Marks Prep's Four Realistic SAT Practice Tests
Answer Explanations for Test 2

Question Types

Reading Question Types

WIC **Words in Context:** These questions ask about the meaning or use of specific words or phrases as they are used in the passage.

COE **Command of Evidence:** These questions are usually in two parts, with the first being a challenging reading comprehension question and the second question providing line numbers to choose from for the best evidence for the correct answer. When these questions are paired, **both** questions are coded as **COE** in the answer keys.

IG **Informational Graphic:** These questions are based on what the test calls "supplemental materials," such as graphs, tables or maps.

RC **Reading Comprehension:** These questions make up the remainder of the test questions, asking about such things as tone, main ideas, or inferences.

Writing Question Types

SEC **Standard English Conventions:** These questions are based on rules for grammar and correct usage, covering topics such as punctuations, pronoun reference, sentence structure and more.

EOI **Expression of Ideas:** These questions are based on the context of the passage, so there are no rules to learn to answer them. They often ask students to do certain compositional tasks, including ordering of sentences or paragraphs, transitioning between ideas, adding or deleting text, and much more.

Math Question Types

HOA **Heart of Algebra:** These questions involve the kind of basic algebraic translation, equation solving, and linear expression found in a first-year Algebra class.

PAM **Passport to Advanced Math:** These questions involve the kind of algebraic form changes and higher level functions found both in a first-year and a second-year Algebra class.

PSD **Problem Solving and Data Analysis:** These questions include manipulating data from graphs and tables, as well as data representation topics such as percent, probability, and statistics.

ATM **Additional Topics in Math:** These questions include geometry and trigonometry topics, plus a few lesser-taught topics such as complex numbers.

Answer Explanations Icons


Indicates that a test-taking strategy can be applied


Warns of a common error to avoid


Alerts to the possibility of using an alternative method

Reading Test

Passage 1

The first passage on every SAT reading section is always a literary passage, which takes a slightly different approach from the more informative and rhetorically oriented passages on the rest of the test. This passage is excerpted from Oscar Wilde's comical ghost story "The Canterville Ghost," and it is essential to read the introduction in order to minimize the disorientation caused by the start of the passage, which begins when the conflict between the family and the ghost has already begun. As you read, it is important to mark the names of characters as they are introduced in order to keep them straight, as the questions ask about different specific characters' ideas and actions. Finally, it is important to get a sense of the tone of the passage as a whole: the family's response to their haunting is patently absurd, and the narrator reports it with a dry wit.

1 **D** COE

We jump into this passage with a COE question immediately, and it is a tough one for almost any reader to get without using the strategy of answering the questions as a pair. Many readers may read the question and not even realize that there was a gift given at all, so you really want to read those line number choices first! Thus, make sure you answer question 2 before you answer question.

2 **C** COE

You want to read through these options to see which tells us why the gift was given. Choice (A) tells us that the Minister was upset that his present was not accepted, which tells us that he gave a gift, but nothing about *why* he gave it. Choices (B) and (D) make no reference to the gift at all and are thus easily ruled out. Choice (C) references the gift he gave—the Rising Sun Lubricator—and that he gave it in the hope that it would silence his chains, which points directly to choice (D) in the previous question.

3 **C** RC

This question can be answered in terms of the tone of the narrator throughout the passage as a whole, but the specific reference given is a particularly clear indication of the kind of voice the narrator uses. When we read the lines referenced, we see that the narrator refers to the Minister's reproach of his children's hurling pillows at the ghost as "impolite" as a "just remark" and then apologizes for having to report that the twins "burst into shouts of laughter" at their father's reproof.

You should write in your own term for this, perhaps something like "mocking" or "ironic," and then match it up with Choice (C).

If you cannot come up with your own term for the narrator's tone, you can also use process of elimination. Choice (A) is then wrong because the narrator is not in the story, which would require a first-person narration from one of the characters in the story itself. Choice (B) is incorrect because he is not "inept," or unskillful, as an observer. Choice (D) may be difficult to rule out because the words are difficult, and the word "apologist" may be tempting due to the narrator's apparent apology, but the narrator is not being sincere, and so this answer does not fit.

