. The information is not vague, as you’d learn if you discovered a pen under your pillow in the middle of the night. The sentence is not pointless but adds detail and is perhaps even entertaining to most readers.

25. (D) *English/Usage and Mechanics/Grammar and Usage/Diction and Pronoun Usage*. CCRS: COU 28–32a. CC: ELA-Literacy.L.11–12.1. The error in the original version is the use of the contraction for “it is” instead of the possessive pronoun “its.” The confusion is a simple but all too common error.

(B) is wrong because it confuses “there” with “their.” “There” is an expletive used to begin a sentence in which the verb will come before the subject:

There are mice in the cupboards. (“Are” is the verb; “mice” is the subject.)

(C) is wrong because “their” is a plural pronoun and the antecedent (referent) is “habit,” a singular noun.

**TIP** Be sure that you do not confuse words such as:

it's	its
you're	your
they're	their

26. (J) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence*. CCRS: ORG 24–27a. CC: ELA-Literacy.L.11–12.3. This item requires that you pick the appropriate conjunctive adverb to join the second and third sentences in the paragraph. In the second sentence, the writer says that it is embarrassing to walk away with someone else’s pen. Then the author mentions another problem with the habit: leaks and stray marks. What is the logical connection between those two ideas? The second doesn’t follow the first in time because both are chronic problems. The second is not an outcome or result of the first because it happens independently. Rather, the problem of leaks and marks is just another downside of the writer’s obsession with pens. The best of the choices given to express this connection is “also.” If you were the writer, you might consider “additionally,” “moreover,” “furthermore,” or some other conjunctive adverb. But of the words given as choices, “also” is the best.

The original, (F), is a weak choice because it can be read to suggest that there is an element of sequence or time involved. We have already seen, however, that this is not the case.

(G) is incorrect because there is no logical or causal connection between the two problems, that is, one doesn’t imply the other or lead to it; and “consequently” is used to show a causal or logical relationship.

(H) is wrong because “instead” is used to show that one idea or course of action takes the place of the other. The writer makes it clear, however, that both the embarrassment and the leaks are ongoing problems.

27. (D) *English/Usage and Mechanics/Grammar and Usage/Verb Tense*. CCRS: SSF 16–19b. CC: ELA-Literacy.L.9–10.1. The problem with the underlined verb is that it uses the active voice. You should remember that the distinction between the active voice and the passive is the difference between the subject acting or being acted upon.

Examples:

The bugler *blew* reveille as loudly as possible. (Active)

Reveille *was blown* by the bugler as loudly as possible. (Passive)

“Have been decorating,” which is active voice, implies that the clothes are making ink blots and scribbles on themselves, a patent absurdity. The writer obviously means to say “The clothes have been decorated,” or “The clothes are decorated,” (D). The shift from the active to the passive voice makes it clear that the clothes do not act but are acted upon.

(B) has the merit of shifting to the passive voice and clearing up the confusion about the clothes using pens. The problem with (B) is that the choice of verb tense is not logical. “Had been decorated” is a tense that shows an action that occurred in the past but before some other action that also occurred in the past. For example:

Beth had already accepted the offer of admission at State University when she received the acceptance from Hepburn College.

“Had accepted” indicates that Beth accepted the offer from State sometime in the past before she got the notice from Hepburn, which she also received in the past.



(C) fails to solve the problem of the original version. The sentence still suggests that the clothes are doing the decorating.

28. (F) *English/Usage and Mechanics/No Change*. CCRS: SSF 20–23a. CC: ELA-Literacy.L.11–12.2. The original is correct as written. “After” introduces a lengthy prepositional phrase that functions as an adverb explaining when the writer was “convinced” not to pack pens in the suitcase. Although punctuation is not a tested element of this item, you should note that the sentence is correctly punctuated with a comma to mark the end of this introductory material and the beginning of the main body of the sentence.

All of the other choices, in one way or another, create sentence fragments or comma splices.

(G) changes the structure of the sentence dramatically. By eliminating the preposition “after,” (G) leaves only a noun, “mishap,” that has no logical role in the sentence. Before, “mishap” was the object of the preposition; now it is nothing—not the subject of a verb, not the object of a verb, just a word as useless and out of place as a bathtub on the wing of a jet airplane.

(H) changes the structure of the overall sentence by creating two independent clauses (“A recent mishap involved half of my travel wardrobe” and “My father convinced me not to pack pens in my suitcase”). However, these two clauses are joined only by a comma, which is not sufficient. A coordinating conjunction must also be present.

(J) results in a sentence fragment. “Involving” is not a conjugated verb and so is not a main verb for the subject “mishap.”

29. (B) *English/Rhetorical Skills/Organization/Paragraph-Level Structure*. CCRS: ORG 24–27b. CC: ELA-Literacy.L.11–12.3. This item asks you to put the sentences in the paragraph in the most logical order. One problem with the original order is that sentence 2 uses the demonstrative pronoun “that.” So what does “that” refer to? It doesn’t refer to anything in the first sentence because there is no idea in the first sentence that could be construed as “traveling light.” So sentence 2 cannot be second or first (because it would again have nothing to refer to.) This means that either sentence 3 or 4 must come immediately before sentence 2, and sentence 4 is a good choice. The writer does not pack pens in the suitcase but does carry them in a pocket. Now what about sentence 3? This explains why the “mishap” occurred, so sentence 3 should come immediately after sentence 1: 1,3,4,2.

**TIP** This is not the only way of solving the ordering problem. You might have started with sentence 3, noting that it should not follow sentence 2 but sentence 1. Then you would work out the rest of the order from there. The exact solution method is not important (you don’t have to show your work on the ACT test) as long as you get the right answer.

(C) is incorrect because sentence 2 must refer to something that has come before (“that”), so it cannot be first.

(D) is wrong because the preposition “despite” signals a contrast with something that has been said before. So sentence 4 cannot come first in the order.

30. (F) *English/Rhetorical Skills/Organization/Passage-Level Structure*. CCRS: TOD 28–32a. CC: ELA-Literacy.L.11–12.3. This item asks you to say whether the brief opening paragraph should be deleted. As a writer, you might or might not want to keep the material for any number of reasons. For example, you might decide that the identity of the “friend” would be known and prove embarrassing to the person. So you would delete it for reasons unrelated to the integrity of the essay. In any case, for this item, the explanation given in each choice is as important as, and perhaps even more important than, the “kept” or “deleted.”

Ultimately, the writer could, without objection, retain the material. It is a nice introduction to the essay. It conveys a personal touch and shows that the writer is human, someone like us all with peculiar habits, some of them bad. (F) summarizes this point.

- TIP** If the first paragraph is eliminated, what does “this situation” in the opening line of the second paragraph refer to? That is another good reason for not eliminating the material. Or at least the material cannot simply be deleted as (C) and (D) suggest without tidying up the loose end in the next paragraph.

(G) reaches the right result but for the wrong reason. The introductory material does not identify the friend. (Our supposition above about identity was purely hypothetical.)

(H) is wrong because the material should not be deleted, at least not because it mentions a “friend.” The point of the little story is to get the ball rolling, so to speak. Once the writer has the essay started, there is no logical reason to refer to the unnamed friend again.

(J) is incorrect because the material does not have to be deleted. It is not incumbent on the writer to resolve the situation. The brief anecdote is used only to get the essay started.

31. (D) *English/Rhetorical Skills/Style/Conciseness*. **CCRS: WC 20–23a**. The error of the original is the needless repetition of the concept of “underwater explorer.” That phrase pretty much says it all. There is no reason to add “exploring the sea.” The phrase is redundant. Of course, the writer may have wanted to add other details:

Underwater explorer Jacques Cousteau, a French naval officer, predicted . . .

Underwater explorer Jacques Cousteau, an advocate for conserving the world’s ocean resources, predicted . . .

Underwater explorer Jacques Cousteau, who was active until his death in 1997, predicted . . .

Additional detail is not mandatory here, but at least the three suggestions above do not needlessly repeat “underwater explorer.”

(B) uses the same wording but different punctuation. Dashes can be used to set apart a nonessential aside. (See item 13, above.) But punctuation alone is not going to make something that is needlessly repetitive useful.

(C) is wrong because the change doesn’t address the underlying problem of redundancy. Additionally, (C) is punctuated incorrectly. (C) would require a comma before “who” to mark the beginning of the phrase “who explored under the sea.”

32. (H) *English/Usage and Mechanics/Grammar and Usage/Diction* and *Pronoun Usage*. **CCRS: COU 28–32a**. **CC: ELA-Literacy.L.11–12.1**. The problem with the original is that “it’s” is the contraction for “it is,” not a possessive pronoun. The third person singular possessive pronoun is “its.” No “s” is required because “its” is a word in its own right used to show possession, like “my” (not “my’s”). (H) provides the correct form.

- TIP** One of the themes often tested by the ACT test is frequently confused words. See also item 25, above.

(G) confuses “their,” the third person plural possessive pronoun, with “there,” the expletive that is used to begin sentences such as, “There is a huge spider living under the porch.”



(J) is simply not a word in the English language. “Its” is the third person singular possessive pronoun. The word does not take an apostrophe.

33. (C) **English/Rhetorical Skills/Style/Conciseness** and **Strategy/Appropriate Supporting Material**. CCRS: WC 33–36a. CC: ELA-Literacy.L.11–12.4. The problem with the proposed addition is that the information provided is already given in the words “undersea habitat.” “Underwater environment” adds nothing to “undersea,” and “where people can live and work” adds nothing to “habitat.” Since there is no reason to include the material, it should be left out.

(A) is wrong because it reaches the wrong conclusion (“yes”). The proposed addition does not any new information beyond what the reader already learned from “undersea habitat,” and so should not be included.

(B) reaches the wrong conclusion, but the reasoning is interesting. The problem with (B) is that the proposed addition doesn’t help the reader envision *SeaLab*. Now, the situation would be different if the writer proposed to add:

a fairly crude windowless tank that could house only four people for just eleven days.

This would help the reader understand that the first *SeaLab* was not some futuristic *Atlantis*.

(D) is wrong. The proposed addition is repetitious, so it can’t possibly lead away from what is being said.

34. (F) **English/Rhetorical Skills/No Change**. CCRS: WC 24–27c. CC: ELA-Literacy.L.11–12.6. This is essentially a vocabulary question that relies on shades of meaning. The original is the best choice of words because “outside” creates the contrast with “inside” that the writer intends. The other choices are wrong because the words have meanings that are not quite so precise.

(G) is wrong because “at the exterior” would refer to the boundary, perhaps inside the container or outside in the water. It would not necessarily refer to the depths of the ocean “out there” where the divers would work.

(H) is wrong because the “reverse side” does not have a clear meaning here. The reverse side of the head of a coin is the tail; the reverse of the sticky side of tape is the smooth side; and the reverse of the shiny side of aluminum foil is the dull side. But what is the reverse side of the “pressure inside”?

(J) is incorrect because “beyond” is not very precise. It does not in this case contrast exactly with the “inside” of a submersible habitat.

35. (B) **English/Usage and Mechanics/Sentence Structure/Misplaced Modifiers**. CCRS: SSF 20–23a. CC: ELA-Literacy.L.9–10.1. The problem with the original version of this sentence is the placement of the modifier “greatly.” As positioned, “greatly” seems to modify “work,” suggesting perhaps that the scientists are doing important work. The writer, however, means for the word to modify “extends,” saying that the underwater habitat allows the scientists to work for much longer periods of time. The proper placement of the modifier to achieve this intention is “greatly extends.” As a rule, modifiers should stay at home, that is, to avoid ambiguity they should be placed near what they are intended to modify.

(C) fails to resolve the problem because the placement leaves an ambiguity. Does the sentence mean to say that the time is extended greatly (the intended meaning) or that time in general is extended greatly? (B) avoids this ambiguity.

(D) is wrong because the suggested placement presents the same problem as the original version of the sentence. “Greatly” seems to modify “work” rather than “extends.”

36. (H) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. CCRS: TOD 16–19b. CC: ELA-Literacy.L.9–10.3. This item asks you to explain what purpose the proposed clause would have if added to the essay. The correct answer is (H): the proposed material would serve no purpose. As (H) points out, the clause is not connected to any idea presently in the paragraph. The paragraph describes how the scientists work, so a sentence about relaxation is not really relevant.

(F) is incorrect because the information does not belong in the paragraph. While the clause does suggest a shared camaraderie, that idea is not related to the information about working conditions.

(G) is incorrect because the clause does not belong in the paragraph. The paragraph is explaining how the undersea lab helps scientists be more efficient, not what the living conditions are in the lab.

(J) is wrong because it gives the wrong reason for not including the information. It should be left out because it is not relevant to the rest of the paragraph, not because it fails to provide details for a point that is irrelevant anyway.

37. (D) *English/Usage and Mechanics/Sentence Structure/Fragments and Punctuation/Commas*. CCRS: SSF 28–32a. CC: ELA-Literacy.L.11–12.3. The problem with the original version of the sentence is that the word grouping from the initial capital to the first period is a fragment. The word group lacks a main verb. A good way of resolving this problem is to “piggy back” the fragment on to the complete sentence that follows. Each of the answer choices suggests a strategy for accomplishing this, but only (D) is acceptable. Placing a comma after “feet” (and adjusting the capitalization) results in a complete sentence that has an introductory modifier. The end of the modifier is marked by the comma so that the reader knows that the introductory prepositional phrase (“at a depth of sixty feet”) ends and the main part of the sentence begins.

(B) is incorrect because the comma after “depth” is superfluous and disrupts the logical flow of the sentence.

(C) is wrong because the semicolon cannot be used in place of the comma to mark the end of the introductory phrase. The semicolon is more “powerful” than the comma and has too much stopping power for this purpose. If you were speaking, you would want a brief pause following “feet,” not a lengthy one.

38. (J) *English/Usage and Mechanics/Sentence Structure/Comma Splices*. CCRS: SSF 16–19a. CC: ELA-Literacy.L.9–10.1. The original sentence contains a comma splice. You have one independent clause with the subject “work” and the verb “would be limited” and a second independent clause with the subject “divers” and the verb “can work.” The two independent clauses, however, are spliced together using just a comma. If you were the writer of this essay and needed to make the correction here, you would have a choice. You could use a semicolon instead of the comma:

Work would be limited; divers can work.

Or you could mark the juncture with a coordinating conjunction:

Work would be limited, but divers can work.

You could even turn one of the clauses into a dependent clause:

While work would be limited, divers can work.

Or you could simply put a period at the end of the first clause and start a new sentence:

Work would be limited. Divers can work.





(J), the correct answer, uses this last strategy.

(G) eliminates the comma splice when it eliminates the comma, but the result is a fused sentence, that is, two independent clauses jammed together with no punctuation or conjunction to mark the end of one and the beginning of the other. The reader is likely to find it difficult to figure out the structure of the sentence.

(H) eliminates the comma and therefore the comma splice, but the result is a fused sentence. The comma following *SeaLab* is a good idea to show the end of the introductory phrase, but it alone will not tell the reader where one independent clause ends and the next begins.

39. (B) **English/Usage and Mechanics/Sentence Structure/Misplaced Modifiers. CCRS: SSF 20–23a. CC: ELA-Literacy.L.9–10.1.** This sentence contains one of our favorite errors: the dangling modifier. The dangling modifier is a favorite for us because it often creates humorous results. In general, a reader will associate a modifier with the noun or verb that is closest to it. (See item 35, above.) What noun is closest to the phrase “bolted to a two-hundred-ton platform sixty-six feet below sea level”? “Scientists.” The sentence, as written, makes it seem as if those poor scientists are bolted to an underwater platform.

If you were the writer of the essay, you would have many options to correct this error. You might choose to make the introductory phrase an independent clause and turn the present independent clause into a relative clause:

The outpost is bolted to a platform sixty-six feet below sea level, which gives scientists a unique opportunity . . .

Or you could use a relative clause inside the independent clause:

Scientists at this research outpost, which is bolted to a platform . . . , are offered a unique opportunity.

Or you could keep the introductory phrase intact and rearrange the order of the elements of the independent clause to put the word the phrase is intended to modify closer:

Bolted to a platform, this research outpost offers scientists . . .

If this were your essay, you could choose any of these strategies or even think of another alternative. Of course, this is a multiple choice test, so you have to pick the best one offered by the test writer, and that is (B), which is the last strategy outlined.

(C) fails to eliminate the ambiguity of the original sentence. The proximity of “scientists” to the introductory phrase will still encourage a reader to associate the two and to wrongly conclude that the phrase is intended to modify “scientists.” Additionally, the phrase “scientists researching at this outpost” is awkward.

(D) fails to eliminate the problem of the original because a reader is still likely to associate “scientists” with the introductory modifier and wrongly conclude that the writer is saying that the scientists are bolted to the underwater platform.

40. (F) **English/Rhetorical Skills/Strategy/Appropriate Supporting Material. CCRS: TOD 33–36b. CC: ELA-Literacy.L.11–12.3.** One of the most important strategies for taking a standardized exam is to read the questions carefully and to respond to the question asked. If you give the question here only a cursory reading, you will find it very difficult to get the right answer. Each of the four answer choices, when taken in isolation, sounds plausible. They all mention the *Aquarius* and so seem to be related to the topic of the essay, and they use words such as “jointly,” “collaborating,” and “project” that seem appropriate. Only (F), however, mentions “governing bodies”: “. . . operated jointly by the National Oceanic and

Atmospheric Administration and the University of North Carolina.” And “governing bodies” is the key phrase in the question itself.

(G) is incorrect because it simply does not respond to the question asked. While it may be true that professors from UNC worked on the project, this does not say what organization or organizations were in charge of the project.

(H) is wrong because it does not address the issue of governance. The fact that some people did not get along with others does not say who was in charge of the project.

(J) seems to be promising at first because it mentions that many groups “support” the project. To “support,” however, does not mean to be in charge. Plus, (J) never mentions specifically any organization or organizations.

41. (A) **English/Rhetorical Skills/Style/Clarity of Meaning. CCRS: WC 24–27c. CC: ELA-Literacy.L.11–12.6.** This is a vocabulary question. (A) is the correct answer because it is the word choice that would be the least acceptable alternative to the original sentence. The original version uses “array,” which means an arrangement or display of items for a particular purpose.

(A) is a poor replacement, so (A) is correct since the question asks for the LEAST acceptable alternative. To classify means to place into categories. The process of classifying is a mental exercise. For example, you might classify the tops you wear according to color, fabric, and sleeve length. The classification scheme might help you to decide which garment would be the best for a particular look or for certain weather, but you cannot wear the “classification.” So too, the scientists use a variety of instruments, but they cannot tighten a bolt or cut a wire with the *classification* of instruments in their hands.

(B) is a possible replacement because “assortment” refers to several items drawn from different groupings.

(C) is a possible replacement because a collection is a group drawn from different places and containing a variety of examples.

(D) is a possible replacement, though perhaps the weakest of the options, because “supply” refers to the available items. “Supply” also may imply a resource that must be replenished from time to time, and that connotation is not very strongly supported by the text.

42. (F) **English/Usage and Mechanics/No Change. CCRS: COP 28–32a. CC: ELA-Literacy.L.11–12.2.** The information that follows “moonpool” is a nonessential (nonrestrictive) appositive. The phrase defines or explains what the *moonpool* does. Now, to say that it is nonessential does not mean that it is irrelevant. The detail is obviously important, for without it, the reader would likely have no idea of the meaning of the word “moonpool.” But because it is nonessential, it should be marked with a comma or commas, and since the end of the appositive coincides with the end of the sentence, this means a comma to signal the start of the appositive and a period to signal its conclusion.

(G) is incorrect because breaking the sentence into the two parts suggested would result in a fragment. The word grouping from the new capital letter “A” to the period would not have a main verb.

(H) is wrong because a semicolon here would signal to the reader the start of a new clause, but the word group from the new semicolon to the period would be lacking a main verb. In other words, the change would create a fragment of a sentence.

(J) is incorrect because the nonessential nature of the appositive remark means that a punctuation signal—in this case a comma—is required to alert the reader that information of a different sort is coming.



43. (C) *English/Usage and Mechanics/Grammar and Usage/Adjectives versus Adverbs*. CCRS: COU 16–19a. CC: ELA-Literacy.L.9–10.1. The problem with the original sentence is that the wording makes it sound as though the pressure in the habitat must be both “gradual” and “returned to that of sea level.” What the writer means to say, however, is that the pressure must be “gradually returned” to the appropriate level. To clarify the meaning, “and” should be removed and “gradual,” an adjective, should be replaced by the adverb “gradually.” (C) makes the needed change.

(B) has the merit of using the adverb “gradually” to modify “return” rather than the adjective form “gradual.” However, it still includes the superfluous “and.” The “and” disrupts the logical flow of the sentence by separating the modifier from the modified.

(D) is incorrect because it fails to address the issue of proper form. “Gradual” is an adjective and cannot modify the verb “returned.”

44. (H) *English/Rhetorical Skills/Organization/Paragraph-Level Structure*. CCRS: ORG 28–32b. CC: ELA-Literacy.L.11–12.3. With a question that asks you to re-sort the sentences, you can look for a variety of clues. Of course, you can look at the intended development of the paragraph, paying attention to whether the sentences are presented chronologically, logically, or in some other order. And you can pay attention to particular phrases and words, such as “on the other hand” and “this.” In this passage, the “this” in sentence 1 is a demonstrative adjective that refers to something that has gone before. For example:

Decompression is very important to avoid accumulating nitrogen bubbles in the blood, a problem called the bends. This decompression can take a long time.

In the original placement of the sentences, however, “this” doesn’t refer to anything because nothing has come before in the paragraph. So sentence 2 needs to follow a sentence that mentions “decompression,” and the proper sentence order must be 2,1.

As it turns out, this is all that you need to answer the question, because only (H) uses the order 2,1. To finish our analysis, we note that sentence 3 works best as a conclusion to the entire essay and not as an introduction to this paragraph.

(G) is wrong because it fails to solve the problem of the failure of “this” to refer to anything. Additionally, sentence 3 refers to a “small price,” but it is not clear what that reference would mean if sentence 3 is placed first.

(J) is wrong because it illogically places the concluding sentence between the two sentences that describe the decompression process.

45. (D) *English/Rhetorical Skills/Strategy/Main Idea*. CCRS: TOD 20–23a. CC: ELA-Literacy.L.11–12.3. This question asks whether the main focus of the essay as written is about Jacques Cousteau’s contributions, and the answer is “no.” Cousteau is mentioned in the first and last sentences, as a rhetorical device to get the essay started and to bring it to a conclusion. The essay itself is about developments in underwater habitats and about *SeaLab* and *Aquarius* in particular, neither of which, so far as we are told, had anything to do with Cousteau.

(A) is incorrect because the “yes” is wrong. The essay is not about Cousteau’s research at all.

(B) is wrong both because it answers “yes” and because the choice wrongly asserts that *SeaLab* was a Cousteau project. The essay only states that Cousteau made a prediction, not that he built the facility.

(C) is incorrect because the *moonpool* is a detail, not the main point. Furthermore, the essay, as written, doesn’t even mention the University of North Carolina. That reference is found in the possible responses for item 40.

46. (F) *English/Usage and Mechanics/Grammar and Usage/Diction* and *Nouns and Noun Clauses*. **CCRS: COU 16–19a. CC: ELA-Literacy.L.9–10.1.** Despite the differences in the order of the elements in the various choices, there is only one alternative that does not work, and that is (F). “In which he is most widely remembered for” is not an idiomatic usage, and as such, is the correct answer because it is NOT acceptable.

**TIP** Remember to read the item stem carefully. You may find it a good idea to circle thought-reversers such as “NOT” and “EXCEPT.”

(G) is an acceptable rendering of the original sentence. “That” introduces an essential relative clause that defines “achievement.” The relative clause has both a subject (“he”) and a main verb (“is remembered”).

(H) offers an older but still acceptable version of the sentence. At one time, grammarians insisted that it was bad form to end a sentence with a preposition, and that injunction extended to clauses as well. Therefore, an old-time grammarian might avoid the original version (which ends in “for”) in favor of making the relative pronoun the object of the preposition “for.” Current usage does not insist upon this point. So as a matter of test-taking strategy, you can safely ignore the injunction against ending a clause or sentence with a preposition, responding as Winston Churchill did, when admonished by a critic against ending a sentence with a preposition:

Winston Churchill: Sir, that is something up with which I shall not put.

(J) is acceptable because the “that” which introduces the noun clause in the original version is here understood. Compare:

Janice knows that she should not put the heavy boxes on the top shelf.

Janice knows she should not put the heavy boxes on the top shelf.

Both are acceptable.

47. (D) *English/Rhetorical Skills/Style/Conciseness*. **CCRS: WC 16–19a. CC: ELA-Literacy.L.11–12.1.** The underlined part of the sentence contains needless repetition. “Creation” is practically synonymous with “invention,” and any slightly different connotations are not sufficiently relevant here to save the one from being redundant of the other. (D) correctly eliminates the unnecessary verbiage.

(B) is even more wordy than the original. Putting “creation” into a relative clause introduced by “which” just compounds the problem.

(C) is wrong because “that is” can be used to introduced a clarification or further definition, but “creation” adds nothing to “invention” in this context.

48. (F) *English/Usage and Mechanics/No Change*. **CCRS: COU 24–27a. CC: ELA-Literacy.L.11–12.1.** This item tests agreement between pronoun and antecedent. The antecedent for the pronoun “his” is in the preceding sentence: “Dr. Grant.” “His” is a third person singular masculine pronoun, so it agrees with “Dr. Grant.”

(G) is incorrect because “their” is a plural pronoun and therefore cannot replace “Dr. Grant.”

(H) is wrong because “its” is not a word in the English language. “Its” appears to be an attempt to form the third person singular possessive, but that is “its.” “Its” is written without an apostrophe because the possession is already indicated by the pronoun itself. And, in any case, “its” is neuter, not masculine. See item 25, above.

(J) is incorrect because “it’s” is the contraction of “it is” and not a pronoun at all.



49. (A) *English/Usage and Mechanics/No Change*. CCRS: SSF 20–23a. CC: ELA-Literacy.L.11–12.3. The key to this item is recognizing that “in order to hit” is idiomatic English. The sentence is correct as written.
- (B) is wrong because “in order for hitting” is not idiomatic. And it doesn’t matter whether you question the use of “for” in place of “to” or “hitting” in place of “hit.” Both “in order to hitting” and “in order for hit” would be unidiomatic as well.
- (C) is wrong because “in order to hitting” is not idiomatic English. “To hitting” seems to be a non-idiomatic mix of the gerund and the infinitive forms of the verb. See item 21, above.
- (D) is incorrect because “that” would seem to be the subject of a relative clause with the verb “hit.” But “that hit” does not modify anything in the independent clause. Without a proper anchor in the main part of the sentence, “that hit” causes the sentence to break apart and lose its sense.
50. (J) *English/Rhetorical Skills/Style/Clarity of Meaning*. CCRS: WC 24–27c. CC: ELA-Literacy.L.11–12.6. This is a vocabulary item that tests shades of meaning. All five of the suggested words (the original plus four choices) can be used to refer to “resolving” situations. But “rescue” has a connotation that is not quite on point. When a problem is solved, it disappears—not the circumstances that gave rise to the problem, perhaps, but the dilemma they created. So when you solve the problem of a flat tire, though the tire remains, the “flatness” is gone. On the other hand, when something is rescued, the something that is rescued survives. That is the purpose of the rescue. It might be useful to compare the following:
- The fire department rescued the kitten from the tree.
- The problem of the kitten in the tree was solved by calling the fire department.
- In these examples, the kitten was rescued, but the kitten itself was not a problem. The problem was “the kitten in the tree.”
- (F) is wrong because it would be acceptable to talk about correcting a problem.
- (G) is wrong because it is acceptable to talk about alleviating a problem. Interestingly, (G) may be the second-best answer because someone might argue that “alleviating” a problem is not a complete solution. So “alleviate” and “remedy” are not exactly synonymous. As a matter of strategy, however, (G) is more acceptable than (J).
- (H) is wrong because it is idiomatic to talk about fixing a problem.
51. (B) *English/Rhetorical Skills/Strategy/Effective Opening Sentence*. CCRS: ORG 20–23c. CC: ELA-Literacy.L.9–10.3. This fairly difficult question requires you to assess the significance of the shift of the discussion from the golf tee to Dr. Grant’s work as a dentist. The main point of the entire essay is that Grant’s approach to dentistry was similar to the thinking that led to the invention of the golf tee. Both were examples of innovative problem solving. The writer uses the rhetorical strategy of contrasting the simple and seemingly insignificant tool used in playing a game with the complex dental appliances designed by Grant to improve the health of patients. Paragraph three marks the turning point of the discussion, so the question is what transition would help the reader understand this? The original sentence does a poor job because the sentence seems to suggest that the writer will go on to discuss why the tee was not a financial success. But the paragraph, as noted, actually goes on to discuss Dr. Grant’s work in dentistry. (B) better signals this transition.
- (C) is incorrect because there is no element of this conclusion in the essay. Nowhere does the writer discuss the psychological or social elements of golf.
- (D) is incorrect because the essay does not mention any “friends” of Dr. Grant.

52. (G) *English/Usage and Mechanics/Punctuation/Apostrophes*. CCRS: COP 24–27c. CC: ELA-Literacy.L.11–12.2. In order for “Grants” to modify “design,” “Grants” must be in the possessive form: “Grant’s.” The possessive form is needed to show to whom the design is to be credited. (G) solves the problem of the original without introducing any new errors.

(H) corrects the problem of the original but introduces a new error. The comma following “design” is superfluous and disrupts the logical flow of the sentence. The main verb of the sentence is “fit.” The simple subject is “those.” And the complete subject of the sentence, with all of its modifiers, is “Those constructed according to Grant’s design.” So (H) puts an unnecessary comma between the subject and the verb, which disrupts the connection between those two important elements.

(J) fails to correct the problem of the missing apostrophe in the original and commits the additional error of adding a superfluous comma that disrupts the logical flow of the sentence by separating the subject from the verb.

53. (B) *English/Usage and Mechanics/Grammar and Usage/Sequence and Verb Tense*. CCRS: SSF 16–19b. CC: ELA-Literacy.L.9–10.1. The problem with the original is the verb tense of the underlined part. “Have been” is the present perfect tense. In the present perfect tense, the action described is still in the process of being “perfected” or “completed.” The problem with the original is that Dr. Grant lived in the 1800s, so he is dead. His work is over. So whatever he accomplished in dentistry has been completed or “perfected.” A better choice of verb tense is just the simple past tense “was.”

(C) uses an illogical verb tense. Dr. Grant (and his patients) must have been dead for some time. The present tense “are” is illogical.

(D) is a good try but wrong. At least (D) uses the simple past, an improvement in one way over the original. But (D) is wrong because “were” is plural and does not agree in number with the subject “health.” Both as a matter of editing your own writing and as a test-taking strategy, do not be distracted by the proximity of the plural “patients” to the verb. “Patients” is the object of the proposition “of,” and the prepositional phrase “of his patients” modifies “health” to show whose health was affected. “Health” is the subject of the sentence.

54. (F) *English/Usage and Mechanics/No Change*. CCRS: COP 24–27b. CC: ELA-Literacy.L.11–12.2. The original sentence is correct. The sentence has a compound subject: “invention” and “bridge.” “Invention” is one element of the subject of the sentence, and the prepositional phrase “of the golf tee” establishes which invention is discussed in the sentence. The other element is “bridge,” which is modified by the adjectives “innovative” and “dental.” The verb is “may seem,” and the rest of the sentence is a predicate complement (meaning it completes the “seem”).

(G) is incorrect because neither of the new commas is needed. The first one disrupts the logical connection between the noun “invention” and the prepositional phrase that identifies the invention discussed. The second comma unnecessarily separates the two elements of the compound subject.

(H) is wrong because the new comma is not needed and obscures the logical connection between the noun “invention” and the prepositional phrase modifying the noun.

(J) is wrong because the new comma is not needed and disrupts the logical connection between the two noun elements of the compound subject.

55. (A) *English/Rhetorical Skills/No Change*. CCRS: WC 16–19a. CC: ELA-Literacy.L.9–10.3. The original sentence is correct. “A need” is direct and to the point. The other choices are all unnecessarily wordy.

(B) is needlessly wordy. What does “lack” mean if not “of something that was needed”? In fact, there is no need for the “of something.” If the writer had wished to substitute “lack” for “need,” the sentence



could have read: “Grant recognized a lack and focused his skill.” The fact that this version would be just as good as (B) and much shorter is pretty good proof that (B) is unnecessarily wordy.

(C) is wrong because how could something be a need unless it was a need “in existence”? The fact that “need” alone does the job in the original sentence and does it well is pretty good evidence that (C) has a lot of unnecessary words.

(D) is wrong because, like the other choices, it uses a lot of unnecessary words. It is awkward and wordy when compared with the original.

56. (H) *English/Usage and Mechanics/Grammar and Usage/Diction*. CCRS: COU 20–23a. CC: ELA-Literacy.L.9–10.1. The problem with the original is that the phrasing “focused . . . to devising” is not idiomatic. In this case, the preposition “on” is needed: “focused . . . on devising.” Each of the wrong choices uses an incorrect preposition. It is important to understand that the problem here is not grammatical. A preposition is a part of speech and all of the variations (original and choices) use prepositions in a grammatical way. The problem is in the subtle meaning of the preposition. If you speak another language or have studied another language, you may already be aware of this problem. Each language has its own peculiar preferences for certain words in certain contexts.

(G) is incorrect because the preposition “at” does not create an idiomatic phrase: “focused . . . at devising.”

(J) is incorrect because “focused . . . for devising” does not create an idiomatic English phrase.

57. (D) *English/Rhetorical Skills/Strategy/Effective Transitional Sentence*. CCRS: ORG 24–27a. CC: ELA-Literacy.L.11–12.3. The problem with the original is that “instead” has a meaning that is inappropriate in this context. Technically, “instead” is a conjunctive adverb, and conjunctive adverbs are used to show the logical connection between two ideas. “Instead” is used to show that one idea has taken the place of or has been substituted for another:

Instead of going to the library, we went to the movies.

In this case, the writer really does not mean to say that the idea expressed in the sentence used to introduce the last paragraph substitutes for something said before. Rather, the idea is actually a continuation of the development. The sentence itself is sufficient to convey this impression, so there is no need for any conjunctive adverb. If the writer really wanted to use a conjunctive adverb, perhaps “ultimately” or “in the final analysis” would have been acceptable.

(B) is incorrect because “in addition” is a conjunctive phrase that is used to connect ideas in a series. The idea expressed in this sentence is not one in a series.

(C) is wrong because “in contrast” is a conjunctive phrase used, as the wording indicates, to show a contrast. But in this case, the writer uses the final paragraph to summarize the development of the essay.

58. (H) *English/Usage and Mechanics/Punctuation/Commas*. CCRS: COP 28–32a. CC: ELA-Literacy.L.11–12.2. A colon should not be used to signal the end of an introductory phrase. Instead, the job of marking the end of an introductory phrase belongs to the comma.

Example:

Carrying our knapsacks above our heads, we forded the chest-high waters of the rain-swollen stream.

Secured with duct tape, the door stayed shut until we reached the next town and found a mechanic to repair it.

Low, long, and shaped like a missile, the new high performance car looks like it will break land speed records.

In this case, a comma rather than a semicolon should follow “dentistry.”

The colon is used to set up a series or further explanation:

It is important to use the mandated safety equipment: goggles, gloves, and hard hat.

A mistake in mixing the chemical proportion could have catastrophic results: a huge explosion.

See item 6, above.

(G) is wrong because the semicolon cannot do the job of the comma here. The semicolon is most often used to join two independent clauses into one longer sentence, with or without a coordinating conjunction. Examples:

If the building permit is approved, the work will begin next week; and the staff will be able to move into its new quarters early next year.

The referee blew the final whistle marking the end of the game; we had won the championship by just one point.

(J) is wrong because a comma is needed to mark the end of the introductory phrase.

59. (D) *English/Usage and Mechanics/Grammar and Usage/Verb Tense*. CCRS: SSF 20–23a. CC: ELA-Literacy.L.11–12.3. The problem with the original is that “concentrated” is the past participle of “concentrate.” The past participle of a verb can be used in conjunction with auxiliary (helping) verbs to be the main verb of a sentence:

Since graduation, she has concentrated on building her own consulting business.

The past participle can also be used as an adjective:

The concentrated form of the chemical is highly unstable.

But in this sentence, the word is not intended to be either a main verb or an adjective. Instead, the syntax of the sentence implies that “generations” is the subject of an infinitive: “. . . possible for generations . . . to concentrate . . .”

(D) makes the needed correction.

(B) is wrong because this version substitutes the present participle for the past participle. The same problems discussed above make this choice incorrect.

(C) is wrong because “concentrate” is a conjugated form of the verb and could function as a main verb given a subject. The problem is that there is no subject to which it can attach. The main subject of the sentence, “he,” is modified by the verb “is,” and there are no other subjects available.

60. (H) *English/Rhetorical Skills/Strategy/Main Idea*. CCRS: TOD 24–27a. CC: ELA-Literacy.L.11–12.3. This question asks about the main point of the essay. Is the main point to document key innovations in golf equipment? The only golf equipment mentioned is the tee, so the essay would have to be counted as a failure on that score. Additionally, there is a lot of information about Dr. Grant and his dentistry; discussion of those topics would be out of place in an essay devoted to “golf equipment.” So the answer is “no.” The mention of the tee does not turn this essay into a discussion on golf equipment.





(F) is incorrect because the essay is not about golf equipment. To be sure, the tee is probably a very important invention, but one invention does not a discussion on equipment make. Think of all the other things that such a discussion might cover: the ball, the driver, the putter, the shoes, the cart, the greens, etc.

(G) is wrong because the essay is not a discussion about golf equipment. Yes, the essay does provide some information about the tee. But the tee is only one of many tools used by golfers.

(J) is wrong because even adding the information noted would not make the essay a discussion of golfing equipment. The focus of the essay is Dr. Grant and his method of thinking that lead to innovation in both sporting equipment and dental practice.

61. (C) *English/Usage and Mechanics/Sentence Structure/Fragments. CCRS: SSF 28–32a. CC: ELA-Literacy.L.11–12.2.* The problem with the original version is that the word group from “in 1917” to the period following “built” is a fragment. “Year” sounds like the subject of a main clause with “[that] our house was built” being a relative clause. But there is no main verb. A good way of solving the problem is to combine the fragment with the sentence that follows, the strategy the writer had in mind in the first place judging from the way the two fit together so neatly. To accomplish this, (C) transforms the fragment into an introductory remark, the end of which is signaled by a comma. Then it adjusts the capitalization, so that the result is a single sentence. “In 1917” is an adverbial phrase modifying the main verb “had,” and the object of the preposition “in,” “1917,” is mirrored by the appositive phrase “the year our house was built.”

(B) is incorrect because the end of the introductory material is not marked by a comma.

(D) is incorrect because a semicolon is too “powerful” to signal a pause at the end of the introductory phrase. The reader will expect the end of a clause, but, as explained, the first word grouping is not an independent clause.

62. (J) *English/Usage and Mechanics/Grammar and Usage/Diction. CCRS: COU 16–19a. CC: ELA-Literacy.L.9–10.1.* The problem with the original is the non-idiomatic use of the preposition “about” to follow “scheme.” The correct idiom is “had a scheme for” doing something. Importantly, this is not a grammar problem but a usage problem. All of the options (original and choices) are prepositions. The question presented is which preposition makes the acceptable statement.

(G) is incorrect because “had a scheme of” doing something is, like the original, non-idiomatic.

(H) is incorrect because “had a scheme by” doing something is, like the original, non-idiomatic.

63. (A) *English/Rhetorical Skills/No Change. CCRS: SSF 20–23a. CC: ELA-Literacy.L.9–10.1.* The original sentence is correct. “That” is a relative pronoun used to introduce a dependent clause. It does this by referring to “alleys” and then functioning as the subject of the verb “ran.” So everything in the original fits together in the way that it should.

(B) is wrong because “being that” is informal usage and should be avoided in formal writing. To be sure, we use the phrase in conversation: “Being that it’s after 8:00, I think we should go home.” But that phrasing has no place in writing.

(C) uses a conjunction, “so,” that completely distorts the intended meaning of the original. “So” suggests that there is a causal or perhaps logical connection between the ideas joined, but the writer does not intend such a connection.

(D) is incorrect because the resulting version would include a dependent clause joined to the main clause by “since.” The problem with this version is that “since” implies that the collection plan flowed

from a pre-existing condition (the location of the alleys) when, in fact, building the alleys was part of the original plan.

64. (H) *English/Rhetorical Skills/Strategy/Appropriate Supporting Material*. CCRS: TOD 20–23b. CC: ELA-Literacy.L.9–10.3. This question asks which of four details would be most effective in giving the reader a good picture of the city planners’ intention regarding garbage pick-up. The original does not do a very good job. The size of the sidewalks in front of the houses (as opposed to the size of the alleys behind them) does not seem particularly relevant. On the other hand, the goal of the plan was to keep the front of the houses nice, neat, and tidy—and free of refuse and containers. (H) hits the nail on the head.

(G) is perhaps a poor second choice. To the extent that “pavement” suggests order and neatness, (G) is arguably an improvement over the original. But (G) has two other weaknesses. First, “paved cement” is needlessly wordy: cement sidewalks are paved. Second, even cement could be covered with garbage. The point is that if you like (G), you have to love H; (H) is a better choice.

(J) is wrong because “old” and “familiar” do not address the point regarding order and cleanliness.

65. (B) *English/Usage and Mechanics/Sentence Structure/Problems of Coordination and Subordination and Nouns and Noun Clauses*. CCRS: SSF 24–27a. CC: ELA-Literacy.L.11–12.3. The problem with the original is faulty subordination. The original wrongly implies that the sidewalks were used by the houses to face a certain direction. That suggestion, of course, is illogical. The houses were built to face a certain direction, and the sidewalks were built as part of the overall plan. (B) resolves this issue by making it clear that the houses faced the sidewalks; the sidewalks did not, however, determine the orientation of the houses.

(C) completely destroys the logical structure of the sentence. Because the resulting sentence is so fragmented, it is difficult to sort out exactly what it says and doesn’t say. “Toward” is a preposition, and “houses” seems to be its object. But then “faced” is a verb with no subject. Overall, the result is words dumped together without regard to their connections.

(D) is incorrect because the resulting sentence would contain what seems to be a prepositional phrase plus a participle used as an adjective: “facing.” But “facing” doesn’t have anything to modify. If “facing” is read to modify “houses,” that simply invites the further inquiry, “facing what?” So even if we try to make sense of the result, we find that there is no way to put all of the pieces together into a coherent sentence.

66. (J) *English/Usage and Mechanics/Grammar and Usage/Verb Tense*. CCRS: SSF 28–32b. CC: ELA-Literacy.L.9–10.1. The problem with the original is the shift to the subjunctive mode: “would have worked.” The “would” implies that the plan was supposed to work in a certain way but didn’t. But if you read the rest of the paragraph, you learn that the writer is saying that the plan did work as originally envisioned for many years—until trucks got too large for the alleys. So the verb should be in the indicative mode rather than the subjunctive.

Granted, that’s a lot of jargon for a point that is more easily grasped in the concrete: instead of saying “would have,” you need to say “did.” And that is why (J) is correct.

(G) is wrong because “were to have” still implies that the plan never worked as originally set forth. The writer, however, makes it clear that the plan did work for many years.

(H) has the merit of using the indicative mode. “Work” implies that things actually do happen a certain way in practice, not just in theory. But the problem with (H) is the choice of verb tense. The writer is clearly describing conditions in the past, so the verb needs to be past tense: “worked.”

67. (A) *English/Rhetorical Skills/No Change*. CCRS: WC 24–27c. CC: ELA-Literacy.L.11–12.6. The original is correct. The writer wants to convey the image of oversized trucks barely passing down narrow alleys to pick up the garbage. “Squeeze” nicely conveys this image.



(B) is a poor choice when compared with the original. “Rambling” implies an almost directionless movement free of any constraints, whereas the image the writer intends is that of vehicles that are highly confined and narrowly directed.

(C) deviates from the writer’s intention in an important respect. “Rolling” implies speed, and speed implies lack of impediments. But the writer means to suggest that the trucks had little room and were forced to move slowly.

(D) is incorrect because “traveled” is neutral, and the writer wants to create an image of the trucks moving very slowly and very carefully.

- 68. (H) English/Rhetorical Skills/Strategy/Appropriate Supporting Material. CCRS: TOD 28–32b. CC: ELA-Literacy.L.11–12.3.** This item asks you to choose a detail that will reinforce the point made by the preceding sentence. In that sentence, the writer explains that the trucks are big and the alleys small. So the correct answer will further illustrate that point. The original sentence is a poor choice because the color of the trucks has nothing to do with size. On the other hand, (H) tells the consequence of the size mismatch: the trucks can barely pass. So (H) helps to prove that the size difference is important. To be sure, things would be different if we were given a choice like:

The modern trucks, which are painted bright yellow, look like huge party balloons being squashed into a narrow slit.

That’s not perfect, but at least it shows how the original might have avoided being completely irrelevant. And it shows that color alone is not an important detail.

(G) is incorrect because frequency of clean-ups is not related to size. Even if this choice specified “trucks” rather than “residents,” it would still be irrelevant. Whether the trucks come every day, twice a week, or once a year, they are still too big.

(J) is wrong because the cleanliness of the alleys has nothing to do with the size disparity between trucks and alleys.

- 69. (C) English/Usage and Mechanics/Sentence Structure/Comma Splices. CCRS: SSF 28–32a. CC: ELA-Literacy.L.11–12.2.** This item asks for you to demonstrate that you know how to correctly join two sentences to make a single sentence. This is not to say that the original is incorrect. There is nothing wrong with the version in the essay as written. But a writer might want to combine the two sentences because the ideas are so closely related. Because of the thought-reverser in the stem, the correct choice here is the one that makes a mistake in joining the sentences.

As you have learned, there are several different strategies that you might use in this situation:

Mary painted the window trim. Amanda painted the ceiling. (Two sentences)

Mary painted the window trim; Amanda painted the ceiling. (Semicolon)

Mary painted the window trim, and Amanda painted the ceiling. (Comma, conjunction)

But you cannot join the two without somehow marking the joint:

Mary painted the window trim Amanda painted the ceiling. (Run-on sentence)

And a comma alone is not sufficient:

Mary painted the window trim, Amanda painted the ceiling. (Comma splice)

(C) is wrong because it creates a comma splice. And because we are looking for the version that is NOT acceptable, (C) is the correct answer

(A) is an acceptable way of combining the two sentences. You can use a comma with a conjunction.

(B) is an acceptable way of combining the two sentences. You can use a semicolon with or without a conjunction. (In this case, the sentences are so short that if you used a conjunction, you'd probably want to use a comma, not a semicolon.)

(D) is an acceptable, though unusual, way of combining the sentences. Ordinarily, you wouldn't combine two independent clauses with a colon because the colon tells the reader to expect a series or an explanation. In this case, however, the second clause is an explanation of the effect of the first clause. So you can use a colon. It is important to understand, however, that the colon is appropriate here because of the content of the two clauses. A colon is not, in general, used to join any two clauses.

70. (G) *English/Usage and Mechanics/Grammar and Usage/Subject-Verb Agreement*. CCRS: COU 28–32b. CC: ELA-Literacy.L.11–12.1. This sentence has an unusual structure, so you have to be careful when you identify the subject of the underlined verb. The proximity of the word “houses” to “are” may mislead your “ear” into thinking that “houses” is the subject. “Houses” is not the subject. “Houses” is the object of the preposition “behind.” Since it is part of a prepositional phrase that modifies some other sentence element (“was hidden” where?), it cannot be the subject. Instead, the subject is “what,” a singular pronoun meaning “that which.” And the singular subject requires the singular verb “is.”

(H) is incorrect both because the past tense is inconsistent with the other verbs in the paragraph and because “were” is plural rather than singular.

(J) is incorrect both because the present perfect tense is inconsistent with the other verbs in the paragraph and because the “have” is a plural form.

71. (B) *English/Rhetorical Skills/Style/Clarity of Meaning*. CCRS: WC 24–27c. CC: ELA-Literacy.L.11–12.6. This is a vocabulary question. The original sentence uses a pretty good word for the context because “display” means any showing or exhibition of something. The worst choice of vocabulary among those we are offered is (B), “attraction,” because garbage is not the sort of thing that would be likely to attract favorable attention.

(A), “exhibition,” is an acceptable replacement, as “exhibition” is a synonym for “display.”

(C), “spectacle,” is a particularly good replacement because the word suggests the irony of garbage being an unsightly display.

(D), “showing,” is an acceptable substitute because “showing” is synonymous with “display.”

72. (F) *English/Usage and Mechanics/Grammar and Usage/Pronoun Usage*. CCRS: COU 28–32a. CC: ELA-Literacy.L.11–12.1. Mention “grammar” to most people and they begin to have unpleasant memories of English classes spent memorizing rules for using “who” and “whom.” The distinction is actually fairly simple, and the rules are easier to follow in writing than in conversation because saying “whom” out loud just seems to cause our tongues to tie in knots. “Who” is a nominative case pronoun, and that means that “who” is used as the subject of verbs. “Whom” is objective case, and that means that “whom” is used as the object of verbs and prepositions:

Who is called? (“Who” is the subject.)

Who shall I say is calling? (“Who” is still the subject; “shall I say” is an aside.)



The student who will be valedictorian is the one with the best grades. (“Who” is the subject of the verb “will be.”)

Ask not for whom the bell is ringing. (“Whom” is the object of the preposition “for.”)

In this case, “who” is the subject of the verb “delight,” so the original is correct.

(G) is incorrect because “whom” is objective case, and an objective case pronoun should not be used as the subject of a verb.

(H) is incorrect because “who” and “whom” are used to refer to people:

The book, which you’ll find under the table, belongs to Leroy, who is coming later to pick it up. (“Which” refers to “book”; “who” refers to “Leroy.”)

Whom did you give the book to? (“Whom” implies the book was given to a person.)

Which book did you give to Leroy? (“Which” refers to “book.”)

(J) is wrong because “whose” is the possessive case and cannot be the subject of a verb:

Leroy, whose book is under the table, will be by later. (“Whose” refers to “Leroy” and establishes the ownership of the book.)

73. (B) *English/Usage and Mechanics/Sentence Structure/Run-on Sentences*. CCRS: SSF 16–19a. CC: ELA-Literacy.L.11–12.2. The original version of the sentence is correct and all of the alternatives are acceptable except for (B). The problem with (B) is that the result would be a run-on or fused sentence. You would have two independent clauses (“the garbage truck is a weekly visitor” and “it is exotic”) jammed together with no signal that the sentence combined two separate thoughts.

**TIP** This item is a bit tricky to classify according to our standards because of the wording of the stem. Had (B) been the original sentence, then there would be no question that the item tests punctuation for complex sentences.

(A) is an acceptable alternative to the original. The result is a single subject and verb with a clarifying note introduced by “that is.”

(C) is an acceptable alternative because it makes clear that there is an elliptical (implied) “is” in the original sentence:

The truck is a visitor and [is] exotic.

(D) is an acceptable alternative because the comma is sufficient to introduce the phrase describing the visitor.

74. (G) *English/Usage and Mechanics/Punctuation/Colons*. CCRS: COP 33–36a. CC: ELA-Literacy.L.11–12.2. Here we have a textbook use of the colon to introduce a series. The original sentence suffers from a serious logical flow problem. As written, the sentence implies that the series following “to beat” consists of objects of “to beat.” But with the subject of the sentence, “the best features,” already completing the idea of what is hard to beat, the list has no logical connection to the other elements of the sentence. The colon suggested by (G) announces to the reader that something will follow, like an explanation, an elaboration, or a series. And “paint, sound, and way” constitute a parallel series of characteristics of the trucks. In this way, the series is removed from the logic of the main clause and stands as an addition introduced by the colon.

(H) is wrong because the comma fails to appropriately introduce the series that follows.

(J) is incorrect because it does not do the work ordinarily given to a semicolon, such as joining two clauses.