4 **D** RC This question, too, is based on the narrator's style throughout the passage, but the specific reference explains that little Virginia "for some unexplained reason" was upset at the sight of a fresh blood-stain every morning. Since any rational person—particularly a small child—would be quite understandably distressed about a blood stain, the term to write in for the tone here is "ironic." This leads to choice (D).

Another way to get this question is to consider that questions 3 and 4 need to "fit" with each other and the passage as a whole, and "subtly ironic" is an appropriate tone for a "wry commentator," while none of the others are good fits with that idea.

5 **B** RC Question 5 is a good example of a question with misleading line numbers: the reference in line 50 is where the key terms are, but the entire paragraph leading up to this sentence is needed to understand how the term is used. The ghost has knocked over a suit of armor and hurt himself, and the Minister is pointing a revolver at him. The instruction that the narrator describes as "Californian etiquette" is to hold up his hands, so this is an ironic use of the term "etiquette." Thus, choices (A), (C), and (D), all of which suggest that the term is meant more or less in earnest, are incorrect, leaving only choice (B).

Another way to get this question is to write in your own idea for the purpose, which would be something like "make fun of the Minister." This makes (B) and (C) seem possible, as both "satirical" and "derisive" fit with making fun, but (C) suggests that he is mocked for being polite, and the minister is not being polite!

6 **C** WIC This is a great example of a WIC question that requires you to go back and re-read the sentence to get correct. No one's first idea of what the word "covered" means is "aimed at," unless you have just read the word in the context of its use in line 48. In the sentence, he "covered" the ghost with his revolver, which refers to the idiomatic use of covered that suggests having a weapon pointed at someone. Seeing this makes choice (C) an easy pick.

7 **A** RC To answer this question, go back and re-read not only the sentence referenced in the question but also the ones before and after it. Once you do this, you can see that the references are there to suggest the powerful effect that the ghost's hauntings have had on people in the past, which is a perfect fit for choice (A). The other choices are tempting only if you do not return to the passage and read it for yourself.

8 **C** WIC This is a very difficult WIC question: it gives a common word used in a way that is archaic and almost certainly unfamiliar to most students. If you know this now obsolete use, you can quickly pick choice (C).

However, even if you are not familiar with the word's use in this sentence, you can use the context and eliminate answers that don't make sense. The ghost hears footsteps approaching, and so he "hesitates in his fell purpose." If we read each of the answers in, we can see that (A) and (D) do not make sense, because they imply that his purpose is already lost. Choice (B) is not impossible, but it doesn't make nearly as much sense as the correct answer, which suggests that he hesitates in his "evil" purpose.

9 **D** COE 

This is the first part of a COE pair, so you should always use the COE paired question strategy: try to answer the second question first and then come back to this one.

10 **B** COE 

Use the paired question strategy and start by using a process of elimination to get this question correct and then go back to get 9. Choices (A), (C) and (D) tell us what the ghost does and what evidence he leaves behind of his actions, but none provide any specific response of the family. Only choice (B) tells us that they were "amused" by the blood-stain and made bets on what color it would be. This matches well with choice (D) in #9, because amusement is a very odd response to a ghost.

Passage 2

This passage is a social science passage that discusses issues of economics, agriculture, public health, and the environment. There is a lot of information here, and so the strategy of circling names, dates, terms and figures is a necessity, both to help keep everything straight as you read and to access needed information to answer questions later. You also want to write down the main purpose of the passage—to show a problem in Uganda and what one entrepreneur is doing to help address that problem. There is also a table with the passage, but remember that you don't really need to pay attention to it until you get to a question about it.

11 **C** RC 

This is a great example of a question with deceptive line numbers. Although it asks about lines 5–12, the clearest articulation of the purpose of these lines comes in lines 18–19, which shows that the story illustrates the kinds of problems Moses wanted to solve with his company, which matches choice (C) perfectly.

You can also get this one correct by thinking about the introductory anecdote in terms of the purpose of the passage as a whole. This story illustrates the kinds of problems that Moses' company tries to address, which nearly corresponds to choice (C).

12 **D** RC 

This is a tone question, and we recommend the following strategy for such questions: use a 5-point system to "score" the tone of the passage, and then find the answer choice that matches your "rating." If the author's tone is very critical and negative, it would be a 1, whereas a passage that is merely informative ranks a 3, and a passage that is very positive—like this one—gets a 5. You can use the even numbers for slightly less strong tones. Once we know that the tone here is a 5, it is easy to choose (D), easily the most positive description of the tone.