75. **(C) *English/Rhetorical Skills/Organization/Paragraph-Level Structure*. CCRS: ORG 28–32b. CC: ELA-Literacy.L.11–12.3.** The problem with the original is that the fourth sentence is out of place. One clue leading to this conclusion is “for them.” “Them” needs to have a clear antecedent, and you won’t find it in sentence 3 but in sentence 2. Additionally, the sentence sets up a contrast between the fire trucks and the garbage trucks, so what follows needs to be about both of those. Sentence 4, then, needs to come before both sentence 3 and sentence 5. Therefore, sentence 4 should come after sentence 2 and before sentence 3, which is (C).

(B) is not a good placement for sentence 4 because “for them” has nothing to refer to.

(D) is not a good choice for sentence 4 because the contrast between the fire truck and the garbage truck set up by sentence 4 would never be delivered—because it has already appeared in the paragraph.



The following tables list the descriptions for all the Common Core State Standards and the College and Career Readiness Standards that are referenced in this *Navigator Plus*.

## English — Common Core State Standards

Standard	Description
<b>ELA-Literacy.L.9-10.1</b>	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
<b>ELA-Literacy.L.9-10.3</b>	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
<b>ELA-Literacy.L.11-12.1</b>	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
<b>ELA-Literacy.L.11-12.2</b>	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
<b>ELA-Literacy.L.11-12.3</b>	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
<b>ELA-Literacy.L.11-12.4</b>	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
<b>ELA-Literacy.L.11-12.6</b>	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

## English — College and Career Readiness Standards

Standard	Description
<b>Topic Development in Terms of Purpose and Focus</b>	
<b>TOD 16-19a</b>	Identify the basic purpose or role of a specified phrase or sentence.
<b>TOD 16-19b</b>	Delete a clause or sentence because it is obviously irrelevant to the essay.
<b>TOD 20-23a</b>	Identify the central idea or main topic of a straightforward piece of writing.
<b>TOD 20-23b</b>	Determine relevancy when presented with a variety of sentence-level details.
<b>TOD 24-27a</b>	Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens that focus or to determine if an essay has met a specified goal.
<b>TOD 24-27b</b>	Delete material primarily because it disturbs the flow and development of the paragraph.
<b>TOD 24-27c</b>	Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given.
<b>TOD 28-32a</b>	Apply an awareness of the focus and purpose of a fairly involved essay to determine the suitability of a phrase or sentence and its rhetorical effect.
<b>TOD 28-32b</b>	Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add detail, or express a meaning.
<b>TOD 33-36b</b>	Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus.
<b>Organization, Unity, and Coherence</b>	
<b>ORG 20-23a</b>	Use conjunctive adverbs or phrases to express straightforward logical relationships.
<b>ORG 20-23c</b>	Add a sentence that introduces a simple paragraph.
<b>ORG 24-27a</b>	Use conjunctive adverbs or phrases to express straightforward logical relationships.
<b>ORG 24-27b</b>	Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
<b>ORG 24-27c</b>	Add a sentence that introduces a simple paragraph.
<b>ORG 28-32b</b>	Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
<b>Word Choice</b>	
<b>WC 16-19a</b>	Delete obviously synonymous and wordy material in a sentence.
<b>WC 20-23a</b>	Delete redundant material when information is repeated in different parts of speech (e.g., "alarmingly startled").
<b>WC 24-27a</b>	Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence.
<b>WC 24-27b</b>	Identify and correct ambiguous pronoun references.
<b>WC 24-27c</b>	Use the word or phrase most appropriate in terms of the content of the sentence and the essay's tone.
<b>WC 33-36a</b>	Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole.
<b>Sentence Structure and Formation</b>	
<b>SSF 16-19a</b>	Determine the need for punctuation and conjunctions to avoid awkward-sounding sentences.
<b>SSF 16-19b</b>	Decide the appropriate verb tense and voice by considering the meaning of the entire sentence.
<b>SSF 20-23a</b>	Recognize and correct marked disturbances of sentence flow and structure.
<b>SSF 24-27a</b>	Revise to avoid faulty placement of phrases and faulty coordination and subordination.
<b>SSF 28-32a</b>	Use sentence-combining techniques, effectively avoiding problematic comma splices, run-ons, and fragments.
<b>SSF 28-32b</b>	Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole.





<b>Conventions and Usage</b>	
<b>COU 16-19a</b>	Solve such grammatical problems as whether to use an adverb or adjective form, ensure subject-verb and pronoun-antecedent agreement, and use the correct preposition.
<b>COU 20-23a</b>	Use idiomatically appropriate prepositions, especially in combination with verbs.
<b>COU 24-27a</b>	Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses.
<b>COU 28-32a</b>	Correctly use reflexive pronouns, the possessive pronouns <i>its</i> and <i>your</i> , and the relative pronouns <i>whom</i> and <i>who</i> .
<b>COU 28-32b</b>	Ensure that a verb agrees with its subject in complex sentences.
<b>Conventions of Punctuation</b>	
<b>COP 16-19b</b>	Delete commas that disturb the sentence flow (e.g., between modifier and modified element).
<b>COP 24-27a</b>	Use punctuation to set off complex parenthetical phrases.
<b>COP 24-27b</b>	Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by <i>and</i> ).
<b>COP 24-27c</b>	Use apostrophes to indicate simple possessive nouns.
<b>COP 24-27d</b>	Recognize inappropriate uses of colons and semicolons.
<b>COP 28-32a</b>	Use commas to set off a nonessential/ nonrestrictive appositive or clause.
<b>COP 33-36a</b>	Use a colon to introduce an example or an elaboration.





## Test 2: Mathematics

1. (C) **Mathematics/Statistics and Probability/Averages** and **Data Representation/Tables (Matrices)**. **CCRS: PSD 16–19a. CC: 6.SP.B.5c.** This item asks you to extract data from a table, specifically, the number of yards and the number of plays for 1998, and then to calculate the average number of yards per running play:

$$\text{Average Yards}_{1998} = \frac{\text{Total Yards}_{1998}}{\text{Number of Running Plays}_{1998}}$$

$$\text{Average Yards}_{1998} = \frac{1,417}{394} \approx 3.6$$

This is a simple problem; you’ve been doing averages since the third grade, and you can use a calculator. However, there are several ways to get the wrong answer. So follow these helpful tips:

**TIP** *Read the question carefully.*

The question asks about the average for 1998—not 1997 or 1999 and not for all three years combined. So don’t add up the values in the third or fourth columns.

The question asks “yards per play.” Don’t make a mistake and divide “yards” by the number of games given in column two.

In other words, focus your attention on *the question that is asked*.

**TIP** *Make a note in the margin of your test booklet of what information is needed.*

Notice that in the explanation above we’ve written:

$$\text{Average Yards}_{1998} = \frac{\text{Total Yards}_{1998}}{\text{Number of Running Plays}_{1998}}$$

Once that equation is written down, plugging in the numbers is a purely mechanical process, that is, no more thinking is required. In the table, you find the total yards for 1998, the total plays for 1998, and you divide the first number by the second.

Your marginal note does not have to be as long as ours. You could write:

$$\text{Avg} = \frac{\text{Yds}_{98}}{\text{Plays}_{98}}$$

Or some variation of that idea.

**TIP** *Use your calculator if necessary.*

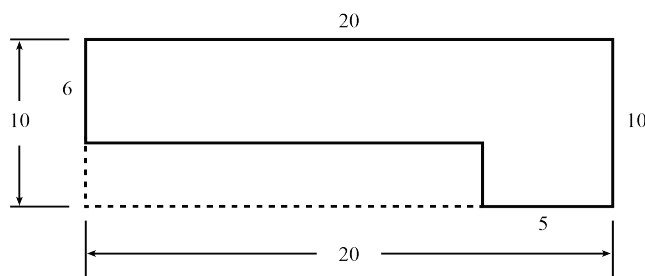
You don’t really need to use your calculator. Notice that the answer choices are spread apart. The exam writers don’t care whether or not you can do long division, with or without a calculator. They want to know whether you understand the *procedure* for finding an average. Instead of using 394,

you could use 400, and instead of 1,417 try 1,400:  $\frac{1,400}{400} = \frac{14}{4} = \frac{7}{2} = 3.5$ . (C) is the only choice in that neighborhood.

2. (H) **Mathematics/Geometry/Rectangles and Squares. CCRS: MEA 24–27c. CC: 7.G.A.1.** Given that all of the angles of the polygon are right angles, the figure is rectilinear and all lines that appear to be parallel are parallel. There is no need to construct a formal proof of this conclusion; your geometry intuition should be sufficient to convince you that it is correct. That being the case, you can reason that the unmarked horizontal side has length of  $20 - 5 = 15$ , and the unmarked vertical side has length of  $10 - 6 = 4$ . You now have every length needed to find the perimeter:

$$P = 6 + 20 + 10 + 5 + 15 + 4 = 60$$

Or you might have jumped to the conclusion spatially:



And:

$$P = 10 + 20 + 10 + 20 = 60$$

**TIP** *Easy items have simple solutions.* This is item #2 out of 60. Although items on the test are not arranged in a strict ascending order, the first few tend to be easier and last several, more difficult ones. So don't make more work for yourself than necessary. There are no hidden tricks here. Stick to the obvious.

**TIP** *Do not confuse perimeter and area.* A silly but common mistake is confusing the formula for finding the perimeter of a rectangular figure with its area:

$$\text{Perimeter} = 2 \cdot \text{width} + 2 \cdot \text{length}$$

$$\text{Area} = \text{width} \cdot \text{length}$$

If you make this mistake here, you would pick (K), a wrong answer.

**TIP** *You can measure the lengths.* Now, this is a simple problem with a simple solution, but let's assume for the moment that you blanked out. Don't panic. You can be confident (though not certain) that the figure is drawn to scale. (The test-writers are not going to intentionally try to confuse you with an out-of-whack drawing.) You can use your answer sheet as a straight-edge and measure a known quantity, using that distance to find the other distances.

3. (B) **Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions. CCRS: GRE 24–27c. CC: 6.EE.B.8.** This item asks you to identify the inequality that is graphed on the number line. In the final analysis, answering this question doesn't really require any mathematical ability. Rather, it depends almost entirely on whether you remember the conventions for writing out statements of inequality and drawing graphs on the number line. The dark line in the figure indicates



that this is the graph of an equality that is marked by  $-2$  (the minimum) and  $3$  (the maximum) on the number line. By convention, the filled in or black point means that the value  $-2$  is included in the statement, meaning that the graphed dark line includes  $-2$  as a possible value. The open point at the other end of the line indicates that  $3$  is not included as a possible value. So in English:

The number line represents all values that are greater than or equal to  $-2$  but less than  $3$ .

And that English statement matches up with (B).

**TIP** *If you are not sure of the conventions for writing inequalities or graphs on a number line, review that material.*

**TIP** *Use the process of elimination. Once you know that  $-2$  is the minimum value, you can eliminate (C), (D), and (E). Or knowing that  $3$  is the maximum value, you can eliminate (A) and (E). And, of course, taking the two insights together, you eliminate every choice but (B). On a multiple-choice test, the process of elimination is a very powerful tool for increasing your score.*

4. (J) **Mathematics/Algebra/Manipulating Algebraic Expressions/Evaluating Expressions. CCRS: NUM 24–27f. CC: 6.EE.A.2c.** This item requires only that you evaluate the given algebraic expression using the values provided. So the best strategy is the simplest: substitute and perform the indicated operations:

$$3 \cdot 2^{x+y} = 3 \cdot 2^{(4+[-1])} = 3 \cdot 2^3 = 3 \cdot 8 = 24$$

**TIP** *Please Excuse My Dear Aunt Sally.* If there is any doubt in your mind about how to proceed, just remember your Aunt Sally. The statement “Please Excuse My Dear Aunt Sally” is a memory device for PEMDAS, which can help you to remember the order of operations for mathematical expressions:

Parentheses: Do operations in parentheses.

Exponents: Do operations involving exponents.

Multiplication: Multiply.

Division: Divide.

Addition: Add.

Subtraction: Subtract.

Here there are no parentheses, so you simplify the exponent first. Add  $x$  and  $y$ , and then raise  $2$  to the third power. Finally, do the multiplication, and you are finished.

5. (D) **Mathematics/Arithmetic/Complicated Manipulations/Factoring. CCRS: NUM 16–19a. CC: 7.NS.A.2a.** This item asks you to identify factors of  $8$ . So just test the numbers given in the answer choices:

A.  $\frac{8}{2} = 4$ , and  $2 \cdot 4 = 8$  ✗

B.  $\frac{8}{1} = 8$ , and  $1 \cdot 8 = 8$  ✗

C.  $\frac{8}{-4} = -2$ , and  $-2 \cdot -4 = 8$  ✗

D.  $\frac{8}{-6} = -1\frac{1}{3}$  ✓

E.  $\frac{8}{-8} = -1$ , and  $-8 \cdot -1 = 8$  ✗

Now technically, the two negative numbers  $-2$  and  $-1$  are not factors of 8 because they are negative numbers. So the first sentence above requires a bit of clarification. The item does ask you to identify factors, that is, you must recognize that both 2 and 1 are factors of 8 in order to reach the conclusion that can be evenly divided by both  $-2$  and  $-1$ . But this minor issue of terminology does not affect the way you approach the problem.

6. (J) **Mathematics/Geometry/Complex Figures. CCRS: MEA 20–23b. CC: 5.MD.C.5b.** This problem is solved by just plugging the value given into the formula for finding the volume of a cube:

Volume of cube = edge • edge • edge

$$V = 4 \cdot 4 \cdot 4 = 64$$

**TIP** *Make sure that you use the correct formula for finding the volume of a cube.* Do not confuse  $e^3$  with  $3e$ ; otherwise you get 12, wrong answer (A). Also, do not find the area of one face of the cube, which is  $4 \cdot 4 = 16$  and wrong answer (G). Do not make the mistake of multiplying the length of the edge by 6, thinking there are 6 faces, because that is  $4 \cdot 6 = 24$ , wrong answer (H). The point is not that you should stop and think about all of the possible mistakes here but that you should know  $V = e^3$ . Your understanding should be crystal clear.

7. (B) **Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions. CCRS: XEI 20–23d. CC: 6.EE.B.6.** Here you are asked to translate some information from English into an algebraic statement. The total amount of the money collected is the sum of the amount from the large tables and the amount from the small tables:

$$T = \$ \text{ Large} + \$ \text{ Small}$$

The amount collected from the small tables is \$25 multiplied by the number of small tables:  $25 \cdot 50 = 1,250$ . And the amount from the large tables is \$50 times the number of large tables,  $L$ :  $40L$ . So the total is:

$$T = 40L + 1,250$$

Translating into an algebraic statement is mainly remembering the rules for writing down the expressions. If you think about this item without the algebra, you surely know how to find the total without writing anything down:

1. Multiply \$25 by 50, which is 1,250.
2. Multiply \$40 times the number of large tables, which we'll say is  $L$  for "large."
3. Add the two together:  $40L + 1,250$

**TIP** *If you really get stuck here, you can just make the situation real.* Make up a number for  $L$ . Making an assumption about  $L$  is legitimate because  $L$  can have any value. So say there are 10 large tables. The total from the large tables would be  $10 \cdot 40 = 400$  added to the 1,250 makes 1,650 for all the tables. Now substitute 10 for  $L$  in the answer choices to find the one that returns the value 1,650:

- A.  $L + 50 = 10 + 50 = 60$  ✗
- B.  $40(10) + 1,250 = 400 + 1,250 = 1,650$  ✓
- C.  $40(10) + 2,000 = 2,400$  ✗
- D.  $65(10) = 650$  ✗
- E.  $4,050(10) = 40,500$  ✗



8. (G) **Mathematics/Geometry/Lines and Angles. CCRS: PPF 20–23b. CC: 7.G.B.5.** One of the fundamental facts about the degree measures of angles that form a straight line is that they total  $180^\circ$ . In this figure, we can say somewhat informally that angle  $ABD$  plus angle  $DBC$  equal  $180^\circ$ . Since  $ABD$  is  $7x$  and  $DBC$  is  $3x$ :

$$7x + 3x = 180$$

$$10x = 180$$

$$x = 18$$

$$\text{So angle } ABC = 7x = 7(18) = 126$$

There are, of course, other ways of conceptualizing a solution. You might reason, for example, that  $7x$  is  $\frac{7}{10}$  of  $10x$  and multiply 180 by 0.7. But there is no effective difference in the approaches.

**TIP** Remember that figures are usually drawn to scale, not because scale drawings are required by some testing law but because a distorted figure would be potentially confusing. Test-writers try to avoid confusion because it interferes with the way the test works. So if you cannot otherwise solve the problem, look at the drawing.

Here, sketch a line that intersects  $ABC$  at point  $B$  at a right angle ( $90^\circ$ ).  $ABC$  is larger than the right angle, so you can safely eliminate (J) and (K). And  $ABD$  is not greater than  $ABC$ ,  $180^\circ$ , so eliminate (F). The question is now whether (G) or (H) is correct, and you have a 50/50 chance of guessing correctly. (Remember, you should always guess on the ACT exam.) You can, however, do better than 50/50. (G) and (H) are  $126^\circ$  and  $108^\circ$ . If you look carefully at your line and  $BD$ , you'll conclude that the correct answer is  $126^\circ$ .

9. (E) **Mathematics/Statistics and Probability/Probability. CCRS: PSD 16–19e. CC: 7.SP.C.5.** One of the fundamental principles of probability is that the probability of an event occurring is somewhere between 0 and 1, inclusive. Intuitively, a probability of 0 means the event just won't occur, while a probability of 1 means the event is certain, it will occur 100% of the time. So the probability that a single toss of a proper coin will result in heads is 1 out 2 or  $\frac{1}{2}$  or 50 percent or 0.5—all of those mean the same thing. The first four choices are numbers that could be assigned to a probability:

A. 0.001 "The chance is one-in-a thousand that she'll figure out the password."

B. 0.5 "The chance that the coin will come up 'heads' is 50/50 or 0.5."

C.  $\frac{6}{10}$  "With six positions to fill and only ten of us to choose from, my chance of being picked for the team is 6 out of 10 or  $\frac{6}{10}$ ."

D.  $\frac{3}{8}$  "The jar contains 3 blue marbles and 5 red ones, so the chance of picking a blue marble is 3 out of 8 or  $\frac{3}{8}$ ."

A probability, however, cannot be greater than 1, though we might sometimes wish it could. Thus, (E), which is greater than 1, must be the correct answer.

10. (K) **Mathematics/Coordinate Geometry/Qualitative Behavior of Graphs of Functions and Slope of a Line. CCRS: GRE 20–23c. CC: 8.F.B.5.** This item asks you to match one of the graphs to the general description of sales of the scooter over time: started slow, picked up speed, then flattened out.

- F. The line on this graph shows that sales started out fast and then began to slow down. ✘
- G. The line on this graph shows that sales started slow and then picked up. But the line never flattens out. ✘
- H. The line on this graph shows a constant increase in sales. ✘
- J. The line on this graph shows sales that are constantly falling. ✘
- K. The line on this graph starts out slow, picks up speed, then slows down again. ✓

The descriptions of the graphs above are loose and informal but adequate for solving the problem here. You should understand, however, that the informal intuitions that support the solution can be made more precise if you think about the lines in terms of slope. In these graphs, the greater the slope of the line, the more rapidly sales are increasing.

- F. The slope of the line is initially large but then decreases. ✘
- G. The slope of the line is initially small but then increases—but never decreases to show the slowing of sales. ✘
- H. The slope of the line is constant. ✘
- J. The slope of the line at all points is negative. ✘
- K. The slope of the line is small but then increases and then decreases. ✓

11. (E) *Mathematics/Geometry/Rectangles and Squares*. CCRS: MEA 20–23a. CC: 7.G.B.6. This problem requires you to find the area of the floor to be varnished and then to calculate the number of cans of varnish required on the assumption that each will cover 250 square feet. The area of the room is:

$$\text{Area} = \text{length} \cdot \text{width}$$

$$\text{Area} = 60 \text{ ft.} \cdot 80 \text{ ft.} = 4,800 \text{ sq. ft.}$$

How many cans of varnish are required? Divide the area of the room by the area that each can covers:

$$\frac{4,800}{250} = 19.1$$

Even though 19.1 rounds down to 19, the correct answer is not (D). The students will need more varnish than is contained in just 19 cans, so they will have to buy 20 cans. Nineteen cans isn't sufficient to cover the entire floor.

**TIP** Use your calculator. This is a good problem for the calculator.

**TIP** Watch out for the “oops” mistake. The correct answer is not (D), 19. The students need more than 19 cans, so they will have to buy one more can, making the total 20. This is a feature the test-writers often use to find out who's paying attention and who's not.

12. (F) *Mathematics/Arithmetic/Common Arithmetic Items/Proportions and Direct-Inverse Variation and Geometry/Rectangles and Squares*. CCRS: BOA 20–23a. CC: 7.G.A.1. A scale drawing problem is one that just begs to be solved using direct proportions. For each of the two dimensions in the figure, you can

find the actual dimension of the room by using  $\frac{1}{4}$  inch = 1 foot :

$$\frac{\frac{1}{4} \text{ in.}}{x \text{ in.}} = \frac{1 \text{ ft.}}{f \text{ ft.}}$$





Let  $f$  equal one of the dimensions of the room. Notice that our proportion groups like terms: inches on one side and feet on the other. We'll start with the width:

$$\frac{\frac{1}{4} \text{ in.}}{x \text{ in.}} = \frac{1 \text{ ft.}}{12 \text{ ft.}}$$

Cross-multiply:

$$\frac{1}{4} \cdot 12 = x$$

$$x = 3$$

So the width of the room in the scale drawing is 3 inches. Now for the length:

$$\frac{\frac{1}{4} \text{ in.}}{x \text{ in.}} = \frac{1 \text{ ft.}}{14 \text{ ft.}}$$

Cross-multiply:

$$\frac{1}{4} \cdot 14 = x$$

$$x = 3\frac{1}{2}$$

**TIP** *Try to do the math in your head.* Use your calculator sparingly. Remember that using a calculator takes time, and while the calculator itself won't make an error, you can make an error keying in the data. In this case,  $\frac{1}{4}$  of 12 is 3—no need for the calculator. And  $\frac{1}{4}$  of 14 is  $3\frac{2}{4}$  or  $3\frac{1}{2}$ .

**TIP** *Try this cute trick.* The difference between 12 feet and 14 feet is 2 feet, and 2 feet on the scale drawing would be represented by  $\frac{1}{4}$  of 2 or  $\frac{1}{2}$  inches. What answer choices has a pair of numbers for the scale drawing that are exactly  $\frac{1}{2}$  inches apart?

13. (E) **Mathematics/Arithmetic/Common Arithmetic Items/Percents and Complicated Arithmetic Application Items.** CCRS: BOA 20–23a. CC: 7.RP.A.3. This item is an ordinary arithmetic problem that requires a couple of steps and the use of percent. The question asks for the number of students who were surveyed. How can you use the information given to produce the response? You know:

$$\text{Percent Preferring Tomato} \cdot \text{Total Surveyed} = 250$$

And you can find the percent who preferred tomato juice by adding up the percent of students who favored the other choices:

$$100\% = \text{Cranberry \%} + \text{Orange \%} + \text{Grapefruit \%} + \text{Tom \%}$$

$$100\% = 20\% + 40\% + 20\% + \text{Tom \%}$$

$$\text{Tom \%} = 100\% - (20\% + 40\% + 20\%) = 20\%$$

Now substitute 20% into the first equation:

$$\text{Percent Preferring Tomato} \cdot \text{Total Surveyed} = 250$$

$$20\% \cdot T = 250$$

$$T = \frac{250}{0.20} = 1,250$$

**TIP** You can also work backward from the choices, using the “Pick (C)” method. Test (C), 625. If the total surveyed is 625, then 20% or 125 preferred cranberry, 40% or 250 preferred orange, and 20% or 125 preferred grapefruit, for a total of 500. But that would leave only  $625 - 500 = 125$  who preferred tomato, contradicting the information given. So (C) is not correct.

At this point, you might notice that 125 is half of 250 and conclude that the total number surveyed would have to be twice 625 or 1250. Or you could proceed by testing (D) because your first assumption, (C), was too small. On the assumption that 1,000 students were surveyed, then 200 preferred cranberry, 400 preferred orange, and 200 preferred grapefruit for a total of 800, leaving  $1000 - 800 = 200$  who preferred tomato—another wrong answer.

So, the correct answer must be even larger, and that is (E). Do you need to test (E)? No. When you determine that (C) and (D) are too small, you know logically that the one choice remaining must be correct.

14. (H) **Mathematics/Geometry/Circles. CCRS: MEA 28–32a. CC: 7.G.B.4.** This is a simple problem that requires only division. The circumference is the distance around the outside of the tire. So each time the wheel goes around, the bike travels 50 inches. Divide the distance travelled by 50 inches; you don’t even have to convert 300 feet to inches as that has already been done for you:  $\frac{3,600}{50} = 72$ .

**TIP** Sometimes you may get confused about whether to multiply or divide, and a wrong procedure leads to a wrong answer. A good way to avoid this problem is to put the units into your calculation:

$$\text{Number of Turns} = \frac{3,600 \text{ inches}}{50 \text{ inches/turn}}$$

Treat “50 inches/turn” as a fraction: invert and multiply.

$$\text{Number of Turns} = 3,600 \text{ inches} \cdot \frac{\text{turn}}{50 \text{ inches}} = \frac{72 \text{ inches-turns}}{\text{inches}}$$

Notice that you have the inches units in the numerator and in the denominator of your answer. Just as numbers cancel, so do units:

$$\frac{72 \cancel{\text{ inches}}\text{-turns}}{\cancel{\text{ inches}}} = 72 \text{ turns}$$



The only unit left is “turns,” and that is the unit that answers the question. If you multiply rather than divide you end up with  $\frac{\text{turns}^2}{\text{inches}}$ , which does not answer the question and doesn’t even make sense.

15. (A) *Mathematics/Algebra/Manipulating Algebraic Expressions/Basic Algebraic Manipulations*. CCRS: XEI 24–27d. CC: 7.EE.A.1. This item requires you to perform the indicated algebraic operations. First, distribute the subtraction sign and then combine like terms:

$$\begin{aligned} (4x^2 - 3x + 7) - (-1 + 5x + 2x^2) &= \\ 4x^2 - 3x + 7 + 1 - 5x - 2x^2 &= \\ 4x^2 - 2x^2 - 3x - 5x + 7 + 1 &= \\ 2x^2 - 8x + 8 & \end{aligned}$$

Of course, you have to carefully follow the rules for subtraction. First, make sure that you treat subtraction of a negative value as addition of that value—the opposite of a negative is a positive. Second, group like terms.

**TIP** *If absolutely necessary, you could solve this problem by assuming a value for  $x$ .* The magic of algebraic variables is that (unless otherwise restricted), they can represent any real number. For example,  $x$  could be 0. On that assumption, the expression in the question stem has the value:

$$\begin{aligned} (4x^2 - 3x + 7) - (-1 + 5x + 2x^2) &= \\ 4(0)^2 - 3(0) + 7 + 1 - 5(0) - 2(0)^2 &= \\ 0 - 0 + 7 + 1 - 0 - 0 &= \\ 7 + 1 &= 8 \end{aligned}$$

Now substitute 0 for  $x$  in the choices to see which return the value 8:

- A.  $2x^2 - 8x + 8 = 2(0) - 8(0) + 8 = 8$  ✓
- B.  $2x^2 + 2x + 8 = 2(0) + 2(0) + 8 = 8$  ✓
- C.  $2x^4 + 2x^2 + 6 = 2(0) + 2(0) + 6 = 6$  ✗
- D.  $6x^2 - 8x + 6 = 6(0) - 8(0) + 6 = 6$  ✗
- E.  $6x^4 - 8x^2 + 6 = 6(0) - 8(0) + 6 = 6$  ✗

(C), (D), and (E) return an incorrect value. Both (A) and (B), though different, return the value 8 because we assumed  $x = 0$ . To find which of those two is correct, we test another value, say  $x = 1$ :

$$\begin{aligned} (4x^2 - 3x + 7) - (-1 + 5x + 2x^2) &= \\ 4(1)^2 - 3(1) + 7 + 1 - 5(1) - 2(1)^2 &= \\ 4 - 3 + 7 + 1 - 5 - 2 &= 2 \end{aligned}$$

Substituting 1 for  $x$  into (A) and (B):

- A.  $2x^2 - 8x + 8 = 2(1) - 8(1) + 8 = 2$  ✓

$$B. 2x^2 + 2x + 8 = 2(1) + 2(1) + 8 = 12 \quad \times$$

16. (H) **Mathematics/Arithmetic/Complicated Arithmetic Application Items. CCRS: XEI 24–27a. CC: 7.EE.B.3.** The test-writers would like for you to solve this problem by setting up an equation; and, in fact, it is not that difficult to translate the description of the situation from English into an algebraic statement. Latoya gave her brother half the money she brought plus \$1, leaving her with just enough for the movie, or \$5. In other words:  $x - \frac{1}{2}x - 1 = 5$ .

Solve for  $x$ :

$$\frac{1}{2}x - 1 = 5 \Rightarrow \frac{1}{2}x = 6 \Rightarrow x = 12$$

**TIP** You can also use the “Pick (C)” method here. For this question, the middle answer is (H) not (C), but the principle is exactly the same.

Test answer choices, starting with (H). Assume that Latoya originally had \$12. She gave half to her brother, leaving her with \$6. Then she gave her brother another \$1, leaving her with \$5—the cost of the movie. So we prove that Latoya started with \$12 and that (H) is correct.

17. (B) **Mathematics/Arithmetic/Common Arithmetic Items/Percents. CCRS: NUM 20–23a. CC: 6.RP.A.3c.** To answer this question, you’ll need to multiply an integer by a percent, a fairly basic operation. But the real trick to the question is recognizing which product is the answer to the question:

- A. 77% of 20 = 15.4
- B. 85% of 20 = 17.0
- C. 88% of 20 = 17.6
- D. 96% of 20 = 19.2
- E. 99% of 20 = 19.8

Only one of those products is an integer, 17. And that is the only score of the five that is possible because you can’t get the spelling of a word partially correct.

18. (F) **Mathematics/Algebra/Evaluating Sequences Involving Exponential Growth. CCRS: NUM 16–19a. CC: HSF-BF.A.2.** This item requires you to find the next terms of a geometric sequence. The key is to find  $r$ , the constant ratio between the pairs of terms:

$$a^j = a_j r^{(j-1)}$$

Or less formally:

$$\text{First Term} \cdot r = \text{Second Term}$$

$$0.375r = -1.5$$

$$r = -4$$

So the sixth term is:

$$\text{Fifth Term} \cdot r = \text{Sixth Term}$$

$$\text{Sixth Term} = 96 \cdot -4 = -384$$

19. (A) *Mathematics/Algebra/Manipulating Algebraic Expressions/Basic Algebraic Manipulations*. CCRS: XEI 20–23e. CC: 7.EE.A.1. This question just tests the mechanics of algebra: multiply two binomials.

$$(2x - 3y)^2 = (2x - 3y)(2x - 3y) = 4x^2 - 6xy - 6xy + 9y^2 = 4x^2 - 12xy + 9y^2$$

**TIP** Use FOIL. If you are the least bit unsure of what needs to be done, just remember FOIL, first-outer-inner-last:

$$(2x - 3y)(2x - 3y) =$$

$$\text{First: } (2x)(2x) = 4x^2$$

$$\text{Outer: } (2x)(-3y) = -6xy$$

$$\text{Inner: } (-3y)(2x) = -6xy$$

$$\text{Last: } (-3y)(-3y) = 9y^2$$

$$\text{Combine like terms: } 4x^2 - 12xy + 9y^2$$

**TIP** Memorize key patterns. If you are really on the ball, you might notice that the expression has the form:

$$(a - b)(a - b) = a^2 - 2ab + b^2$$

So the  $a$  term is  $2x$ , and the first term of the product is  $4x^2$ . The  $b$  term is  $-3y$ , and the last term of the product is  $9y^2$ . The  $-2ab$  term is twice the product of  $2x$  and  $3y$  or twice  $-6xy$  or  $-12xy$ . Now, combine like terms:

$$4x^2 - 12xy + 9y^2$$

Other key patterns to learn or memorize are:

$$(a + b)(a - b) = a^2 - b^2 \text{ (The difference of two perfect squares.)}$$

$$(a + b)(a + b) = a^2 + 2ab + b^2$$

$$a^2 + b^2 = a^2 + b^2 \text{ (The sum of two perfect squares is not factorable.)}$$

**TIP** Assume some numbers. One of the most interesting things about algebraic variables is that, unless otherwise restricted, they could be any value. So just make up some numbers and see how they behave. Let's say that  $x = 1$  and  $y = 1$ . Substituting those values into the expression:

$$(2x - 3y)(2x - 3y) = (2[1] - 3[1])(2[1] - 3[1]) = (2 - 3)(2 - 3) = (-1)(-1) = 1$$

Now plug 1 for  $x$  and 1 for  $y$  into the answer choices to find the one that returns the value 1:

$$\text{A. } 4(1)^2 - 12(1)(1) + 9(1)^2 = 4 - 12 + 9 = 1 \quad \checkmark$$

$$\text{B. } 4(1)^2 - 10(1)(1) + 9(1)^2 = 4 - 10 + 9 = 3 \quad \times$$

$$\text{C. } 4(1)^2 - 9(1)^2 = 4 - 9 = -5 \quad \times$$

$$D. 4(1)^2 + 9(1)^2 = 4 + 9 = 13 \quad \times$$

$$E. 4(1) - 6(1) = -2 \quad \times$$

Remember, however, that if you use 1 or 0 as an assumption, you do run the risk of getting duplicate results in the choices. But if that happens, just take another pair of numbers. In this case, of course, we were lucky and found the right answer with the first substitution set.

20. (J) **Mathematics/Geometry/Triangles/Properties of Triangles and Arithmetic/Common Arithmetic Items/Proportions and Direct-Indirect Variation. CCRS: PPF 28–32a. CC: HSG–SRT.B.5.** In this problem, you have similar triangles, so the lengths of the corresponding sides will be proportionate to each other. That is:

$$\frac{AD}{CE} = \frac{AB}{BC}$$

$$\frac{6 \text{ ft.}}{CE} = \frac{4 \text{ ft.}}{14 \text{ ft.}}$$

This is a proportion, so you can cross-multiply:

$$CE = \frac{(6 \cdot 14)}{4} = 21$$

- TIP** You could also solve this problem very easily just by measuring. Can you be absolutely certain that this figure is drawn to scale? No, but if you can't solve the problem using similar triangles, you've got nothing to lose by trying to measure the length of  $CE$ . Use the edge of your answer sheet and make a light tic marking the distance  $AD$ , which is 6 feet. Then measure  $CE$ .  $CE$  is about  $3\frac{1}{2}$  times  $AD$  which makes  $CE$  about  $6 \cdot 3\frac{1}{2} = 21$  feet. That is (J).

21. (C) **Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Simple Equations. CCRS: XEI 20–23c. CC: 8.EE.C.7b.** This problem asks you to solve a routine equation. First, distribute the subtraction sign and then combine like terms:

$$7x - (x - 3) = 6$$

$$7x - x + 3 = 6$$

$$6x = 3$$

$$x = \frac{1}{2}$$

- TIP** You should be able to solve a simple equation such as this, but if you get completely lost, you could always fall back on substituting answer choices. Substituting choices in this case is going to take more time than the direct solution, but it is available in an emergency:

$$A. 7\left(-\frac{3}{2}\right) - \left(-\frac{3}{2} - 3\right) = 6$$

$$-\frac{21}{2} + \frac{3}{2} + 3 = 6$$



$$-6 = 6 \quad \times$$

$$\text{B. } 7(-2) - (-2 - 3) = 6$$

$$-14 + 2 + 3 = 6$$

$$-9 = 6 \quad \times$$

$$\text{C. } 7\left(\frac{1}{2}\right) - \left(\frac{1}{2} - 3\right) = 6$$

$$\frac{7}{2} - \frac{1}{2} + 3 = 6$$

$$6 = 6 \quad \checkmark$$

$$\text{D. } 7\left(\frac{3}{2}\right) - \left(\frac{3}{2} - 3\right) = 6$$

$$\frac{21}{2} - \frac{3}{2} + 3 = 6$$

$$12 = 6 \quad \times$$

$$\text{E. } 7(2) - (2 - 3) = 6$$

$$14 - 2 + 3 = 6$$

$$15 = 6 \quad \times$$

The only substitution that returns a “TRUE” statement is (C),  $x = \frac{1}{2}$ . So the value of  $x$  is  $\frac{1}{2}$ .

You may notice that this technique is similar to the technique you were taught for checking your solution to an equation. After solving for  $x$ , you were encouraged to substitute your solution back into the original equation to check that it produced a true statement. The only difference here is that you are testing four wrong solutions and only one right one.

- 22. (G) Mathematics/Geometry/Triangles/Properties of Triangles. CCRS: MEA 28–32a. CC: 7.G.B.6.** This item requires the formula for calculating the area of a triangle (altitude is equivalent to height):

$$\text{Area} = \frac{1}{2} \cdot \text{base} \cdot \text{height}$$

But there is an added wrinkle. You’re given the area and the base, and you must find the height:

$$32 = \frac{1}{2}(8)(h)$$

Just solve for  $h$  (height):



$$32 = \frac{1}{2}(8)(h)$$

$$4 = \frac{1}{2}h$$

$$h = 8$$

**TIP** Here is another problem that can be solved just by measuring. Use the answer sheet to measure the distance of  $XZ$ , which is stated to have length of 8. Now compare that distance to  $WY$ . Are they the same? Yes. The answer can't be 10 or 6, so it has to be 8. And you don't even have to know anything at all about triangles to get the problem right.

23. (D) *Mathematics/Algebra/Expressing and Evaluating Algebraic Functions/Function Notation*. **CCRS: FUN 20–23a. CC: HSF-IF.A.2.** This item asks you to evaluate the function when  $x = -10$ :

$$2x^2 - 5x + 7 = 2(-10)^2 - 5(-10) + 7 = 2(100) + 50 + 7 = 257$$

**TIP** The trickiest thing about this problem is the function notation. You should know what the notation  $f(x)$  means. But even if you don't, you only have to substitute the value given and do the arithmetic. So if you find a problem on the test that has the form:

Given that  $f(x) = [\text{whatever}]$ , what is the value of function  $f$  [some number]?

Just plug in that number and do the arithmetic. You should get the right answer.

24. (J) *Mathematics/Arithmetic/Complicated Arithmetic Application Items*. **CCRS: BOA 28–32a. CC: HSN-Q.A.1.** The test-writer would like for you to solve this problem by setting up an equation:

$$\$350 = (\$0.40 \cdot 200) + (\$0.50 \cdot 300) + (\$0.60 \cdot x)$$

$$350 = 80 + 150 + 0.6x$$

$$0.6x = 120$$

$$x = 200$$

Where  $x$  is the additional candy bars at 60 cents. But the question asks for the total number of candy bars:  $200 + 300 + 200 = 700$ .

You do not have to set up an equation to reach this result. You could just reason that 200 candy bars at 40 cents will yield \$80, and 300 candy bars at 50 cents will yield another \$150. That's a total so far of \$230. This means the squad needs another \$120, and each of the other candy bars is worth 60 cents.

$\frac{\$120}{\$0.60}$  is 200 candy bars, so the total is 200 plus 300 plus 200 or 700. This line of reasoning is not

different from the equation, but the equation makes it less likely that you will make an error. That is one reason we go through the trouble of learning how to use equations to do what we can also do with common sense: they're less prone to error.

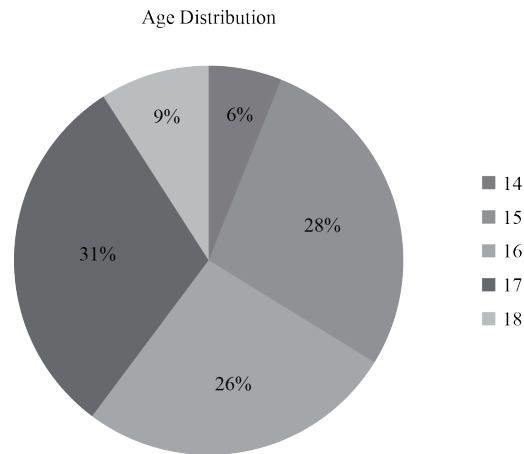
**TIP** You could also work backward from the answer choices using the "Pick (C)" method—here the middle answer choice is (H). Assume that the squad sells 667 candy bars. You know that the first 200 produce \$80 and the next 300 another \$150 for a total of \$230. So 500 candy bars produce \$230.  $667 - 500 = 167$ , but 167 candy bars at 60 cents each is only \$100.20, and the total is only \$330.20—not \$350. (H) is too small, so test (J). A total of 700 would mean  $700 - 500$  or 200 candy bars at 60 cents for \$120. And \$120 added to the \$230 is the \$350 the squad needs, so (J) is correct. No need to check (K) because you already know the right answer.



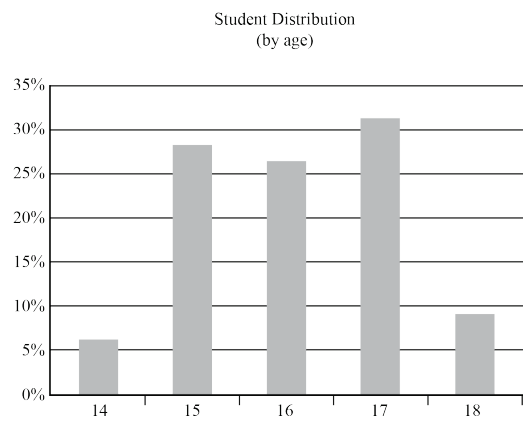
25. (E) *Mathematics/Arithmetic/Common Arithmetic Items/Percents* and *Statistics and Probability/Data Representation/Tables (Matrices)*. CCRS: BOA 16–19a. CC: 6.RP.A.3c. This item asks you to extract data from a table and perform a simple operation. According to the question stem, the table shows the age distribution of students at the school: 6 percent of the students are 14, 28 percent are 15, etc. The question asks for the percent at least 16 years old, which means 16 or older:

$$26\% + 31\% + 9\% = 66\%$$

**TIP** *Be ready for other forms of data presentation.* For example, the test-writer might have chosen to use a pie chart for this one:



Or perhaps a bar graph:



The data are the same in all three presentations (the original table in the test, the pie chart, and the bar graph), and the answer to the question would be the same.

26. (H) *Mathematics/Arithmetic/Common Arithmetic Items/Percents*. CCRS: BOA 16–19b. CC: 6.RP.A.3d. The item asks for you to perform a calculation using percents:

$$\frac{\frac{1}{3}}{\frac{2}{3}} = \frac{1}{2} = 50\%$$

- TIP** When dividing by a fraction, simply multiply by the reciprocal.  $\frac{1}{3}$  divided by  $\frac{2}{3}$  is the same as  $\frac{1}{3} \cdot \frac{3}{2}$ .
- TIP** This problem can be solved by translating English into an algebraic statement. The English “what” translates into the variable “ $x$ .” The English “of” translates into a “multiplication sign.” The English “is” translates into “ $=$ .” So “What percent of  $\frac{2}{3}$  is  $\frac{1}{3}$ ” translates into “ $x \cdot \frac{2}{3} = \frac{1}{3}$ .” Then just solve for  $x$ .
- TIP** This is a good time to use the “this of that” percent tip. A question that includes the phrase “what percent of that” can be answered by creating a fraction in which the denominator (downstairs) is the “of” and the numerator (upstairs) is the other number given in the question,  $\frac{\text{other \#}}{\text{of \#}} = \text{percent}$  :

What percent of  $\frac{2}{3}$  is  $\frac{1}{3}$ ?

The denominator is  $\frac{2}{3}$ , and the numerator is  $\frac{1}{3}$ :

$$\frac{\frac{1}{3}}{\frac{2}{3}} = \frac{1}{2} = 50\%$$

Other examples:

What percent of 12 is 6?

$$\frac{6}{12} = 50\%$$

Of 20, what percent is 5?

$$\frac{5}{20} = 25\%$$

What percent of 5 is 2?

$$\frac{2}{5} = 40\%$$

27. (B) *Mathematics/Arithmetic/Common Arithmetic Items/Percents*. CCRS: BOA 20–23a. CC: 6.RP.A.3c. The sign states that coats are priced at three-fourths or 75% off. So the sale price is:

Sale Price = Regular Price – Discount

$$\text{Sale Price} = \$84.00 - \left( \frac{3}{4} \text{ of } \$84 \right) = \$21.00$$

Or, if you prefer, you could reason that three-fourths off means that the coats are priced at one-fourth the regular price:



$$\text{Sale Price} = 25\% \text{ of } \$84 = \$21.00$$

- 28. (K) Mathematics/Geometry/Rectangles and Squares and Arithmetic/Common Arithmetic Items/Ratios. CCRS: MEA 28–32a. CC: 7.G.B.6.** This item involves the formulas for finding the area of a rectangular figure, including the special case of the square. (This is special because in a square, the width is equal to the length.) But there is a bit more going on. You are not asked just to find the area but to find the ratio of the area of the square to the area of the rectangle. The given information tells you everything you need to know.

One way of approaching the solution is to use  $s$  to represent the length of the side of the square. That way, the area of the square is:

$$s \cdot s = s^2$$

Then the length of the rectangle, say  $L$ , would be:

$$\frac{2}{3} = \frac{s}{L}$$

$$L = \frac{3s}{2}$$

And the width of the rectangle,  $W$ , would be:

$$\frac{2}{1} = \frac{s}{W}$$

$$W = \frac{s}{2}$$

Using these values for  $L$  and  $W$ , the area of the rectangle is:

$$LW = \left(\frac{3s}{2}\right)\left(\frac{s}{2}\right) = \frac{3}{4}s^2$$

Finally, the ratio “square/rectangle” is:

$$\frac{s^2}{\frac{3}{4}s^2} = \frac{1}{\frac{3}{4}} = \frac{4}{3}$$

**TIP** The solution described above is “general” in that it applies to all squares and rectangles with dimensions in the ratios given. But the ratios 2:3 and 2:1 are true for specific cases such as 2 feet and 3 feet, 2 feet and 1 foot, 2 inches and three inches, 2 inches and 1 inch, and so on. So you don’t really even have to bother with the variable.

Just assume that the square has a side of 2—two “whats” doesn’t really matter, but you can say “inches” if you like. On that assumption, the area of the square is  $2 \cdot 2 = 4$  (square inches if you like). And the  $L$  of the rectangle is 3 and the  $W$  of the rectangle is 1, so the area of the rectangle is 3 (square inches, if you like). And the ratio of the area of the square (4) to the area of the rectangle (3) is 4:3.

29. (A) *Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions. CCRS: XEI 20–23d. CC: 6.EE.C.9.* To find the right answer to this question, you need to translate the English statements in the stem into an algebraic statement. When we say that a quantity varies in *direct* proportion to another, we mean that as the one increases, the other also increases, and, conversely, as the one decreases, the other also decreases. The ratio between the quantities, however, remains the same and is given the value  $k$ , called the constant of proportionality. Thus, the equation:

$$x = ky$$

describes a relationship in which as  $y$  increases,  $x$  increases, and the ratio  $x:y$  is always equal to  $k$ . So the first portion of the teacher’s statement is translated as:

$$y = kw^2x$$

When we say that two quantities are *inversely* proportional, we mean that an increase in one is paralleled by a decrease in the other and vice versa. Their product, however, remains the same. Thus, the equation:

$$xy = k$$

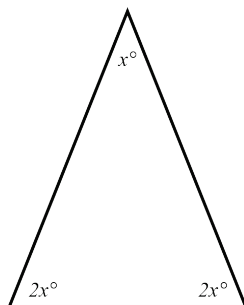
describes a relationship in which  $x$  and  $y$  vary inversely, but the product of  $x$  and  $y$  is always  $k$ . The equation can also be written:  $y = \frac{k}{x}$ . So we add the second half of the statement to our equation translation:

$$y = \frac{kw^2x}{z^3}$$

- TIP** *You could, theoretically, solve this problem by assuming values and testing numbers.* But in order to do so, you would have to have a clear understanding of the significance of  $k$ . If you have a clear understanding of the significance of  $k$ , then you can solve the problem directly.
- TIP** *There could be an opportunity here to use a partial understanding to improve the chances of guessing the right answer.* Let’s assume that you remember that the constant of proportionality,  $k$ , is supposed to fit into the equation:  $y = kx$ . That is, you know that it belongs in the numerator. On that basis, you can eliminate both (C) and (D), improving the chances of guessing correctly to 1 out of 3.

Just as baseball is a game of inches, the ACT test is a game of small gains, and even just improving the odds of guessing is important.

30. (H) *Mathematics/Geometry/Triangles/Properties of Triangles. CCRS: PPF 24–27c. CC: 7.G.B.5.* Although it is not strictly necessary, you might find it helpful to sketch the triangle:





Since the sum of the angle measures of the interior angles of a triangle is 180:

$$x + 2x + 2x = 180$$

$$5x = 180$$

$$x = 36$$

$$\text{So } 2x = 72.$$

You're not going to be able to use the trick of measuring here because the test-writers have not included a figure, and there is no reason to believe that a figure that you draw freehand is going to be very accurate.

31. (E) *Mathematics/Algebra/Manipulating Algebraic Expressions/Evaluating Expressions*. CCRS: XEI 28-32e. CC: HSA-REI.B.4b. There are three steps required to solve this problem. First, you have to understand that the question is asking for  $n$  when  $P = 0$ :

$$n^2 - 300n - 100,000 = 0$$

Second, you have to solve the quadratic equation. One way to solve is by factoring:

$$(n - 500)(n + 200) = 0$$

$$n - 500 = 0 \text{ or } n + 200 = 0$$

$$n = 500 \text{ or } n = -200$$

Third, you have to recognize that the positive solution is the answer to the question because it refers to the number of items manufactured. You cannot manufacture  $-200$  thingamabobs, so  $n = 500$ .

**TIP** You can also solve this problem by substituting answer choices back into the question. Given that this is a multiple-choice test, you know that one of those five numbers is the one that will return the value 0 for "no profit." Start with (C):

$$P = n^2 - 300n - 100,000 = (300)^2 - 300(300) - 100,000 = -100,000$$

A \$100,000 loss is not breaking even. (C),  $n = 300$ , is wrong, but is it too small or too large? Selling 300 units left the business in the red, so it didn't sell enough units. You should try the next larger number, (D):

$$P = n^2 - 300n - 100,000 =$$

$$(350)^2 - 300(350) - 100,000 =$$

$$122,500 - 105,000 - 100,000 = -82,500$$

That still a loss, but a smaller loss than (C). So (D) is incorrect, and the right answer is (E). Do you need to check (E)? No, because we have just proved logically that (E) is correct. But if you insist:

$$P = n^2 - 300n - 100,000 =$$

$$(500)^2 - 300(500) - 100,000 =$$

$$250,000 - 150,000 - 100,000 = 0$$

Since  $P = 0$  when  $n = 500$ , (E) is, indeed, correct.

32. (F) *Mathematics/Statistics and Probability/Data Representation/Bar, Cumulative, and Line Graphs*. CCRS: PSD 16–19c. CC: 8.SP.A.3. The “break-even point,” where cost exactly equals revenue, is represented by the point of intersection of the two lines on the graph. That point corresponds on the  $x$ -axis to  $10 \cdot 1,000$  units or 10,000.
33. (D) *Mathematics/Statistics and Probability/Data Representation/Bar, Cumulative, and Line Graphs*. CCRS: PSD 28–32b. CC: HSF–IF.B.4. The “cost” line does not begin at zero but at \$35,000. On the graph, this is where the cost line intersects the  $y$ -axis (in other words, this is the cost line’s  $y$ -intercept). In other words, before the company even produces one unit, it has incurred costs. Those are the “fixed” costs, meaning that they are incurred before production begins and do not change according to the number of units produced. The cost of producing each unit is called the production cost, which is a variable (as opposed to fixed) cost: the more units produced, the higher the production cost.
34. (H) *Mathematics/Statistics and Probability/Data Representation/Bar, Cumulative, and Line Graphs*. CCRS: PSD 28–32b. CC: 8.F.B.4. The “break event point,” where cost equals revenues, shows that the cost of producing 10,000 units is \$100,000. So if “cost equals revenue” at that point, the 10,000 units are sold for a total of \$100,000, which is \$10 apiece:  $\$100,000 \text{ revenue} \div 10,000 \text{ pads sold} = \frac{\$10}{\text{pad sold}}$ .

Another way to solve this problem is to look at any point on the revenue function. Take the point (2, 20) on the revenue line, for example. At this point, 2,000 mousepads cost \$20,000, so each mousepad costs \$10 ( $\frac{\$20,000}{2,000}$ ). If you had picked the point (6, 60) on the revenue line, you would have gotten the same correct answer of \$10 (H).

35. (E) *Mathematics/Algebra/Manipulating Algebraic Expressions/Factoring Expressions*. CCRS: XEI 24–27e. CC: HSA–SSE.A.2. The problem asks you to factor as completely as possible:

$$2x + 2xy + 6x^2y$$

2 is a common factor to all three terms of the expression:

$$2x + 2xy + 6x^2y = 2(x + xy + 3x^2y)$$

And  $x$  is a factor common to all three terms:

$$2(x + xy + 3x^2y) = 2x(1 + y + 3xy)$$

**TIP** You could also approach this item by assuming some values for  $x$  and  $y$ . Assume that  $x = 1$  and  $y = 1$ . Then:

$$2x + 2xy + 6x^2y = 2(1) + 2(1)(1) + 6(1)^2(1) = 10$$

Which answer choices produce the value 10 when  $x = 1$  and  $y = 1$ ?

- A.  $2(1)[1 + 3(1)(1)] = 8$  ✗  
 B.  $2(1) + 2(1)(1)[1 + 3(1)] = 10$  (?)  
 C.  $2(1)[1 + 1 + 4(1)(1)] = 12$  ✗



$$D. 1 + 1 + 3(1)(1) = 5 \times$$

$$E. 2(1)[1 + 1 + 3(1)(1)] = 10 (?)$$

We have eliminated (A), (C), and (D) but seem to have two correct choices. The duplication arises because (B) and (E) are equivalent expressions, algebraically. But (B) is not the complete factorization of the expression in the question stem because (B) does not isolate the greatest common factor of all three terms. So (B) is only a partial factorization, not a complete factorization.

So our “test the choices” strategy is not perfect. In this case, it eliminated 3 of the 5 options. Still, if the choice is between guessing at random (1 out of 5) and making an educated guess (50/50), the substitution methods comes out way ahead.

36. (G) *Mathematics/Coordinate Geometry/Slope of a Line*. CCRS: GRE 24–27b. CC: 8.F.B.4. This item asks you to identify the equation of the line that includes points (1,3) and (−3,−13). You can do this by finding the slope and then the y-intercept. The slope of the line is the “rise/run”:

$$m = \frac{3 - (-13)}{1 - (-3)} = \frac{16}{4} = 4$$

And use one of the pairs of coordinates:

$$y = 4x + b$$

$$3 = 4(1) + b$$

$$b = -1$$

So the slope-intercept form of the equation for the line is:

$$y = 4x - 1$$

This is equivalent to:

$$4x - y = 1$$

**TIP** *If you overlook using the slope-intercept method for deriving the equation, you can still get the right answer: substitute the pairs of coordinates in the equations given until you find the equation that makes a true statement. Start with (1,3):*

$$F. 1 + 3 = 4 \checkmark$$

$$G. 4(1) - 3 = 1 \checkmark$$

$$H. 5(1) - 3 = 2 \checkmark$$

$$J. 6(1) - 2(3) = 8 \times$$

$$K. 7(1) - 2(3) = 5 \times$$

Using the first pair, we eliminate (J) and (K). Now we test the second pair, (−3,−13):

$$F. -3 + (-13) = 4 \times$$

$$G. 4(-3) - (-13) = 1 \checkmark$$

$$H. 5(-3) - (-13) = 2 \times$$

Only (G) tests out as “TRUE” for both sets of coordinates. So the equation, (G) must be the correct answer.

37. (B) *Mathematics/Geometry/Rectangles and Squares and Circles. CCRS: MEA 20–23b. CC: 7.G.B.4.* This item requires you to use the formula for determining the area of a circle and the procedure for finding the perimeter of a square. The question states that the radius of the circle is the same length as the side of the square, so given the radius, it would be possible to calculate the perimeter of the square. Is the information provided sufficient to determine the radius of the circle? Yes:

$$\text{Area} = \pi r^2$$

$$36\pi = \pi r^2$$

$$r^2 = 36$$

$$r = 6$$

So the radius of the circle is 6. (Remember that distance cannot be negative.) Therefore, the side of the square is also 6, and the perimeter of the square is:

$$P = s + s + s + s = 4s$$

$$P = 4(6) = 24$$

**TIP** As noted above, it is very important to be clear about the following:

Circles

$$\text{Area} = \pi r^2$$

$$\text{Circumference} = 2\pi r$$

Rectangles

$$\text{Area} = \text{width} \cdot \text{length}$$

$$\text{Perimeter} = \text{width} + \text{length} + \text{width} + \text{length}$$

Squares

$$\text{Area} = \text{side} \cdot \text{side} = s^2$$

$$\text{Perimeter} = \text{side} + \text{side} + \text{side} + \text{side} = 4s$$

38. (G) *Mathematics/Algebra/Solving Simultaneous Equations. CCRS: XEI 28–32f. CC: HSA-REI.C.5.* You can use any of several procedures for finding the solutions to this system of linear equations. You could manipulate the first equation to find  $y$  in terms of  $x$ , then substitute that expression for  $y$  in the second equation, and solve for  $x$ . Or you could manipulate the second equation to find  $y$  in terms of  $x$ , then substitute that expression for  $y$  in the first equation, and solve for  $x$ . You could use a similar approach but isolating  $x$ , though you would have to then solve for  $x$  after you find  $y$ . Or you can combine the two equations and solve the system of equations by subtracting:

$$3x + 6y = 52$$

$$-(x + 6y = 24)$$

$$2x = 28$$

$$x = 14$$

**TIP** You can also substitute answer choices into the equations until you find a value for  $x$  that gives you the same value for  $y$  in both cases. Since this is a system of equations, the solution must satisfy both simultaneously, that is, at the same time.





$$A. 3(19) + 6y = 52 \qquad 19 + 6y = 24$$

$$6y = -5 \qquad 6y = 5$$

$$y = -\frac{5}{6} \qquad y = \frac{5}{6}$$

But  $-\frac{5}{6}$  is not equal to  $\frac{5}{6}$ , so A is wrong.

$$B. 3(14) + 6y = 52 \qquad 14 + 6y = 24$$

$$6y = 10 \qquad 6y = 10$$

$$y = \frac{10}{6} \qquad y = \frac{10}{6}$$

$\frac{10}{6} = \frac{10}{6}$ , so  $x = 14$  and  $y = \frac{10}{6}$  satisfy both equations.

At this point, you have found the correct answer, so it is not worth your time to test the remaining answer choices.

39. (C) *Mathematics/Algebra/Manipulating Algebraic Expressions/Evaluating Expressions* and *Geometry/Complex Figures*. **CCRS: MEA 20–23a. CC: 7.G.B.4.** Although the description of the figure is fairly long and involved, the solution is actually fairly simple. You are given the formula for finding the area of a trapezoid:

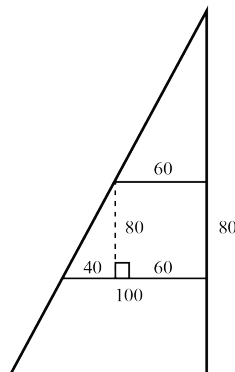
$$A = \frac{1}{2}h(b_1 + b_2)$$

$b$  stands for base and refers to the two sides that are parallel. The figure gives you all of the measurements you need:

$$A = \frac{1}{2}(80)(60 + 100) = 6,400$$

**TIP** *A more intuitive way of remembering the formula for the area of a trapezoid is to conceptualize it as “Height times the average of the lengths of the two bases.” It’s analogous to having a “rectangle” with two different “lengths.” To find the area, instead of multiplying “length • width,” you multiply the width times the average of the lengths. So in this case, you average 60 and 100 to get 80, and then multiply 80 by 80 to get 6,400.*

40. (J) *Mathematics/Geometry/Triangles/Pythagorean Theorem* and *Complex Figures*. **CCRS: PPF 28–32b. CC: 8.G.B.7.** The most direct way to solving this problem is to use the Pythagorean theorem:



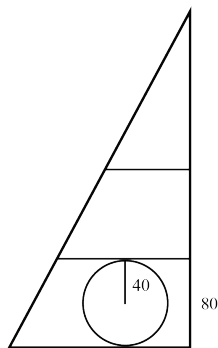
$$BC^2 = (80)^2 + (40)^2$$

$$BC^2 = 6,400 + 1,600$$

$$BC^2 = \sqrt{8,000}$$

- TIP** Here is yet another problem that can be solved by measuring—with a little addition of common sense. Using the edge of your answer sheet as a ruler, measure one of the distances given in the figure, say the “80” for  $FE$ . Then compare the “80” to  $BC$ .  $BC$  is longer than 80 but not much, maybe 87 to 89. Next, which answer choice is closest to 80?  $\sqrt{4,800}$  is slightly less than 70;  $\sqrt{8,000}$  is slightly less than 90; and  $\sqrt{16,400}$  is about 128. The closest answer is (J).

41. (A) **Mathematics/Geometry/Circles and Complex Figures. CCRS: FUN 28–32a. CC: HSG–SRT.C.8.** This item doesn’t require a calculation of any sort. Instead, the solution depends upon a single insight:



42. (J) **Mathematics/Trigonometry/Definitions of the Six Trigonometric Functions. CCRS: FUN 28–32b. CC: HSG–SRT.C.8.** This item asks you to use the value of a trig function to find the length of a side of a right triangle. You can use the sine function directly:

$$\sin x = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin 15^\circ = \frac{x}{35}$$

$$0.259 = \frac{x}{35}$$

$$x = 0.259 \cdot 35 \approx 9.1$$



**TIP** *Can't remember the basic trig ratios? Think: SOHCAHTOA.*

$$\text{SOH: } \sin = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\text{CAH: } \cos = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{TOA: } \tan = \frac{\text{opposite}}{\text{adjacent}}$$

**TIP** *Didn't take trigonometry? You can still answer correctly. Using the edge of your answer sheet, mark off the distance of 35 shown as the hypotenuse of the triangle. Try to divide that into 4 equal parts:*

$$\frac{35}{4} \approx 9. \text{ Measure the side marked "?". About 9? Select (J).}$$

43. (B) *Mathematics/Arithmetic/Common Arithmetic Items/Properties of Numbers. CCRS: NUM 20–23a. CC: 6.NS.B.4.* Although the description of this item mentions a circle, geometry is actually not an element of this problem. Instead, this item tests a feature of the number system. The circle with the ten equally spaced dots represents the base ten counting system, but the repetition of the circle avoids the need to talk about the tens digit. This problem might just as well have well asked about “counting off by n” and eliminating the last digit of the result until all ten digits have be struck one time. For example:

1st count by 3: 1 2 - 4 5 6 7 8 9 10  
 2nd count by 3: 1 2 - 4 5 - 7 8 9 10  
 3rd count by 3: 1 2 - 4 5 - 7 8 - 10  
 4th count by 3: 11 - - 14 15 - 17 18 - 20  
 5th count by 3: 11 - - 14 - - 17 18 - 20  
 6th count by 3: 11 - - 14 - - - - 20  
 7th count by 3: - - - 24 - - - - 30  
 8th count by 3: - - - - - - - 30  
 9th count by 3: - - - - - - - 30  
 10<sup>th</sup> count by 3: - - - - - - -

Or you could reason about the divisibility of numbers and the odd/even properties of numbers. Using 2,4 or 6, would count only the even numbered dots. Using 5, would count only the numbers divisible by 5.

**TIP** *You could just count on your fingers, bending down the last one in the sequence:*

1,2, [bend the middle finger, left hand]  
 4,5, [bend the little finger, right hand]  
 7,8, [bend the pointer, right hand]

And so on until no fingers are left expended.

You'll find that counting by 3 eventually bends all the fingers; counting by 2, 4, 5, or 6 does not.

44. (H) *Mathematics/Algebra/Solving Algebraic Equations or Inequalities with One Variable/Equations Involving Integer and Rational Exponents. CCRS: NUM 33–36a. CC: HSN-RN.A.1.* Once you strip away the technical jargon from this problem, the concept tested is fairly simple: What kind of number, when raised to a positive power, gives a result smaller than the number you started with? And the answer is “a positive fraction.” The statement of inequality in (H) describes the positive fractions.

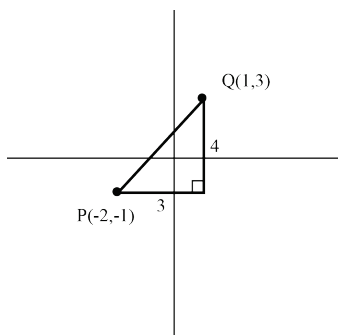
To be complete accurate, the language above would have to be tightened up a bit to replace “gives” with a more precise “returns a product such that” or whatever, but the underlying insight would remain the same: raise a positive fraction to a (positive) power, and the result is smaller than the fraction itself.

45. (D) **Mathematics/Coordinate Geometry/Distance Formula. CCRS: GRE 28–32c. CC: 8.G.B.8.** The wording of this question tells you exactly what you need to do to answer: distance. So use the Distance Formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{[3 - (-1)]^2 + [-1 - 2]^2} = \sqrt{(4)^2 + (3)^2} = \sqrt{25} = 5$$

**TIP** The Distance Formula is just a special application of the Pythagorean Theorem. To see this, do a sketch of the coordinate system and enter the points P and Q:



46. (F) **Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions. CCRS: XEI 28–32b. CC: HSA-CED.A.1.** This item asks you to create an equation to model the situation described in the question stem. Jean has to make up 10 meters, and the time required to run that distance relative to Sula’s changing position is the distance divided by the difference between their two rates of speed. Remember: (rate)(time) = distance.

$$t = \frac{10}{(2.4 - 2.0)}$$

This is the same equation as that given in (F):

$$(2.4 - 2.0)t = 10$$

$$2.4t - 2.0t = 10$$

$$2.4t = 10 + 2.0t$$

$$2.0t + 10 = 2.4t$$

**TIP** Manipulating the equation to find an equivalent form is an “iffy” proposition. There is no guarantee that you will find the sequence of steps to produce the form required by (F). There is a simpler way to solve the problem. When Jean resumes jogging at 2.4 meters per second, she’ll be gaining on Sula at the rate of  $2.4 - 2.0 = 0.4$  meters per second. It will take her  $\frac{10}{0.4} = 25$  seconds to make up the gap.

So substitute 25 for t into the choices to find the choice that returns a “TRUE” statement:

F.  $2(25) + 10 = 2.4(25)$



$$60 = 60 \checkmark$$

$$G. 2(25) - 10 = 2.4(25)$$

$$40 = 60 \times$$

$$H. \frac{10 + 2.4(25)}{2.4} = 2(25)$$

$$\frac{70}{2.4} = 50 \times$$

$$J. 2(25) = 10 \times$$

$$K. 2.4(25) = 10 \times$$

47. (D) *Mathematics/Algebra/Solving Algebraic Equations and Inequalities with One Variable/Simple Inequalities*. CCRS: XEI 24–27f. CC: HSA–REI.B.3. Manipulate the second inequality:

$$4 + 2x \geq 0$$

$$2x \geq -4$$

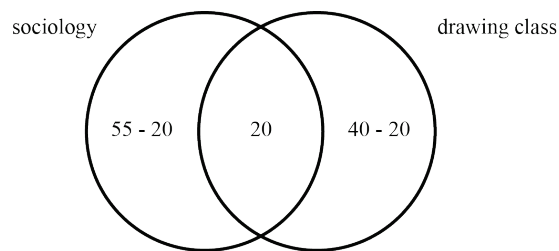
$$x \geq -2$$

And combine this statement with inequality one:

$$-2 \leq x \leq 6$$

**TIP** You could try to test various numbers to find the correct statement in the choices, but you're still going to have to deal with statement two. Somehow you'd have to figure out values that will satisfy the second inequality, and the only way to do that is to rewrite the statement so that you have:  $x \geq -2$ . But once you've done that, you have everything you need to answer without testing values.

48. (K) *Mathematics/Arithmetic/Common Arithmetic Items/Sets: Union, Intersection, and Elements*. CCRS: PSD 24–27d. CC: HSS–CP.A.1. This is a classic "Venn Diagram" problem:



The total number of seniors enrolled in sociology or in drawing class or in both is:

$$t = (55 - 20) + 20 + (40 - 20) = 75$$

So the number not enrolled in either class is:

$$120 - 75 = 45$$

**TIP** You can solve the problem without doing a Venn Diagram: Enrollments in the two classes total 55 plus 40 or 95, but 20 of those are duplicates, so the number of students is  $95 - 20$  or 75 in both. The number not enrolled in either is 120 minus 75 or 45. But hey, Venn Diagrams are so cool.

49. (C) **Mathematics/Coordinate Geometry/Slope of a Line. CCRS: GRE 20–23c. CC: HSG–GPE.B.5.** This item asks about a very important concept related to slope: When two lines in the coordinate plane are perpendicular, their slopes are the negative reciprocals of each other. So if a line has a slope of 3, any line perpendicular to that line has a slope of  $-\frac{1}{3}$ .

**TIP** Remember also that if two lines in the coordinate plane are parallel, they have the same slope. So the line with the equation  $y = 3x - 1$  is parallel to the line with the equation  $y = 3x + 10$ .

50. (J) **Mathematics/Coordinate Geometry/The Coordinate System. CCRS: GRE 24–27d. CC: HSG–GPE.B.6.** This item asks you to use the expression for finding the midpoint of a line segment in the coordinate plane:

$$M(x_m, y_m) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

So:

$$12 = \frac{(2a + 4a)}{2}$$

$$12 = \frac{6a}{2}$$

$$3a = 12$$

$$a = 4$$

**TIP** You could test answer choices. You'll have to start with (F) and work through them one-by-one until you find the right answer. If  $a = 0$ , then the x-coordinate of the midpoint would be  $\frac{[2(0) + 4(0)]}{2} = 0$ .

But we know that the x-coordinate is 12. So we try (G), 2:  $\frac{[2(2) + 4(2)]}{2} = 6$ . Again a wrong answer,

so we try (H), 3:  $\frac{[2(3) + 4(3)]}{2} = 9$ . Another miss, and it on to (J), 4:  $\frac{[2(4) + 4(4)]}{2} = \frac{24}{2} = 12$ . So (J) is the correct answer.

51. (D) **Mathematics/Arithmetic/Simple Manipulations. CCRS: PSD 28–32c. CC: HSS–CP.B.9.** This problem can be solved by applying the counting technique for the number of permutations:

$$P(n, r) = \frac{n!}{(n-r)!}$$

$$P(6, 3) = \frac{6!}{(6-3)!} = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1} = 120$$

**TIP** You can reach the same conclusion without a formula by using a little reasoning. You need to fill three



different positions:

$$\overline{1} \quad \overline{2} \quad \overline{3}$$

How many letters are available for filling position 1? Six. And for each one of the six, how many letters are available for position 2? Only five, because you've used one. So there are  $6 \cdot 5 = 30$  pairs of letters for the first two positions. And how many letters remain for position 3? Only 4 because you've used 2 already? So for each of the 30 pairs, you have 4 other letters to complete the sequence:  $30 \cdot 4 = 120$ .

To summarize, you have six choices for position 1; for each of the six possible letters in position 1, you have five letters to choose from for position 2; and for each of those pairs, four letters to choose from for position 3:  $6 \cdot 5 \cdot 4 = 120$ .

52. (H) *Mathematics/Coordinate Geometry/The Coordinate System* and *Geometry/Complex Figures and Triangles/Pythagorean Theorem*. CCRS: GRE 33–36c. CC: 8.G.B.7. Since this item involves a volume presented in three dimensions, it is technically not a question about plane geometry; but the techniques needed to solve the problem do belong to plane geometry.

Be careful on this problem. The answer choices do not represent coordinates for the diagram.

The vertex  $F$  is positioned at the origin  $(0,0,0)$ , and point  $D$  is one unit up on the  $z$ -axis. So the  $z$ -coordinate of  $D$  is 1.  $D$  is above  $H$ , which is one vertex of an isosceles right triangle defined by points  $F$ ,  $E$ , and  $H$ .  $FH$  is the hypotenuse of the right triangle which has sides of 1. So using the Pythagorean theorem to find the length of  $FH$ :

$$FH^2 = 1^2 + 1^2$$

$$FH = \sqrt{2}$$

$H$  is  $\sqrt{2}$  from the origin along the  $y$ -axis, so the  $y$ -coordinate of  $H$  (and therefore  $D$ ) is  $\sqrt{2}$ . Finally, since  $D$  is directly above  $H$  on the  $y$ -axis, the  $x$ -coordinate of  $D$  is 0. So the  $(x,y,z)$ -coordinates of  $D$  are  $(0, \sqrt{2}, 1)$ .

**TIP** You can increase your chances of getting this item correct by eliminating answer choices. For example,  $H$  lies on the  $y$ -axis and has  $x$ -coordinate of 0. So too,  $D$  has  $x$ -coordinate 0. This bit of information eliminates (K) and improves the guessing chance from 1 out of 5 to 1 out of 4. Next,  $D$  is 1 unit above the  $y$ -axis, so the  $z$ -coordinate is 1. This insight eliminates (G) and (J), improving the chance of guessing to  $\frac{1}{2}$  or 50/50. Finally,  $H$  cannot be just 1 unit from the origin along the  $y$ -axis because  $FH$  must be longer than  $FE$  and  $EH$ . And if the  $y$ -coordinate cannot be 1, then (F) is wrong. By the process of elimination, we have just proven that (H) is the right answer.

53. (B) *Mathematics/Algebra/Manipulating Algebraic Expressions/Manipulating Expressions Involving Exponents*. CCRS: NUM 33–36b. CC: HSF-LE.A.4. This item requires knowledge of the rules of exponents and logarithms, specifically the quotient and power rules:

$$\text{Quotient Rule: } \log \frac{A}{B} = \log A - \log B$$

$$\text{Power Rule: } \log A^b = b \log A$$

Applying these two rules to the expression given in the stem:

$$2\log_3 x + \frac{1}{2}\log_6 y - \log_3 z =$$

$$2\log_3 x - \log_3 z + \frac{1}{2}\log_6 y =$$

$$\log_3 x^2 - \log_3 z + \log_6(\sqrt{y}) =$$

$$\log_3\left(\frac{x^2}{z}\right) + \log_6(\sqrt{y})$$

54. (G) *Mathematics/Algebra/Manipulating Algebraic Expressions/Evaluating Expressions*. CCRS: XEI 33–36c. CC: 7.NS.A.3. The easiest way to solve this problem is to recognize that there are only two values for each of the variables that are important,  $x$  at 2 or 5 and  $y$  at  $-4$  or  $-3$ . These are the minimum and maximum values for each. Taken together, there are four possible combinations:

$$x = 2 \text{ and } y = -4$$

$$x = 2 \text{ and } y = -3$$

$$x = 5 \text{ and } y = -4$$

$$x = 5 \text{ and } y = -3$$

It's a simple matter to test all four combinations in:

$$|y - 2x|$$

$$|-4 - 2(2)| = |-8| = 8$$

$$|-3 - 2(2)| = |-7| = 7$$

$$|-4 - 2(5)| = |-14| = 14$$

$$|-3 - 2(5)| = |-13| = 13$$

55. (D) *Mathematics/Geometry/Complex Figures and Lines and Angles*. CCRS: PPF 24–27a. CC: 7.G.B.5. In this item, you are given the formula for finding the measure of the interior angles of the regular pentagon:

$$x^\circ = \frac{(n-2)180^\circ}{n} = \frac{(5-2)180^\circ}{5} = 108^\circ$$

This is the measure of the interior angle. To find the designated angle:

$$360^\circ - 108^\circ = 252^\circ$$

**TIP** Using just an eye estimate, you should be able to eliminate (A), (B), and (C). The designated angle is obviously greater than a straight line and so greater than  $180^\circ$ . (A) and (B) are less than 180 and (C) isn't much greater than a straight line. You can safely eliminate those choices, leaving only (D) and (E). Even though (D) and (E) are pretty close to each other, you still enjoy a 50/50 chance of guessing correctly, and on the ACT test you always guess.

56. (F) *Mathematics/Trigonometry/Trigonometric Relationships*. CCRS: FUN 33–36b. CC: HSF-TF.B.5. There are several approaches you might take with this item. First, the most direct solution is to remember the definitions of the concepts of amplitude, frequency, and period of the sine and cosine functions:





For  $y = a \sin bx$  or  $y = a \cos bx$ ,  $a > 0$ ,  $b > 0$ :

1. Amplitude,  $a$ , is the maximum ordinate.
2. Frequency,  $b$ , is the number of cycles within the range  $0 \leq b \leq 2\pi$ .
3. Period,  $\frac{2\pi}{b}$ , is the horizontal length of one cycle.

Only the function in (F) has an amplitude of 2.

(G) is a tangent function, and because the tangent function does not have maximum or minimum values, it does not, by definition, have amplitude. (See the definition provided in the question stem.) (H) is incorrect because the " $\frac{1}{2}$ " modifies the frequency of the function, in this case "stretching" it out. In (J), the "2" increases the frequency, "contracting" the function. And in (K), the " $\frac{1}{2}$ " alters the amplitude but reduces it, "flattening" the function.

57. (A) **Mathematics/Algebra/Manipulating Algebraic Expressions/Creating Algebraic Expressions. CCRS: XEI 28–32a. CC: HSA-CED.A.4.** This item asks you to rewrite the equation so that  $r$  is expressed in terms of  $S$  and  $t$ . Most people will probably not see the way to the final result when they start out. So the best strategy is to begin moving terms around to see what develops. Your goal is to get all of the terms containing  $r$  on the same side of the equation. To begin, multiply both sides of the equation by the quantity  $(r - t)$ .

Step 1: Cross-multiply.

$$S = \frac{(rt - 3)}{(r - t)}$$

$$S(r - t) = rt - 3$$

Step 2: Distribute  $S$ .

$$Sr - St = rt - 3$$

Step 3: Add  $St$  to both sides; subtract  $rt$  from both sides. Remember your goal: to get all the terms containing  $r$  on the same side of the equation.

$$Sr - rt = St - 3$$

Step 4: Factor  $r$ .

$$r(S - t) = St - 3$$

Step 5: Divide both sides by  $S - t$ .

$$r = \frac{(St - 3)}{(S - t)}$$

In this problem it is important to remember your goal: to get all the terms containing  $r$  on the same side of the equation. It may take some algebraic manipulation, but in time you will get there.

**TIP** A surefire alternative strategy is to assume some values for  $r$  and  $t$ . Make it easy on yourself. Looking at the expression to the right of the equals sign, it looks as though  $r = 3$  and  $t = 2$  would make the calculation easy:

$$S = \frac{[(3)(2) - 3]}{(3 - 2)} = 3$$

So for each choice, substitute  $S = 3$  and  $t = 2$  to find the one that returns the value 3 for  $r$ :

A.  $r = \frac{[(3)(2) - 3]}{(3 - 2)} = \frac{-3}{-1} = 3 \checkmark$

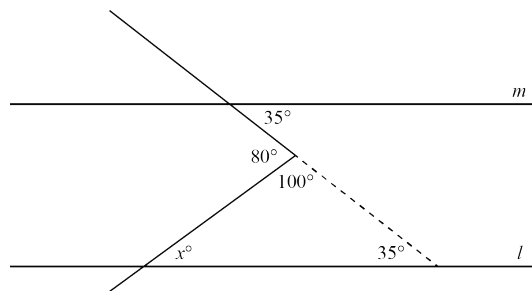
B.  $r = \frac{(3 - 3)}{(3 - 1)} = 0 \times$

C.  $r = \frac{(3 - 1)}{(3 - 3)} = \text{division by } 0 \times$

D.  $r = \frac{[(3)1 - 3]}{(3 + 1)} = 0 \times$

E.  $r = \frac{3}{(1 - 3)} = \frac{-3}{2} \times$

58. (G) *Mathematics/Geometry/Lines and Angles*. CCRS: PPF 24–27a. CC: HSG-CO.C.9. Adding a line to the figure will help you see the solution:



Using the principle that the alternate interior angles (angles created when two parallel lines are cut by a transversal) are equal, we find that the lower right angle of the newly created triangle has a degree measure of 35. Then using the principle of supplementary angles, the top angle of our new triangle is  $100^\circ$ . So:

$$x + 100 + 35 = 180$$

$$x = 45$$

**TIP** Although the explanation above uses technical terms like “alternate interior,” you can remember everything you need to know about the angles created when parallel lines are cut by a third line with: All big angles are equal; all small angles are equal; any big plus any small equals 180.

**TIP** You can use your eye to estimate the size of  $x^\circ$ . You should be able to see that it is about half of a right angle or  $45^\circ$ .



59. (E) *Mathematics/Trigonometry/Trigonometric Relationships*. CCRS: FUN 28–32b. CC: HSG-SRT.C.8. The triangle given is a right triangle, so the third angle must be  $70^\circ$ . The tangent is the ratio of the opposite side over the adjacent side, so set up the equation and multiply both sides by 3:

$$\tan 70^\circ = \frac{b}{3}$$

$$3 \tan 70^\circ = b$$

**TIP** Remember SOH-CAH-TOA:

$$\text{SOH (sine): } \sin = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\text{CAH (cosine): } \cos = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{TOA (tangent): } \tan = \frac{\text{opposite}}{\text{adjacent}}$$

60. (K) *Mathematics/Coordinate Geometry/The Coordinate System*. CCRS: FUN 33–36b. CC: HSG-C.A.2. An angle of any measure (positive or negative) may be generated by a ray that rotates about a fixed point (the vertex) from an initial position to a terminal position. The degree measure of the angle is the number of degrees of rotation, a complete rotation being  $360^\circ$ .

So an angle with a vertex at the origin of the coordinate plane, an initial side on the positive  $x$ -axis, and a degree measure of  $1,573^\circ$ , rotates about the origin 4 times plus an additional  $133^\circ$ .

The following tables list the descriptions for all the Common Core State Standards and the College and Career Readiness Standards that are referenced in this *Navigator Plus*.

## Mathematics — Common Core State Standards

Standard	Description
<b>5.MD.C.5b</b>	Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.
<b>6.EE.A.2c</b>	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
<b>6.EE.B.6</b>	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
<b>6.EE.B.8</b>	Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.
<b>6.EE.C.9</b>	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. <i>For example, in a problem involving motion at a constant speed, list and graph ordered pairs of distances and times, and write the equation <math>d = 65t</math> to represent the relationship between distance and time.</i>
<b>6.NS.B.4</b>	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
<b>6.RP.A.3c</b>	Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
<b>6.RP.A.3d</b>	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
<b>6.SP.B.5c</b>	Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
<b>7.EE.A.1</b>	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
<b>7.EE.B.3</b>	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
<b>7.G.A.1</b>	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
<b>7.G.B.4</b>	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
<b>7.G.B.5</b>	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

<b>7.G.B.6</b>	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
<b>7.NS.A.2a</b>	Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
<b>7.NS.A.3</b>	Solve real-world and mathematical problems involving the four operations with rational numbers.
<b>7.RP.A.3</b>	Solve real-world and mathematical problems involving the four operations with rational numbers.
<b>7.SP.C.5</b>	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $1/2$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
<b>8.EE.C.7b</b>	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
<b>8.F.B.4</b>	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two $(x, y)$ values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
<b>8.F.B.5</b>	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
<b>8.G.B.7</b>	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
<b>8.G.B.8</b>	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
<b>8.SP.A.3</b>	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. <i>For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.</i>
<b>HSA-CED.A.1</b>	Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>
<b>HSA-CED.A.4</b>	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
<b>HSA-REI.B.3</b>	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
<b>HSA-REI.B.4b</b>	Solve quadratic equations by inspection (e.g., for $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$ .
<b>HSA-REI.C.5</b>	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
<b>HSA-SSE.A.2</b>	Use the structure of an expression to identify ways to rewrite it.
<b>HSF-BF.A.2</b>	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
<b>HSF-IF.A.2</b>	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
<b>HSF-IF.B.4</b>	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i>
<b>HSF-LE.A.4</b>	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a$ , $c$ , and $d$ are numbers and the base $b$ is 2, 10, or $e$ ; evaluate the logarithm using technology.
<b>HSF-TF.B.5</b>	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.



<b>HSG-C.A.2</b>	Identify and describe relationships among inscribed angles, radii, and chords. <i>Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</i>
<b>HSG-CO.C.9</b>	Prove theorems about lines and angles. <i>Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</i>
<b>HSG-GPE.B.5</b>	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
<b>HSG-GPE.B.6</b>	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
<b>HSG-SRT.B.5</b>	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
<b>HSG-SRT.C.8</b>	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
<b>HSN-Q.A.1</b>	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
<b>HSN-RN.A.1</b>	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. <i>For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = (5^{1/3})^3</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</i>
<b>HSS-CP.A.1</b>	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).
<b>HSS-CP.B.9</b>	Use permutations and combinations to compute probabilities of compound events and solve problems.



## Mathematics — College and Career Readiness Standards

Standard	Description
<b>Basic Operations and Applications</b>	
<b>BOA 16–19a</b>	Solve one-step arithmetic problems.
<b>BOA 16–19b</b>	Solve two-step arithmetic problems.
<b>BOA 20–23a</b>	Solve multi-step arithmetic problems involving percents, proportions, rates, and computing with a given average.
<b>BOA 28–32a</b>	Solve complex word problems involving percentages, proportions, ratios, rates, or averages.
<b>Probability, Statistics, and Data Analysis</b>	
<b>PSD 16–19a</b>	Determine the average of a list of numbers.
<b>PSD 16–19c</b>	Read tables and graphs.
<b>PSD 16–19e</b>	Use the relationship between an event probability and the probability of its complement.
<b>PSD 24–27d</b>	Know how to use Venn diagrams.
<b>PSD 28–32b</b>	Understand and use information from tables, graphs, and figures.
<b>PSD 28–32c</b>	Use counting techniques.
<b>Number Concepts</b>	
<b>NUM 16–19a</b>	Recognize one-digit factors.
<b>NUM 20–23a</b>	Show familiarity with number concepts such as absolute value, ordering decimals, rounding, primes, and greatest common factor.
<b>NUM 24–27f</b>	Work with problems that have positive integer exponents.
<b>NUM 33–36a</b>	Draw conclusions based on number concepts, algebraic properties, and relationships between numbers and expressions.
<b>NUM 33–36b</b>	Show familiarity with logarithms and geometric sequences.
<b>Expressions, Equations, and Inequalities</b>	
<b>XEI 20–23c</b>	Solve simple first-degree equations.
<b>XEI 20–23d</b>	Execute simple word-to-symbol translations.
<b>XEI 20–23e</b>	Multiply two binomials.
<b>XEI 24–27a</b>	Use first-degree equations to solve real-world problems.
<b>XEI 24–27d</b>	Add, subtract, and multiply polynomials.
<b>XEI 24–27e</b>	Factor simple quadratic expressions such as the difference of squares and perfect square trinomials.
<b>XEI 24–27f</b>	Solve simple first-degree inequalities not requiring reversal of the inequality sign.
<b>XEI 28–32a</b>	Manipulate algebraic expressions and equations.
<b>XEI 28–32b</b>	Create expressions, equations, and inequalities for common algebra situations.
<b>XEI 28–32e</b>	Solve quadratic equations.
<b>XEI 28–32f</b>	Find solutions to systems of linear equations.
<b>XEI 33–36c</b>	Solve linear equations and simple inequalities involving absolute value.
<b>Graphical Representations</b>	
<b>GRE 20–23c</b>	Show familiarity with slope.
<b>GRE 24–27b</b>	Determine slope from linear equations or coordinate points.
<b>GRE 24–27c</b>	Identify graphs of linear equations.
<b>GRE 24–27d</b>	Determine the midpoint of a line segment.
<b>GRE 28–32c</b>	Use the distance formula.
<b>GRE 33–36c</b>	Solve problems involving multiple algebraic and/or geometric concepts.

<b>Properties of Plane Figures</b>	
<b>PPF 20-23b</b>	Show familiarity with basic angle properties and special angle sums such as $90^\circ$ , $180^\circ$ , and $360^\circ$ .
<b>PPF 24-27a</b>	Determine an unknown angle measure using several angle properties.
<b>PPF 24-27c</b>	Use isosceles triangle properties.
<b>PPF 28-32a</b>	Apply properties of special triangles such as $30^\circ$ - $60^\circ$ - $90^\circ$ , $45^\circ$ - $45^\circ$ - $90^\circ$ , similar, and congruent.
<b>PPF 28-32b</b>	Use the Pythagorean theorem.
<b>Measurement</b>	
<b>MEA 20-23a</b>	Determine the perimeter and area of triangles and rectangles in one-step problems.
<b>MEA 20-23b</b>	Use geometric formulas when all the required information is given.
<b>MEA 24-27c</b>	Determine the perimeter of composite figures.
<b>MEA 28-32a</b>	Compute a measure using relationships between perimeter, area, and volume of geometric figures.
<b>Functions</b>	
<b>FUN 20-23a</b>	Evaluate quadratic and polynomial functions using integer values.
<b>FUN 28-32a</b>	Evaluate composite functions using integer values.
<b>FUN 28-32b</b>	Apply basic trigonometric ratios.
<b>FUN 33-36b</b>	Use trigonometric concepts and identities.





### Test 3: Reading

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1. **(D) Reading/Prose Fiction/Implied Idea. CCRS: GEN 13–15a. CC: ELA-Literacy.CCRA.R.1.** This question asks why the narrator chooses to highlight certain details and not others. It can be inferred that these features of the experiences are the ones that the narrator considers most important and therefore remembers most vividly. This is the conclusion provided by (D).

(A) is wrong because the narrator is not extremely young and does appreciate various subtle points about the trip. In the first place, the opening paragraph states that the narrator has just turned ten; her younger sister cries at the airport but she does not. Then the rest of the passage narrates a variety of incidents that go way beyond simple sensory experiences and involve social interaction and psychological reflection.

(B) is wrong because the narrator makes it clear that she is not “upset” by the separation from her parents. Her younger sister cries when their mother leaves them with the flight attendant, but she does not. And the rest of the narrative is filled with positive description (even the “hamburger” incident has a happy ending).

(C) is wrong because there is nothing to suggest that the flight is “routine.” In fact, the occasion for the flight is transportation to the grandmother’s home where she and the sister will spend the summer while their parents are away.

2. **(H) Reading/Prose Fiction/Implied Idea. CCRS: GEN 16–19a. CC: ELA-Literacy.CCRA.R.1.** In the sixth paragraph, the narrator talks about the other children in the neighborhood where she is visiting. She says they play ball and go to the beach. In Paragraph 7, the narrator recalls that she tells the other children about other places she has visited. It is a fair inference that the narrator regards the other children as pals and someone with whom to play and share stories.

(F) is incorrect because the other children are not depicted as “spoilsports.” A “spoilsport” is someone who, as the word implies, spoils the play. We might also say a “wet blanket” or a “drag.”

(G) is wrong because the narrator does not mention that the other children have anything at all to say about the ocean. The description of the Pacific Ocean as beautiful and blue and the Gulf of Mexico as flat and warm is provided by the narrator, not the other children.

(J) must surely be wrong since the narrator says specifically that they all go to the beach together. To be sure, the narrator tells them about the Gulf of Mexico, a location they have perhaps not visited, but that does not mean that they have not been to the beach near where they live.

3. **(B) Reading/Prose Fiction/Development. CCRS: GEN 20–23a. CC: ELA-Literacy.CCRA.R.3.** In the paragraphs referenced, the narrator says specifically “we compromise.” The compromise mentioned has to do with eating. The sister is allowed to use a fork rather than the chopsticks first provided by the grandmother, and the grandmother cooks hamburgers rather than food she ordinarily prepares.

(A) is incorrect because it is, at best, half the story. A compromise means that both sides are giving up something.

(C) is incorrect as a characterization of the referenced material. There is nothing in those lines to suggest that the grandmother grows tired. Additionally, the narrator says specifically at lines 20-21 that the grandmother is “inexhaustible.”

(D) is wrong because the girls and their grandmother *compromise*. The grandmother gives in on the issue of the fork and cooks hamburgers. So the grandmother is not rigid.

4. **(J) Reading/Prose Fiction/Implied Idea. CCRS: GEN 24–27a. CC: ELA-Literacy.CCRA.R.2** In the tenth paragraph, the narrator describes how her grandmother showed her some souvenirs. Some of them were gifts from admirers given to her when she was a singer. These facts imply that the grandmother must have enjoyed some fame when she was younger. The grandmother shows the girls these memorabilia to let them in on the story of her life when she was younger.

(F) goes beyond the text. While it is a fair inference that the grandmother shares her souvenirs with her granddaughters in order to let them have a look at her life before she became a grandmother, this statement is not supported by the text. There is nothing in the incident to suggest that the grandmother hopes the girls will follow in her footsteps.

(G) is incorrect because the passage does not say that the grandmother gives these objects to the girls. So the objects are not for the girls to keep and preserve.

(H) is wrong because there is no indication that the grandmother exaggerates her life's story. The narrator reports the incident as though it is exactly what the grandmother represents it be: a look at her earlier life.

5. **(D) Reading/Prose Fiction/Explicit Detail. CCRS: SUP 20–23b. CC: ELA-Literacy.CCRA.R.2.** This question asks which of the four references in the choices is the most imaginative. Certainly the longest is the description of the perfume, and it is also the most involved.

(A) is incorrect because the narrator says nothing about the baby shirt except that it was small enough to put on the stuffed animal. There is no mention of color or decoration or that it has any significance other than being a baby shirt.

(B) is incorrect because the white gloves worn by the flight attendant are mentioned in passing only. Nothing is made of the detail. They don't signify authority or cleanliness or style. So the gloves are not a very important detail.

(C) is perhaps the second best choice because at least the lotion is described as coconut lotion. But there is no significance to the detail. Yes, the car smells of the lotion, but the narrator doesn't ascribe any further significance to the detail.

6. **(G) Reading/Prose Fiction/Implied Idea. CCRS: SUP 20–23a. CC: ELA-Literacy.CCRA.R.2.** In the opening paragraph, the narrator explains that she and her sister are going to San Diego to visit their grandmother while their parents are out of the country. The purpose of the visit is summarized by (G).

(F) is incorrect because the narrator's birthday is not observed this time because it is necessary to travel to San Diego. The trip is not a birthday celebration but a trip to the grandmother's house for the summer while the parents are out of the country.

(H) is simply not supported by anything in the passage. (H) expresses a nice sentiment, and many people might share this attitude; but there is absolutely nothing in the passage to indicate that this idea played a part in the parents' decision to send the children to their grandmother.

(J) is an interesting idea, and it might very well be true that the girls will be better entertained in San Diego. Of course, we do not know that; we'd be guessing. And in any case, there is no language in the passage to suggest that this was a part of the plan for sending the girls to San Diego.

7. **(D) Reading/Prose Fiction/Implied Idea. CCRS: GEN 20–23a. CC: ELA-Literacy.CCRA.R.2.** Though the narrator does not state explicitly who or what Piggy is, the detail strongly suggests that it is a stuffed animal. The narrator says that she brought Piggy though her sister left a doll behind, so we can infer that functionally they are similar. Then the name of the object is "Piggy," suggesting a pig or perhaps some other stylized small animal. Finally, the object is tattered, suggesting that it is cloth covered. So



we can infer that Piggy is a stuffed animal. The grandmother, however, does not ridicule the narrator for an attachment that seems inconsistent with the narrator's age (too old for stuffed animals). Instead, she treats the object with respect. The narrator acknowledges her grandmother's understanding attitude, as (D) correctly points out.

(A) is incorrect but may be the second best choice. (A) has the merit of indicating that the grandmother's attitude is one of sympathy, but (A) goes too far. The narrator does not suggest that she would be laughed at for bringing the toy. Rather, it looks a bit curious but isn't outrageous. Contrast the situation with a full-grown adult holding on to a stuffed animal.

(B) misses the point of the story about Piggy. Piggy is representative of a child's insecurities, and even ten-year-olds have some left over from their earlier lives. The grandmother understands this. So the T-shirt is the way of expressing sympathy and understanding. As for the exact wording of (B), the narrator does not even consider a T-shirt until her grandmother looks for one.

(C) confuses details from different parts of the passage. The Piggy incident is in Paragraph 5. The question about her grandmother's bedtime belongs to the preceding paragraph.

8. **(H) Reading/Prose Fiction/Implied Idea. CCRS: REL 20–23a. CC: ELA-Literacy.CCRA.R.5.** This question asks about the sequence of events in the narrative. We know that the first event is "Monterey" because the narrator states that is where she was born. She also describes some of her childhood memories there, so we know she lived there for a while.

(F) is incorrect because the visit to her aunt and uncle's home obviously occurred after she was born, so the visit there cannot be the first event that took place. Of course, it is possible that she made the visit while still living in Monterey (the passage doesn't say one way or the other), but "living in Monterey" would still be first on the list.

(G) is incorrect because the narrator does not say that she ever visited at Su-yi's house. Perhaps she learned from family discussions that her grandmother lived with Su-yi before finding her own house; that is, someone said to her, "Oh yes, your Nai-nai used to live with Su-yi before you were born, but she got her own house."

(J) is incorrect because the passage does not say that the narrator lived in Taiwan. We know only that her father and mother are spending the summer there.

9. **(B) Reading/Prose Fiction/Implied Idea. CCRS: MOW 20–23a. CC: ELA-Literacy.CCRA.R.4.** The narrator remarks that the wedding picture of her parents shows her father as a confident man who looks as though no misfortune has befallen him. It is a fair inference that sometime between the wedding and the present, something happened to the father to change his appearance. That is why the narrator finds it difficult to recognize him.

(A) is wrong and just confuses the discussion of the photo with the point that the father is going to Taiwan to teach. The only absence mentioned is the current one.

(C) is incorrect because the narrator knows that she is looking at a wedding picture of her father and mother. She simply notes that her father has changed over the years.

(D) is wrong because the discussion implies that the father has aged, not that he looks younger.

10. **(F) Reading/Prose Fiction/Implied Idea. CCRS: GEN 20–23a. CC: ELA-Literacy.CCRA.R.1.** This question asks you to draw a conclusion about the father's life. The father is mentioned only twice in the passage. In Paragraph 1, it is said that the father and mother are spending the summer in Taiwan where the father will teach. That information does not support any of the conclusions given the choices. The eleventh paragraph talks about the wedding photo. The narrator said that in the photo her father is

hard to recognize and looks as though nothing bad had ever happened to him. We can infer, therefore, the conclusion offered by (F) that something bad has happened to the father.

(G) is incorrect because the narrator does not say that the father is even present when the two girls board the plane. The mother hands them off to the flight attendant.

(H) is incorrect because we get no insight into the father’s thoughts. The narrator refers only to that which is outside and observable.

(J) is wrong because neither of the references to the father suggests that the family may relocated.

**11. (A) Reading/Social Science/Implied Idea. CCRS: GEN 24–27b. CC: ELA-Literacy.CCRA.R.1.** In the first paragraph, the writer explains that the log covered with peanut butter is not just a food source for the bears. It is also a challenge intended to stimulate them mentally. Choice (A) best summarizes this idea: offer them mental simulation.

(B) is wrong because the log is said specifically to be a way to stimulate problem-solving by the bears. The bears have to figure out how to get the peanut butter out of the holes and nooks.

(C) has no support in that first paragraph. The passage simply does not address the issue of whether polar bears are or are not tolerant of humans.

(D) goes beyond the scope of the article. While it is certainly possible that the bears will be released (nothing in the article prohibits this notion), there is nothing in the text to suggest that this is the goal of the program.

**12. (F) Reading/Social Science/Application. CCRS: GEN 24–27b. CC: ELA-Literacy.CCRA.R.3.** This item asks you to apply the theory of Dennett and Terrace to the behavior described in Paragraph 1. According to the writer, Dennett and Terrace are *skeptics*; they do not accept the notion that animals have conscious states. This is the position described by (F).

(G) is wrong because the two scientists mentioned reject the notion that animals have conscious states. So “mental stimulation” would not be possible for animals.

(H) is incorrect because the two skeptics reject the notion that animals have consciousness, even phenomenal consciousness.

(J) is incorrect because the skeptics reject the idea that animals have even phenomenal consciousness, so they also reject the notion that animals have self-consciousness, which is a reflective, higher order mental state.

**13. (D) Reading/Social Science/Development. CCRS: SUP 28–32a. CC: ELA-Literacy.CCRA.R.8.** This item asks for you to explain how the examples presented in Paragraph 4 develop the argument. The examples are animals that seem to have made progress in learning skills associated with intelligence: identifying colors and shapes, communicating and watching television, and dreaming. If animals do have intelligence, then the position of skeptics such as Dennett is weakened.

(A) is incorrect because the author of the passage doesn’t take a position on the issue. The author reports on both sides and gives arguments supporting each.

(B) is incorrect since the very first sentence of Paragraph 4 states that the examples seem to support Griffin’s position.

(C) is wrong because, in Paragraph 8, McGinn is said to be one of the pro-consciousness philosophers, that is, one of the group that believes that animals do have conscious states.



**TIP** Make sure to review the line numbers listed in the item before making your answer choice.

14. (H) *Reading/Social Science/Application*. CCRS: GEN 28–32a. CC: ELA-Literacy.CCRA.R.1. “Animal rights advocate[s]” are mentioned in Paragraph 8. There the author notes that Peter Singer, one of the animal rights advocates, believes that most animals, and perhaps all, have at least phenomenal consciousness. So it is a fair inference that a tenet of that group’s philosophy is that animals have some sort of intelligence.

(F) is wrong because the animal rights advocates premise their position on the belief that animals are not automata. On their view, animals have at least phenomenal consciousness.

(G) is incorrect because the discussion in Paragraph 8 does not address the idea of animal enrichment programs. This is not to say that animal rights advocates are opposed to such programs; it’s just that the author gives us no information one way or the other.

(J) is incorrect because the animal rights advocates accept the premise that animals do have some conscious states. Indeed, animal rights advocates would be likely to reject the idea that animals merely respond to stimuli because that would be inconsistent with the idea that animals are entitled to be treated as having rights because they have conscious states.

15. (B) *Reading/Social Science/Implied Idea*. CCRS: REL 24–27e. CC: ELA-Literacy.CCRA.R.1. This item asks you to explain what lead up to the current debate about animal consciousness. Paragraph 2 states that Griffin published a book some 25 years prior to the publication of the article that argued that animals have thoughts and feelings. The first sentence of Paragraph 3 says that other scientists were “appalled.” They rejected the idea. Paragraph 4 says that in the ten years leading up to the publication of the article new scientific research seemed to support Griffin’s theory. And the passage continues to describe how the debate rages on. It was all started, however, by the publication of Griffin’s little book, as (B) correctly points out.

(A) is wrong because the primate research mention in Paragraph 4 took place in the ten years leading up to the publication of the article from which the selection is taken. By then, the debate had been going on for years.

(C) is wrong because the research mentioned in Paragraph 4 using the parrot took place in the years leading up to the publication of the article on which the test excerpt is based. The debate had been going on since the 1970s.

(D) is incorrect because the animal enrichment program at the Central Park Zoo that is described in Paragraph 1 was going on at the time that the writer published the article, in 2001. The debate began back in the 1970s.

16. (H) *Reading/Social Science/Main Idea*. CCRS: MID 24–27b. CC: ELA-Literacy.CCRA.R.2. Dennett is said to be one of the “skeptics,” the group that rejects the idea that animals are capable of thought. Dennet points out that people will ascribe not just rudimentary consciousness but even thought to robots dressed up to look like furry animals. The point of this argument is that people who think they see human-type thoughts in animals are merely projecting their own understanding and emotions on to the animal (or even the robot).

(F) is incorrect but probably the second best answer. If you picked (F), you just didn’t read the choice carefully enough. Dennett does not say that the robots act like humans but like animals. Then the humans wrongly impute to the robots human-like thoughts and emotions.

(G) is incorrect and the very opposite of the main point of the paragraph. The main point is that Dennett is a skeptic who denies that animals have conscious states. The proof he offers is that people will mistakenly attribute to robots thoughts and motives when, of course, the robots do not have

thoughts and motives. He uses this to show that people are fooling themselves; mammals are not really capable of curiosity and friendship.

(J) is wrong because Dennett is a skeptic who denies that even mammals have phenomenal consciousness. Dennett would not draw a distinction between insect and mammals but would insist that neither group can think.

17. (A) *Reading/Social Science/Main Idea. CCRS: MID 24–27b. CC: ELA-Literacy.CCRA.R.2.* This item asks about the main idea of the final paragraph. In that paragraph, the author returns to Griffin to “complete the circle” and draw the essay to a close. What is Griffin’s position? He accepts that animal consciousness has not yet been proved, but he notes that all of the brain hardware used for consciousness in humans can also be found in animals. No one has yet proved that animals do not have consciousness, so Griffin’s theory is still viable. This position is summarized by (A).

(B) is wrong because the author does not use Griffin to provide details in that paragraph. The author quotes Griffin for the general point that the jury is still out.

(C) is incorrect because there is nothing in the passage to suggest that Griffin feels any emotion about the opposing philosophical position. For all that the author tells us, Griffin regards Dennett’s position as one more intellectual position, among others, neutral, cool, and detached.

(D) is incorrect because the quotations do not hint that Griffin is about to introduce any new evidence at all. Griffin merely says that the debate continues. In fact, the quotations do not even reassert the content of Griffin’s position.

18. (G) *Reading/Social Science/Vocabulary. CCRS: MOW 24–27b. CC: ELA-Literacy.CCRA.R.2.* This item asks you to show that you understand the meaning of the phrase “stimulus response automata.” The phrase appears in Paragraph 3 where the author is contrasting the view that animals have some sort of consciousness with the behaviorist’s view. The author equates “stimulus response automata” with “robots with a central nervous system.”

(F) is incorrect though interesting. The automata are like toys in that they are cogs and pulleys, not flesh and blood. But the author does not equate them with “puzzles.” (G) provides a much more precise interpretation of the phrase.

(H) is incorrect because the parrot mentioned in Paragraph 4 supposedly learned to identify colors and shapes, thus evidencing a rudimentary consciousness. So the parrot is not an automaton.

(J) is perhaps the second best answer because it would not be wrong to think of automata as machines. But it is not necessary that the machine be dressed up like a mammal. The point of Paragraph 2 is that a robot reacts to input without thinking.

19. (B) *Reading/Social Science/Voice. CCRS: SUP 24–27a. CC: ELA-Literacy.CCRA.R.2.* To answer this item, you have to locate the detail regarding Griffin’s attitude toward the debate. In Paragraph 5, the author provides us with Griffin’s take. Griffin urges caution and notes that some early researchers jumped the gun and reached conclusions that were not warranted. (B) summarizes this point.

(A) is wrong because Griffin thinks that the early work was reckless. He urges caution in paragraph 5 as a counterbalance to the excessive enthusiasm of the early period.

(C) is based on a confusion of two parts of the passage. In Paragraph 10 Griffin is quoted as having made a play on words that amuses him and the audience. That is Griffin’s view of the more recent debate. For this item you need the detail regarding Griffin’s attitude on the early debate.



(D) is wrong because Griffin is quoted in Paragraph 6 as saying that the early work was “grossly misrepresented,” so it could not have been satisfactory.

20. **(F) Reading/Social Science/Explicit Detail. CCRS: SUP 24–27a. CC: ELA-Literacy.CCRA.R.2.** The detail that you need to answer this item is found in Paragraph 8. There the author states that pain, desire and other sensations experienced by humans are called phenomenal consciousness by philosophers.

(G) is wrong because stimulus response, mentioned in Paragraph 3, is like the reaction of a machine.

(H) is a fairly weak response because primate gestures are the hand signals that may or may not be the use of language.

(J) is wrong because sentience or self-consciousness (awareness) is a higher order mental state than mere phenomenal consciousness.

21. **(D) Reading/Humanities/Main Idea. CCRS: MID 28–32a. CC: ELA-Literacy.CCRA.R.2.** The passage starts off by explaining that we begin to listen to bits and pieces of stories when we are children. This often occurs in unstructured settings as opposed to formal storytelling settings. We overhear adults talking; we hear the television and the radio; we notice what is not said as well as what is said; and we piece things together for ourselves. In Paragraph 4, the author theorizes that interesting storytelling is a combination of perspectives: what really is and what happens only in stories. Then the author goes on to discuss how this mix is achieved. The author explains the formal elements that make the story a story: the author makes an implied commitment to say something meaningful and to close the story by making events come to an end. As part of this discussion the author contrasts the expectations of children and those of adults. Children are impatient; adults will put up with defects in the story. Ultimately, however, the measure of a story is how well it is told, the intensity that the author brings to the narrative.

(A) is incorrect because the author does not want to discourage anyone from telling stories. The entire discussion is theoretical, an investigation in the elements of the story.

(B) is incorrect because the author is describing the elements of good storytelling, but the author is not encouraging anyone to take up writing.

(C) is incorrect because the discussion of oral stories is part of the theory, not a method for becoming a good writer. The author treats our first introduction to stories as a fact. This is how we first learn about stories. The author does not say that it would do a writer any good to try to capture that experience.

**TIP** With a question like this one that is presented in sentence completion form, you can often eliminate choices on the basis of the first words. In this case, you can eliminate both (B) and (C). The discussion is theoretical. The author does “present,” but does not “persuade” or “instruct.”

22. **(F) Reading/Humanities/Development. CCRS: MID 28–32a. CC: ELA-Literacy.CCRA.R.2.** This question asks you to explain how the first paragraph supports the development of the entire passage. The opening paragraph does at least three different things. One, it announces that the topic is “stories.” Two, it states that stories are like heard voices. Three, it implies that the author is going to explain to us, the readers, how the heard voices are a story. This function is nicely described by (F).

(G) is incorrect because the idea set forth in Paragraph 1 is not contradicted or refuted later on. The author sets forth the idea about how we first hear stories and then develops that idea.

(H) is wrong because the author uses the ambiguity in the first couple of sentences as the starting point for the discussion. To be sure, taken in isolation, the first paragraph is confusing: What do you mean stories “come through the air” and we “hear voices?” But the author goes on immediately to explain what is meant: We overhear voices from a lot of different sources and piece the information together.

(J) is wrong because the author never says that writing is easy. In fact, the author implies that good writing requires work and attention to the various conventions of storytelling.

23. (A) *Reading/Humanities/Vocabulary. CCRS: MOW 28–32a. CC: ELA-Literacy.CCRA.R.4.* The author uses the word “censorship” in a nonstandard way. In the most common usage, censoring is the government suppression of speech or writing because of the content. A key element of the definition is “government.” In fact, you may hear someone say, “If your boss tells you not to talk about something at work, that’s not censorship.” So the author is using the phrase in a unique way to mean adults are usually careful not to talk about certain topics or at least to talk about them only when they think children are not listening. The key element of this usage is “adult,” as (A) correctly notes.

(B) is incorrect because “law” in the sense of a government enactment is not an element of the author’s usage in this context.

(C) is interesting insofar as it refers to “customs and habits,” for the adult censorship mentioned by the author is not a formal censorship. It’s an informal practice of watching one’s tongue. But (B) is wrong because the customs and practices belong to adults in general and not just to the tellers of tales.

(D) is wrong because the censorship is an adult practice, not an understanding between adults and children.

24. (G) *Reading/Humanities/Explicit Detail. CCRS: GEN 28–32a. CC: ELA-Literacy.CCRA.R.1.* The admonition to a writer to “express the story” is a sort of summary of the points made in Paragraph 4. What points does the author mention earlier in the paragraph that help to “express the story?”

The author mentions those contained in (F), (H), and (J) but does not mention simply retelling events just because they occurred. In fact, the author specifically says that relating events just as a sort of news report is not storytelling.

(F) is mentioned as a skill of good storytellers. The author specifically says a bad storyteller has no narrative skills. So we can infer that a good storyteller does have narrative skill.

(H) is mentioned as a skill of a good storyteller: sense of timing. We can infer, therefore, that the lack of timing makes for bad storytelling.

(J) is incorrect because the author says that good storytelling seems to result from the intersection of the two kinds of storytelling—pure fact and pure imagination.

25. (B) *Reading/Humanities/Explicit Detail. CCRS: MOW 28–32a. CC: ELA-Literacy.CCRA.R.3.* This detail question tells you exactly where to look for the answer. The author contrasts “real life” events with those that occur only in literature. This is the explanation provided by (B). “Real life” is “actual events,” and “mere literature” is “fiction.”

(A) is wrong because the distinction drawn in the referenced lines is a characteristic of storytelling, not a difference between possible audiences for stories.

(C) is incorrect because the author says that the “material” claimed by authors is the real life events, not literature.

(D) is wrong because both approaches, taken in isolation of each other, produce dead work. The formal sense alone produces dead work; a news report is a dead work.

26. (J) *Reading/Humanities/Explicit Detail. CCRS: SUP 28–32a. CC: ELA-Literacy.CCRA.R.3.* The information you need to answer this question is located in Paragraphs 5 through 9. The author says that both children and adults want to have their attention held, though adults are more likely to





persevere in their reading when children might give up. Both want to trust the integrity of the teller and the story, though adults are more demanding. And children absolutely require an intensity or commitment in the telling. So there are some similarities between the two groups, though the demands of adults are more sophisticated. This idea is summarized by (J).

(F) is wrong. The author specifically states that the two groups, adults and children, make somewhat similar demands on a storyteller.

(G) is incorrect because this notion is not mentioned by the author. In fact, the author implies that both groups are demanding, though their requirements are different.

(H) is wrong because the distinction between “real life” and “mere literature” is found in paragraph 4. It is not part of the comparison the author is developing in Paragraphs 5 through 9.

27. (C) *Reading/Humanities/Explicit Detail*. CCRS: SUP 28–32a. CC: ELA-Literacy.CCRA.R.3. This detail question requires you to find the part of the passage that discusses jokes and riddles, Paragraph 7. There the author says that in order to be successful jokes and riddles require a buildup, a surprising twist, and a sense of timing. The author does not mention “predictable ending.” In fact, the author says specifically that a riddle or joke makes no sense if the ending is obvious beforehand.

(A) is wrong because the author does say that riddles and jokes require a mystifying building.

(B) is wrong because the author specifically states that jokes and riddles must have a surprising twist.

(D) is incorrect because the author mentions the need for sense of timing for a joke or riddle to be successful.

28. (H) *Reading/Humanities/Implied Idea*. CCRS: REL 28–32C. CC: ELA-Literacy.CCRA.R.3. This is a fairly difficult question because you are asked to explain the effect of the web of stories that enmeshes children. In the second paragraph, the author explains that children hear and overhear things and that they piece together these fragments into a coherent whole, a story with a sequence of events, characters, and even mysterious gaps that are the forbidden knowledge (information not intended for the ears of children). (H) is the best approximation of this idea.

(F) is incorrect because the author does not say that this story building function (described in Paragraph 2) later prevents us from distinguishing fact and fiction. Indeed, the very wording of (F) is peculiar: child as a writer. The author does say that children can be tale-bearers (say things) and later can grow up to be authors (writers, presumably adults, never kick the habit).

(G) is wrong; the adult censorship is a social practice that exists because children are able to overhear conversations. So when a child is in the room, adults say things like “You know what” and “Who shall remain nameless” or use expressions or gestures to communicate hoping the child will not understand. Sometimes, you’ll recall, adults even spell words they don’t want the child to hear.

(J) is interesting right up to the point where it says “by tuning out.” Up to that point, (J) is a lot like (H): “create meaning” is like “to create a new world.” But then (J) veers off into a wrong direction. The child creates a world or meaning out of what is said and the silence in between, but the child has to notice both the words and the gaps.

29. (A) *Reading/Humanities/Explicit Detail*. CCRS: SUP 24–27a. CC: ELA-Literacy.CCRA.R.2. The answer to this detail question is found in Paragraph 6. There the author states that she always reads to the end of the story. She adds that when she loses the thread of a story, she feels that she is obligated to go back and reread the confusing material to make sense of it.

(B) is incorrect because the author says specifically that she feels duty-bound to finish the story, even when she’s lost the thread.

(C) is wrong because the author says that she feels an obligation to read to the end. The author does not tell us what she feels if she decides not to reread pages she has not understood.

(D) is wrong because it mixes up two parts of the passage. The discussion about revealing what is behind the curtain is in the next paragraph. It is not relevant to the fact that the author feels obligated to finish the story.

30. (F) *Reading/Humanities/Vocabulary. CCRS: MOW 28–32a. CC: ELA-Literacy.CCRA.R.4.* The phrase “a sense of urgency” has a meaning here that is dependent upon context. We ordinarily use “urgency” to mean that circumstances require immediate action, for example, the train is approaching and we’d better get off the tracks quickly. Here, however, the author specifically says that “urgency” does not mean that the storytelling must be quick. So we have a somewhat different meaning. In this context, “urgency” means “intentness,” or we might say “intensity.” The storyteller has to convey that the story is important, and, as (F) suggests, this requires a sense of commitment.

(G) is incorrect because the author specifically says that the story can be a quiet story and does not have to be frenzied.

(H) is wrong because the “intentness” does not refer to the need to resolve the story quickly. Instead, it means “intensity” or “commitment.”

(J) makes the mistake of confusing the information in line 76 with information from Paragraph 6.

31. (D) *Reading/Natural Science/Main Idea. CCRS: MID 28–32c. CC: ELA-Literacy.CCRA.R.2.* This is a main idea question. Remember that the task with this type of question is to choose a statement that summarizes the overall point of the passage without going beyond the text. We call this the “Goldilocks Rule:” Not too big, not too small, but just right. The author begins by discussing the process of fusion that fuels the Sun. Then the author explains that the Sun will at some point in the distant future destroy itself and become a white dwarf star. Then the author describes some of the scientific findings about the Sun. The passage continues with a discussion of the life course of other stars. So the main theme of the passage is the life of stars and how they change as they grow older.

(A) violates the “Goldilocks Rule” by going beyond the text. The word “encourage” is not descriptive of the passage. The author describes scientific theory and findings. The author is not attempting to produce any kind of action by the reader.

(B) is wrong because the author specifically says that it is not possible to observe the Sun’s core directly. But even if (B) were rewritten to read “indirect,” it would be wrong because it would violate the “Goldilocks Rule” by being too small. While the author does present some scientific findings about the Sun, those are contained in just one paragraph.

(C) is incorrect because the passage is not an attempt to “convince” the reader of any proposition. The passage is scientific and neutral, not persuasive.

32. (J) *Reading/Natural Science/Explicit Detail. CCRS: SUP 33–36a. CC: ELA-Literacy.CCRA.R.2.* This item asks about details. The correct answer is (J). In Paragraph 2, the author explains that one day the Sun will become a white dwarf that gives off a dull blue light in intensity about equal to moonlight. But the author does not say how long the Sun will last as a white dwarf.

(F) is wrong because the author does say in the first sentence of Paragraph 3 that astrophysicists have been able to form a pretty good picture of the inside of the Sun.



(G) is wrong because the author does explain in Paragraph 2 what will happen to the Sun over the next few billion years: it will burn; fuel will eventually run out; it will become a red giant; it will settle down and live the rest of its stellar life as a white dwarf.

(H) is incorrect because in Paragraph 4, using the Trapezium stars as examples, the author explains that stars ten times the size of our Sun or larger end up as supernovas.

**TIP** The “EXCEPT” is a thought-reverser, and a thought-reverser turns the ordinary question inside-out. The correct answer is the one that is NOT mentioned in the passage. The three that are mentioned are wrong answers. You should always circle thought-reversers in your test booklet so that you don’t overlook them.

**33. (C) Reading/Natural Science/Explicit Detail. CCRS: MOW 28–32a. CC: ELA-Literacy.CCRA.R.2.** This question asks about the causal conditions for achieving controlled fusion. The details needed to answer the question are in Paragraph 1. Since the question stem includes the thought-reverser “EXCEPT,” three of the four conditions are stated in that paragraph; the one not stated is the right answer. In Paragraph 1, the author discusses fusion in the Sun’s core and notes that controlled fusion is theoretically possible. There are, however, a number of practical issues that would have to be solved. But it is not necessary that the process use the Sun itself as fuel. The fuel is hydrogen, found not only in the Sun but other places as well, including right here on Earth.

(A) is mentioned as a precondition of controlled fusion: the hydrogen atom with its single proton has to be converted into helium with its two protons and two neutrons.

(B) is mentioned as a precondition of controlled fusion: the process occurs only at very high temperatures.

(D) is mentioned as a precondition of controlled fusion: the heat needed to trigger fusion would be so tremendous that it would melt any solid container, so the process would have to be contained by magnetic forces.

**34. (G) Reading/Natural Science/Explicit Detail. CCRS: REL 33–36a. CC: ELA-Literacy.CCRA.R.5.** The Sun’s life cycle is described in Paragraph 2. It goes from a normal star for its size to a red giant that burns very brightly to a white dwarf that emits a dull blue glow. So the last step is the white dwarf.

(F) is incorrect since the red giant stage occurs in the middle of the Sun’s life cycle.

(G) is incorrect because the throwing off of the outer layers occurs at the beginning of the red giant stage, the middle stage of the Sun’s life cycle.

(H) is incorrect because the Sun will not become a supernova. According to Paragraph 4, supernovas are exploding stars that began with a mass ten times that of our Sun or even greater. So our Sun would never go supernova.

**35. (C) Reading/Natural Science/Development. CCRS: MID 28–32c. CC: ELA-Literacy.CCRA.R.8.** This question asks you to explain how the author uses the details introduced in Paragraph 3. In Paragraph 3, the author explains that astrophysicists have calculated the likely course of the Sun’s life. It will last for several billion more years. How can the scientists be confident that their predictions are correct when “billions of years” is way beyond the life span of humans? The author explains that the scientists study other stars like the Sun that are in various stages of their life’s cycles. The author says that it is analogous to looking at humans. Some are infants, some are toddlers, some children, some adolescents, and so on. By looking at examples of various stages, it is possible to get a pretty good idea of how humans grow up, age, and die—in just a few minutes. And just as it would not be necessary to watch one human being go through all of the stages, so it is not necessary to watch the Sun until it becomes a white dwarf to know what will happen.

(A) is incorrect because the point of the observations is not that scientists can find other stars like the Sun but that once they are found, they can be used to theorize about the Sun's development.

(B) represents a confused reading of the passage, the reference to "snapshot" in particular. In this context, "snapshot" means "a look at" and not literally a "photograph." While it is not possible to observe the entire life cycle of the Sun, observing other similar stars in different stages is just about as good.

(D) is wrong because the author says that observing other stars does give a pretty accurate picture of our Sun's past and its likely future.

36. (H) *Reading/Natural Science/Explicit Detail*. CCRS: SUP 28–32b. CC: ELA-Literacy.CCRA.R.2. This question has an unusual format. You are asked to determine whether the passage contains information to answer the question presented. And the question contains a thought-reverser. So three of the four questions are answered somewhere in the passage; you have to locate the information. One of the questions is not answered in the passage, and that one is the correct answer. (H) is not answered in the passage. The author does say in Paragraph 1 that the Sun is massive. Indeed, this is the reason that the process of fusion can be contained within the Sun. But the author doesn't make a comparison of the Sun with the Earth or offer an explanation as to why the Sun is so much larger.

(F) is incorrect because in Paragraph 2 the author mentions how white dwarfs are formed from red giants and what they look like.

(G) is incorrect; in the final sentence of Paragraph 3, the author specifically says that astrophysicists base their projections on "the assumption that atoms and their nuclei are the same everywhere."


(J) is wrong because the author tells us in the last paragraph that astrophysicists are really fascinated by supernovae because they are huge. Who wouldn't be fascinated by an explosion that size?

37. (A) *Reading/Natural Science/Main Idea*. CCRS: MID 28–32c. CC: ELA-Literacy.CCRA.R.2. This paragraph asks about the main point of the last paragraph. (A) is the correct answer. The author explains that supernovae are not just a scientific phenomenon of interest to a few specialists; they are a precondition of our very existence. The atoms that we and the Earth are made up of come from supernovae.

(B) is wrong because it goes beyond what it actually stated in the final paragraph. The author does not discuss cataclysmic events in our solar system. The cataclysmic events discussed are the supernovae that occur considerable distance from our solar system.

(C) is wrong because the author simply does not argue against Darwin's theory. In fact, the author seems to accept that theory and believes that the evidence of supernovae support it.

(D) is incorrect because it is "too big." To be sure, some few people might read this selection and think, "Wow, that's great; I'd like to buy a telescope and learn more about the stars." But that is not the author's purpose. The author has written a report of scientific discoveries for people who do not have advanced degrees in astrophysics.

 The measure of the right answer is provided by the "Goldilocks Rule:" Not too big, not too small, but just right.

38. (J) *Reading/Natural Science/Vocabulary*. CCRS: MOW 28–32a. CC: ELA-Literacy.CCRA.R.4. In order to understand the sentence in which this phrase appears (and the point made by the author in it), you must understand what "others" refers to. In the preceding sentence, the author notes that not too many people work as astrophysicists, so why should the rest of us worry about supernovae. The "others" are



us, the non-scientists. And the author goes on to say that the reason supernovae are important even to us laypersons is that we wouldn't be here without them.

(F) is incorrect; the "others" are we the people who live here on Earth far away from the supernovae.

(G) is a fairly weak answer; it is difficult to imagine how "others" could be construed to refer to planets, which are not even mentioned in the final paragraph.

(H) is wrong because "others" contrasts with "scientists." We are the "others" because we are not in the group of "scientists."

- 39. (D) Reading/Natural Science/Application. CCRS: GEN 33–36a. CC: ELA-Literacy.CCRA.R.1.** This item asks you to draw a further conclusion from the information that you have read. In the final paragraph, the author states that without supernovae the atoms necessary for Earth's and our existence would not be available. In other words, none of us would be here. These atoms can be traced back to stars that exploded way before our Solar System was formed. Thus, (D) correctly states that we and the Earth are made up of particles that originated in the ancient stars.

(A) gets off to a good start. The author would probably agree that fusion will not be available as a source of power in the foreseeable future because of the practical difficulties discussed in Paragraph 1. But (A) does not refer to those difficulties. Instead, (A) says fusion will not be used because of political opposition. That is a concept not mentioned by the author.

(B) gets off to a good start because the age of stars is the subject of scientific calculation, but (B) goes off course when it asserts that the measure of a star's age is how close it is to our Sun. The author does not say that.

(C) has a promising beginning because the Trapezium stars are in the Orion constellation and are discussed in Paragraph 4. But then (C) makes a fatal error. The author says those stars are burning themselves up faster than our Sun.

- 40. (G) Reading/Natural Science/Implied Idea. CCRS: SUP 33–36a. CC: ELA-Literacy.CCRA.R.2.** This item asks you to comment on the feasibility of using controlled fusion as a power source. Controlled fusion is discussed in Paragraph 1, where the author lists a number of practical objections: attaining necessary temperature, containing the reaction, and using magnetic forces. The author gives the clear impression that controlled fusion is not practical.

(F) is incorrect because too many practical problems would have to be solved before controlled fusion could be attempted. The Sun does a great job, to be sure, but the Sun is huge and hot.

(G) is wrong because the author indicates that controlled fusion will be impractical for the foreseeable future, not just that a few problems remain to be solved.

(H) is wrong because the author never mentions financial pressures.

The following tables list the descriptions for all the Common Core State Standards and the College and Career Readiness Standards that are referenced in this *Navigator Plus*.

## Reading — Common Core State Standards

Standard	Description
<b>ELA-Literacy.CCRA.R.1</b>	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
<b>ELA-Literacy.CCRA.R.2</b>	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
<b>ELA-Literacy.CCRA.R.3</b>	Analyze how and why individuals, events, or ideas develop and interact over the course of a text.
<b>ELA-Literacy.CCRA.R.4</b>	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
<b>ELA-Literacy.CCRA.R.5</b>	Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
<b>ELA-Literacy.CCRA.R.8</b>	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.



## Reading — College and Career Readiness Standards

Standard	Description
<b>Main Idea and Authors Approach</b>	
<b>MID 24-27b</b>	Infer the main idea or purpose of paragraphs in more complex passages.
<b>MID 28-32a</b>	Infer the main idea or purpose of more complex passages and paragraphs.
<b>MID 28-32c</b>	Understand the author's or narrator's overall approach (e.g., point of view, kinds of evidence used) in almost any passage.
<b>Supporting Details</b>	
<b>SUP 20-23a</b>	Locate important details in uncomplicated passages.
<b>SUP 20-23b</b>	Make simple inferences about the role of details in passages.
<b>SUP 24-27a</b>	Locate important details in more complex passages.
<b>SUP 28-32a</b>	Locate and interpret subtle details in more complex passages.
<b>SUP 28-32b</b>	Use details that appear in different sections of complex informational passages to support specific points or arguments.
<b>SUP 33-36a</b>	Locate and interpret details in challenging passages
<b>Sequential, Comparative, and Cause–Effect Relationships</b>	
<b>REL 20-23a</b>	Order sequences of events in uncomplicated literary passages.
<b>REL 24-27e</b>	Identify clear cause-effect relationships in more complex passages.
<b>REL 28-32c</b>	Understand implied or subtly stated cause-effect relationship in more complex passages.
<b>REL 33-36a</b>	Order sequences of events in challenging passages.
<b>Meaning of Words</b>	
<b>MOW 20-23a</b>	Determine the meaning of figurative and nonfigurative words, phrases, and statements in uncomplicated passages using contextual clues.
<b>MOW 24-27b</b>	Determine, using context, the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more complex passages.
<b>MOW 28-32a</b>	Determine the appropriate meaning of words, phrases, and statements from figurative or technical contexts.
<b>Generalizations and Conclusions</b>	
<b>GEN 13-15a</b>	Draw conclusions about the people or events in straightforward narratives.
<b>GEN 16-19a</b>	Make generalizations and draw conclusions about people and ideas.
<b>GEN 20-23a</b>	Draw generalizations and conclusions using details that support the main points of more challenging passages.
<b>GEN 24-27a</b>	Draw generalizations and conclusions about people, ideas, and so on in more complex passages.
<b>GEN 24-27b</b>	Draw subtle generalizations and conclusions about characters, ideas, and so on in uncomplicated literary narratives.
<b>GEN 28-32a</b>	Draw generalizations and conclusions about people, ideas, etc. by using information from one or more sections of more complex passages.
<b>GEN 33-36a</b>	Draw complex or subtle generalizations or conclusions about people, ideas, etc. by combining information from different parts of the passage.





## Test 4: Science

1. **(D) Science/Data Representation/Analysis. CCRS: ID 24–27d.** The number of larvae per mouse is given in the column in Table 1 labeled “larvae/mouse.” The number of mice found in each zone is given in the column labeled “mice.” The number of mice is least in Zone E and greatest in Zone A with the number increasing through Zones D, C, and B. The number of larvae per mouse neither increases nor decreases from Zone E through Zones D, C, B, and A.

This question is a bit peculiar in that there is no apparent reason why the number of mice should decrease according to an alphabetical series. That is, there is no reason to expect that Zone B would have fewer mice than Zone A or Zone C fewer than Zone B and so on. So the lack of a correlation does not seem to have any scientific significance. This would be a more interesting question had it read:

Based on Table 1, as the percent of households inhabited by at least 1 infected person increases, the number of larvae/mouse:

- A. increases
- B. decreases
- C. remains the same
- D. changes with no trend

One might expect that the incidence of infection would correlate with the number of larvae per mouse, and the lack of such a correlation would be interesting. As it is, the fact that the letters assigned arbitrarily to the zones have no scientific significance is not surprising.

2. **(G) Science/Data Representation/Comprehension. CCRS: ID 16–19a.** This question asks you to demonstrate that you can read the diagram. If you track the life cycle of the deer tick, you’ll see that the eggs hatch into larvae, and the larvae then feed once on a mouse before they become nymphs. That’s the only food source for the larvae. Without mice, the chain is broken.
3. **(C) Science/Data Representation/Analysis. CCRS: ID 24–27b.** To find the average percent of households inhabited by at least 1 infected person in all five zones, add the percents in the right column and divide by 5:

$$\frac{75 + 62 + 54 + 38 + 36}{5} = \frac{265}{5} = 53$$

The best approximation is the 50% offered by (C).

4. **(F) Science/Data Representation/Application. CCRS: SI 24–27c.** This item asks you to make an assumption about additional data and to predict what that data would show. You are asked to assume that the researchers gathered data about the total number of infected deer tick in each zone. This information is not included in the original table. So you will have to apply what you have learned about the deer tick from the case study presented.

According to the chart showing the life cycle of the tick, the way the tick becomes infected is by feeding on a mouse that is carrying the bacteria. The size of the infected tick population ought to be reflective of the size of the infected mouse population, and the size of the infected mouse population ought to be reflective of the size of the mouse population in general. So you would expect that Zone A would have the largest number of infected ticks.

5. **(D) Science/Data Representation/Comprehension. CCRS: ID 20–23b.** This item asks you to demonstrate that you know how to read a cumulating bar graph. Remember that with a graph of this sort, only the

bottom measure and the total can be read directly from the scale. Other measures stacked above the bottom measure have to be read from the bottom of that part of the bar to its top. Examples:

With rash: July = 10  
 Without rash: July = 4  
 Total: July = 14

So in both March and September, a total of two new cases were reported; in both April and December, no new cases were reported; in both May and October, 8 new cases were reported. But in August, five new cases were reported, and in November only three.

6. **(G) Science/Research Summary/Analysis. CCRS: ID 24–27c.** This question asks you to *interpolate* between data points given in Table 1. The table does not contain data points for 150°F; but it does contain values for 140°F and 160°F, and the values in the table get smaller as the temperature increases. So the values for OFC1 and OFC2 must be between those for 140°F and 160°F. For OFC1, 311 is between 218 and 442, and for OFC2, 203 is between 133 and 301.

**TIP** *Interpolate* simply means to insert between. The word has Latin roots: *polare*, which means to polish, and *inter*, which means between. The main thing to remember is *inter* or between. It’s like *interstate highway* which refers to highways that run between states. You can contrast *interpolate* with *extrapolate* which means to place something outside or beyond, the key part being *extra*. This question asks you to *interpolate* or put a value between two other values in a sequence. You might also be asked to *extrapolate* a value:

If, in Experiment 1, a trial had been done at 230°C, the induction period (in seconds) for OFC1 and OFC2 would probably have been:

	OFC1	OFC2
A.	152	98
B.	90	36
C.	35	12
D.	15	3

The correct answer would be (D). Of course, you don’t know for certain that (D) is scientifically accurate, but you do know that the new values must be less than those for 220°C. That means that (A), (B) and (C) cannot be correct, so by the logic of multiple-choice (process of elimination), (D) must be right.

**TIP** *You do not have to do a lengthy calculation to answer “interpolation” questions. Use the known data points as guides and just think “Which answer choices fits in between?”*

7. **(B) Science/Research Summary/Comprehension. CCRS: ID 16–19a.** Table 2 contains the information you need for this item. The shortest induction time is 3 seconds (right-hand column). As stated in the text under Experiment 1, “Shorter induction periods indicate more rapid decomposition.” So the shortest induction time is also the fastest decomposition. The answer is 3 seconds for FeF<sub>3</sub>.

**TIP** *What is FeF<sub>3</sub>? Iron(III)fluoride. What is Iron(III)fluoride? Who cares? This is what’s so cool about the ACT science test. You really don’t have to know any science to answer the questions. For this item, you need to know that “3” is the smallest number in the right-hand column and that “3” is on the same line as “FeF<sub>3</sub>.”*

8. **(H) Science/Research Summary/Analysis. CCRS: SI 20–23d.** This question obviously is asking for a difference between the two experiments. There seem to be two important differences between the two experiments. Difference 1: The first experiment used one powdered iron compound and tested two OFCs; the second used five powdered iron compounds and tested only one OFC. Difference 2: The first



experiment tested using several different temperatures while the second used only one temperature. (H) points out the second difference.

**TIP** *Even if you can't understand the structure of the experiments you can use multiple-choice logic (process of elimination) to get the right answer.* (F) says that only OFC1 was used in Experiment 1 and only OFC2 in Experiment 2. This statement is wrong. Both were used in Experiment 1, and only OFC1 was used in Experiment 2. (G) states that only OFC2 was used in Experiment 1. This is incorrect. OFC1 was also used in Experiment 1. (J) asserts that the temperature was constant in Experiment 1 and varied in Experiment 2. This is exactly backwards.

9. **(D) Science/Research Summary/Analysis. CCRS: SI 16–19a.** The answer to this question is contained in the brief introduction to Experiment 1. The text states that the initial conditions in the chamber included a pressure of 0.01 atmospheres (atm). The experiment lasted until the pressure reached 0.20 atmospheres (atm).

**TIP** *At first, you might think that this question is asking about the results of Experiment 1 and look for a choice that uses the numbers 6, 29, 998, or 1,800 from Table 1.* But the choices all use 0.01 and 0.20. So the choices would tell you that you are going in the wrong direction. Reread the stem and go back to the passage.

10. **(J) Science/Research Summary/Analysis. CCRS: EM 24–27b.** This question asks whether the data obtained from Experiment 1 support the conclusion that OFC2 breaks down more quickly than OFC1. Table 1 shows the time it took for the breakdown of each OFC to raise the pressure in the chamber from 0.01 atm to 0.20 atm. For each temperature, the time for OFC2 was less than for OFC 1, indicating that OFC2 broke down more quickly than OFC 1 at each temperature tested.

11. **(A) Science/Research Summary/Application. CCRS: ID 16–19c.** The answer to this item is contained in the introduction. The text specifically states that OFCs are made up of C's (carbon), F's (fluorine), and O's (oxygen). Only (A) is a chemical compound made up of only carbon, fluorine, and oxygen.

**TIP** *You do not need to know anything about chemistry to answer this question.* The passage says that an OFC will only have O's, F's, and C's. Only one of the choices meets that requirement. (B) has an H; (C) has a Cl; and (D) has an H. What is H? What is Cl? You don't need to know. All that is important is that those letters do not belong in OFCs.

12. **(H) Science/Conflicting Viewpoints/Comprehension. CCRS: EM 20–23a.** This item asks you to show that you understand the design of the experiment described. Student 2 states that the pollination of *Zania* ovules depends on insects and wind and that the success of pollination is about 50% attributable to each. If mesh bags are used to keep insects out but allow air-borne pollen in, then Student 2 would expect only the 50% of pollination due to wind-borne particles to take place.

13. **(B) Science/Conflicting Viewpoints/Comprehension. CCRS: ID 16–19c.** Student 2 addresses the issue of the shape of the female cones in the first sentence of the second paragraph. There Student 2 makes the point that the shape of the female cones creates air currents to allow the pollen to enter the horizontal openings.

**TIP** *At first, it may not be clear to you what kind of answer the question is looking for, but when you read the choices you see that every one of them talks about "air currents."* In the land of the multiple-choice test, that is a sign that clearly says "This Way to the Answer Choice." Find the phrase "air currents" in the discussion by Student 2, and there you will find your right answer.

14. **(F) Science/Conflicting Viewpoints/Analysis. CCRS: EM 20–23b.** Student 1 says specifically that the pollinators of *Zamia* are insects and wind and that "no other pollination method exists." This is a critical assumption of Student 1's analysis. If *Zamia* were self-pollinating (however that might happen), then Student 1's statement about the 90/10 ratio regarding pollination would be incorrect. And a plastic bag

over the cone would not prevent pollination. But if Student 1 is correct, then a plastic bag that keeps out insects and wind-born pollination should reduce pollination to zero.

- 15. (B) Science/Conflicting Viewpoints/Analysis. CCRS: EM 20–23b.** In the first sentence of the third paragraph of the text provided by Student 1, it is stated that *Zamia* pollen is large and heavy. Thus, it doesn't travel far on the wind. Of course (A) and (C) are wrong, because it is the male cone that produces the pollen. And (D) is directly contradicted by the text.
- 16. (F) Science/Conflicting Viewpoints/Analysis. CCRS: EM 24–27a.** This item asks you to find a point of agreement between the two students. Both students seem to agree that the only two mechanisms of pollination for *Zamia* are insects and wind, though they disagree as to how much each contributes. They would also agree that eliminating one or the other would decrease the percent of pollination, though again they might differ as to how much. Therefore, both would predict that overall pollination would be highest when nothing prevents pollination by both insects and wind. Plastic bags would interfere with both, the mesh bags would interfere with the insects, and the cylinders would interfere with the wind.
- 17. (D) Science/Conflicting Viewpoints/Comprehension. CCRS: SI 24–27b.** This item asks you to identify a possible control group for the experiment. The idea of a control group is fairly intuitive. You need a group of individuals similar to those in the experiment that are not part of the experiment. That way, you can determine whether the results were caused by the experimental conditions or would have just happened anyway. Now, this is a very rough description of “control group,” and experimenters would tighten up the definition considerably. But for purposes of understanding this question, it's all you need. So for a control group, you'll need some female *Zamia* cones that do not get the treatments described in the table. Cones without bags, mesh, or cylinders are ideal, meaning some plain, old ordinary cones that you don't do anything to.
- 18. (J) Science/Conflicting Viewpoints/Analysis. CCRS: EM 24–27e.** This item asks you to specify what results would support the model presented by Student 2. Student 2 agrees with Student 1 that the two pollination mechanisms are insects and wind, though Student 2 insists that the ratio of pollination is 50:50. What would be the effect on this model of each of the outcomes sketched in the choices:
- (F) would undermine Student 2's model because covering the cones with plastic bags should reduce pollination to zero while those not covered should show normal pollination.
- (G) would undermine Student 2's model because Student 2 theorizes that half of the pollination is accomplished by wind. So even with the mesh bags, the pollination should be 50%, but with plastic bags it should be zero.
- (H) would undermine Student 2's model because Student 2 expects the mesh to keep the insects out, reducing the pollination by half.
- The correct answer is (J) because those covered with mesh bags would be 50% pollinated by wind, and those covered with cylinders would be 50% pollinated by insects, thus supporting Student 2's 50:50 hypothesis.
- 19. (B) Science/Research Summary/Analysis. CCRS: EM 24–27b.** The data obtained in Study 1 do support the hypothesis that soils with higher clay content contain more water than those with lower clay content. As Table 1 shows, the higher the clay content, the greater the water content.
- 20. (G) Science/Research Summary/Application. CCRS: ID 24–27c.** This question asks you to interpolate a data value for Table 1. The values 73%, 15%, and 12% for sand, silt, and clay, respectively, fit right in between soil samples A and B. So you would expect the water content to be between 2.9% and 6.8%.

**TIP** *Is there a sound scientific reason for our conclusion?* Not one that is obvious, but then this is the land of multiple-choice, not science. Once you understand that three or four questions on the test require



you to interpolate data, you know that the answer to this question must be (G). It's a matter of arithmetic, not science:  $2.9 < x < 6.8$ .

- 21. (D) Science/Research Summary/Analysis. CCRS: ID 24–27d.** Like the preceding question, the answer to this item depends on arithmetic rather than science. In Study 1, the analysis of the sample of Soil C yielded a water content of 21.3%. After a dried sample has been soaked in water for 24 hours, the water content should be approaching normal. So one would expect it to be at least 15%.
- 22. (H) Science/Research Summary/Analysis. CCRS: ID 20–23b.** This item asks you to do a fairly simple task: compare the numbers in the center column of Table 2: 0.31, 0.30, 0.31. They are pretty much equal.
- 23. (A) Science/Research Summary/Comprehension. CCRS: ID 20–23b.** This item asks you to compare the numbers in the right column to the numbers in the center column of Table 2: 0.22 versus 0.31; 0.21 versus 0.30; and 0.21 versus 0.31. It appears that the numbers in the right hand column are about 2/3 of those in the center column. In other words, they are 1/3 lower.
- TIP** *You might notice the relationship between the two columns just at a glance; but if you do not, let the answer choices be your guide. (A) says that the numbers in the right column are about 2/3 of those in the center column. Check it out. That is correct. (B) says the numbers in the right column are the same as the numbers in the center column, but 0.3 does not equal 0.2, so (B) is wrong. (C) says the numbers in the right column are 1/2 the numbers in the center column, but 1/2 of 0.3 is 0.15, NOT 0.2, so (C) is wrong. (D) says that the right column is twice as high as the center column, but 0.2 is not twice 0.3, so (D) is wrong.*
- TIP** *This problem set might have been made clearer if the test-writers had explained that the sand was added to the wind before it passed over the samples and also that the sand landed on the samples, dislodging particles of soil (abrasive effect) instead of just being blown over the tray in the air. But as it turns out, you can answer all of the questions correctly even without figuring out that little point. However, the experiment makes a lot more sense if you understand that the sand is being blow over the surface of the sample dislodging particles that are then blown against the tape.*
- 24. (H) Science/Research Summary/Application. CCRS: ID 24–27c.** Here we have another item that requires interpolation. The test-writer wants you to reason that the mixture of A and B should yield results that are more or less an average of the results obtained for each individually. Now, the problem set does not say specifically that it is permissible to average the two, but that has to be what is expected given that this is the ACT. Indeed, the answer choices are ranges that do not require a weighted average, but only the insight that 0.22 m/sec and 0.21 m/sec would, if combined in some way, produce a result that is between 0.20 and 0.25. Again, this is more a matter of arithmetic than science:  $0.21 < (0.22 + 0.21)/2 < 0.25$ .
- 25. (B) Science/Research Summary/Analysis. CCRS: ID 24–27d.** You have seen other examples of this type of question already (#1 and #19). This item is a bit more difficult as there are three variables involved. You'll notice that in Table 1 the voltage and capacitance vary inversely, that is, as one gets bigger the other gets smaller. The variation is a result of varying the plate separation. To get more volts, you would increase the separation; to get more capacitance you would decrease the separation. So as the separation increased, voltage increased and capacitance decreased.
- 26. (G) Science/Research Summary/Comprehension. CCRS: SI 20–23b.** In Experiment 2, the student varied the surface area of the plates to determine what effect surface area has on voltage and capacitance. As Table 2 shows, increasing surface area results in a decrease in voltage and increase in capacitance. As for the other choice, the separation, (H), was the subject of testing in Experiment 1. And Experiment 3 tested K, (F), and the different materials, (J).
- 27. (C) Science/Research Summary/Analysis. CCRS: EM 28–32c.** This is a fairly difficult question that asks you to pull together several different strands in the experiments. Experiment 1 shows that the smaller the separation, the greater the capacitance. Experiment 2 shows that increasing the surface area

increases capacitance. And Experiment 3 shows that Titanium dioxide produces the greatest capacitance. So the correct answer to the question (“greatest capacitance”) should be the answer choice with the smallest separation, the largest surface area, and titanium oxide. That is (C).

**TIP** *In a real scientific setting, it would probably be necessary to figure out how much separation would be worth how much area would be worth how much of the kind of material, but this is not the lab.* Notice that the correct answer has the minimum or maximum values that are the best for each of the three variables. For (C), the separation is less than (D), even though it is equal to (A) and (B). The surface area is the largest of the three. And the material is the most suitable, even though (B) also uses that material. (C) beats out the others on one or more of the variables and does no worse than tie on the others. So (C) has to be the winner.

**28. (H) Science/Research Summary/Analysis. CCRS: ID 16–19a.** This item requires you to sort the names of the materials according to their relative positions on the capacitance scale. The numbers in the right column are ordered 119, 1,780, 2,828, which correspond to mica, water, and titanium dioxide. But you are told to assume that the larger the number, the more suitable the material is for use between the plates of a capacitor, so the suitability from most to least is titanium dioxide, water, and mica, (H).

**29. (A) Science/Research Summary/Comprehension. CCRS: SI 24–27a.** This item asks you to explain the working of the experimental apparatus. According to the information provided, closing the switch causes a current to flow from Plate A to Plate B, moving electrons from the one to the other. Initially, the two plates are neutral and in balance, but after the switch is closed and then opened again, Plate B has enough electrons to give it a negative charge:  $-1 \times 10^{-8}$  coulomb. Where did those electrons come from? Plate A. So Plate A has a deficit of the same number of electrons, leaving it with a charge of:  $+1 \times 10^{-8}$  coulomb. One plate is positive, the other negative.

**30. (F) Science/Research Summary/Analysis. CCRS: ID 20–23c.** This item asks you to translate the description of the capacitor into picture form. According to information provided in the last paragraph before the description of the three experiments, closing the switch caused electrons to flow from Plate A through the ammeter, resistor, and battery to Plate B. The arrows in the diagram in (F) go from Plate A to Plate B.

**31. (D) Science/Data Representation/Comprehension. CCRS: ID 24–27a.** This item asks you to combine data from two different line graphs. You will have to check the solubility for both compounds at each of the temperatures given:

	Compound A	Compound B
0°	0.1	0.025
35°	0.3	0.022
55°	0.8	0.019

These are approximations but they are close enough to determine that the correct answer is (D).

**TIP** *You don't really have to look very closely.* The scale for Figure 2 is ten times the scale for Figure 3, so the two compounds won't have the same solubility at any temperature.

**32. (H) Science/Data Representation/Application. CCRS: ID 24–27e.** This item asks you to read information and to apply that information to a new situation. The passage states that a mole of any compound is  $6 \times 10^{23}$  molecules. Let's just say that number is N. If you mix a mole of A with half a mole of B, you'll have N molecules of A and 0.5N molecules of B. You will have twice as many molecules of A as B.

**33. (B) Science/Data Representation/Analysis. CCRS: EM 24–27b.** The question here is whether a compound that dissolves exothermically decreases in solubility as the temperature increases. First, we need an example of compound that dissolves exothermically, and we find that information in Figure 1: Compound



B dissolves exothermically. Now we look at Figure 3 to determine whether Compound B is more or less soluble as temperature increases. As the temperature increases, the solubility decreases. So Compound B is a compound that dissolves exothermically and becomes less soluble as temperature increases. This supports the chemist's statement.

**TIP** Remember to use the process of elimination whenever possible. Once we've determined that Compound B is the exothermic compound, we can eliminate choices (A) and (C).

- 34. (F) Science/Data Representation/Analysis. CCRS: ID 24–27f.** This question asks you to assume that either Compound A or Compound B was dissolved in water with the result that the water temperature decreased. For the water temperature to decrease, energy must be absorbed from the solution, so the chemical had to have dissolved endothermically. So the chemical is Compound A. This eliminates (H) and (J), but we still have to provide a correct explanation. According to the text, when heat is absorbed (endothermic), the change in H is positive.
- 35. (A) Science/Data Representation/Application. CCRS: ID 33–36b.** This question is similar to the preceding one except that it is a bit more complex. A new chemical is introduced: ammonium nitrate. Ammonium nitrate has a  $\Delta H$  that is +25.7 kJ/mole, a positive change in H so like Compound A, ammonium nitrate dissolves endothermically (absorbs energy). That is the first half of our answer, and we eliminate both (C) and (D). Then, ammonium nitrate has a  $\Delta H$  that is less than half that of Compound A, so ammonium nitrate absorbs less energy going into solution than does Compound A.
- 36. (G) Science/Data Representation/Comprehension. CCRS: ID 20–23a.** This item tells you to look at the first graph in Figure 2, the one for a planet with a semimajor axis of  $1.5 \times 10^8$  km. And the speed of a planet with an eccentricity of 0.10 is shown by the solid line. The solid line crosses the “30 km/sec” on the vertical axis twice, once at  $90^\circ$  and again at  $270^\circ$ .
- 37. (C) Science/Data Representation/Analysis. CCRS: ID 24–27d.** Despite the strange measurements, the question is really asking: What happens to the lines from 0 to 180, and then what happens to them from 180 to 360? All of them first decrease and then increase. In other words, the speed decreases up to the aphelion and then increases as the planet rounds back to the perihelion.
- 38. (J) Science/Data Representation/Analysis. CCRS: EM 33–36b.** For this item, you need to look at Figure 2, the first graph. The solid line shows the speed of a planet with an eccentricity of 0.10. The planet reaches its maximum speed of about 33 km/sec at  $0^\circ$  or the perihelion. Since 33 km/sec is less than the 44.2 km/sec escape velocity assumed by the question, this planet is secure in its orbit. It doesn't go fast enough to get loose.
- 39. (A) Science/Data Representation/Analysis. CCRS: ID 33–36b.** This is a very difficult question. The difference between the maximum and minimum speed of a planet (regardless of the length of the major axis of the orbit) varies according to eccentricity: the greater the eccentricity, the greater the difference between the maximum speed (perihelion) and minimum speed (aphelion). If the eccentricity could be eliminated altogether, the difference would be zero. In other words, a planet with an eccentricity of 0 should have a constant speed.
- 40. (F) Science/Data Representation/Analysis. CCRS: ID 28–32c.** This item requires you to extrapolate from the data in the second graph in Figure 2. That is the graph for a planet with an elliptical orbit with a semimajor axis of  $3.0 \times 10^8$  kilometers. You'll note that there is no line on the graph for an eccentricity of 0.05. There are, however, three lines for eccentricities of 0.30, 0.20, and 0.10, and the speeds for those eccentricities at  $0^\circ$  are 28 km/sec, 26 km/sec, and 23 km/sec—approximately. So the speed of a planet with those characteristics at that angle with an even lower eccentricity should be less than 23 km/sec, and that is (F).

**TIP** This is a difficult question, but you answer it mostly using the insight that the smaller the eccentricity the slower the speed at the angle  $0^\circ$ . The only answer choice that is less than 23 km/sec is (F).

The following table lists the descriptions for all the College and Career Readiness Standards that are referenced in this *Navigator Plus*.

## Science – College and Career Readiness Standards

<b>Interpretation of Data</b>	
<b>ID 16-19a</b>	Use a simple presentation of data to identify two or more pieces of data, either numerical or non-numerical.
<b>ID 16-19c</b>	Find information in a body of scientific text.
<b>ID 20-23a</b>	Select data from a complex data presentation.
<b>ID 20-23b</b>	Compare or combine data from a simple data presentation.
<b>ID 20-23c</b>	Create a table, graph, or diagram using provided information.
<b>ID 24-27a</b>	Compare or combine data from a two or more simple data presentations.
<b>ID 24-27b</b>	Compare or combine data from a data presentation that is more complex.
<b>ID 24-27c</b>	Know how to interpolate between data points.
<b>ID 24-27d</b>	Determine direct and inverse relationships of variables in a complex data presentation.
<b>ID 24-27e</b>	Understand how to use a simple mathematical relationship between data.
<b>ID 24-27f</b>	Analyze given information once presented with additional information.
<b>ID 28-32c</b>	Come to a conclusion based upon data points in a table or graph.
<b>ID 33-36b</b>	Analyze given information once presented with additional, complex information.
<b>Scientific Investigation</b>	
<b>SI 16-19a</b>	Understand tools and methods in an experiment.
<b>SI 20-23b</b>	Understand an experimental design.
<b>SI 20-23d</b>	Compare and contrast experiments.
<b>SI 24-27a</b>	Understand tools and methods in a complex experiment.
<b>SI 24-27b</b>	Understand a complex experimental design.
<b>SI 24-27c</b>	Predict the results of an additional step in an experiment.
<b>Evaluation of Models, Inferences, and Experimental Results</b>	
<b>EM 20-23a</b>	Select a hypothesis, prediction, or conclusion supported by a data presentation or a model.
<b>EM 20-23b</b>	Identify key issues or assumptions in a model.
<b>EM 24-27a</b>	Select a hypothesis, prediction, or conclusion supported by two or more data presentations or models.
<b>EM 24-27b</b>	Determine whether information supports or contradicts a hypothesis or conclusion.
<b>EM 24-27e</b>	Determine the effect of new information on a model.
<b>EM 28-32c</b>	Use additional information to make a prediction based on a model.
<b>EM 33-36b</b>	Determine the effect of new information on a complex hypothesis or conclusion and why it has that effect.