13 **A** RC

Answering this question correctly requires a basic understanding of the structure of the passage. If you understand that the first part introduced the problem and the rest of the passage discusses a partial solution to the problem, it is easy to choose (A).

If you are stuck on a question like this, you can use the specific language in each answer choice to "match up" with what you find in the passage at the indicated point. Choice (B) suggests that these lines introduce the problem: not only has the problem already been introduced, but these lines also do not articulate any problem at all. Choice (C) is incorrect, because both social and environmental impacts have already been brought up prior to these lines. Choice (D) is entirely inaccurate—these lines are not about restoring forests, they are about using farm waste. Choice (A), however, is directly supported by the language of the transition, which indicates a change from a past time to what is being done to address a problem four years later.

14 **A** COE

This is an ideal example to illustrate why it is much better to go directly to the line number references in the second of a COE question pair. The entire passage is filled with the problems of burning wood, so we want to let the test lead us to the correct places to look for the answer to this question.

15 **B** COE

Once we know by carefully reading the previous question that we are looking for lines that show a specific problem caused by burning wood, we can read through these line references and find which provides such a problem.

Choice (A) is a very tempting answer, as it starts talking about problems caused by wood-burning, but it only addresses the fact that these problems are widespread—it does not actually give any specific problems. Choices (C) and (D) are easier to eliminate, as both only talk about ways in which Moses and his group are trying to improve things. Choice (B) tells us about the toll on health that wood burning takes, which makes it the correct answer for this question and also clearly points to choice (A) in the previous question.

16 **C** COE

This COE question requires close reading of the lines for the next question—in one form or another, all of these answers come up in the course of the passage, so just go on to the next question and find the lines that answer this exact question about the unsold char left over from Moses' kilns.

Once you choose (C) for question 17, you may still struggle between choices (B) and (C) if you do not understand how percentages are used in the passage. Choice (B) suggests that the farmers double their yield; however, the passage says that they increase harvests by more than 50%. To double yields, they would have to increase by 100%.

17 **C** COE

Once you know what you are looking for—the usefulness of unsold leftover char—this question is quite easy to solve by process of elimination. Choice (A) discusses benefits to families, choice (B) discusses the profits from sold char, and choice (D) gives a quote about how individual employees have benefited from the program. Only choice (C) discusses the unsold leftover char at all, and so is, of course, the correct answer.

18 **A** WIC

This WIC question asks about a common word with a few meanings, so you must read the sentence again to determine how "value" is used in this sentence. First, you should notice that it is a verb, not a noun, and then replace it with your own word. In context, one word you could use instead of "value" is "appreciate," which is an exact match with choice (A).

Choice (B) "enjoy" would make the sentence mean roughly the same thing and it is almost certainly true that people enjoy the opportunity Moses's company offers. However, the best strategy for these questions is not simply to read each choice into the sentence and pick the one that sounds best, but to replace the word with your own term first and then match it. Only resort to putting each of the answers in place of the selected word if you are stuck between two based on your own replacement word or if none of the words are a good fit with your word.

19 **D** WIC

Like #18, this is a WIC question on a common word with several uses. In this sentence, "credit" refers to a financial transaction based on a loan given to be repaid later, which is a perfect match with choice (D).

20 **C** IG This is a fairly straightforward IG question. Proceed by eliminating answers that are untrue or unsupported. Choice (A) is made up of two parts, and inaccuracy in either part is enough to rule it out. The first part is a claim that the author has exaggerated the severity of deforestation, but, even if the second part were true, it would not make this initial claim accurate. Choice (B) is clearly inaccurate based on the table. Choice (D) is impossible to determine based on the table.

Passage 3

This is a science passage that not only presents a lot of information but also has a clear argumentative purpose. In order to handle the first aspect well, you want to be sure to circle all of the names, terms, dates, and numbers given in the passage. In order to understand the rhetorical aspects of the passage, you should do two things: First, you should pay attention to the way the passage develops, underlining key words like "easy to overstate" in line 52 and "the problem arises" in line 65. Second, you should write a good summary—something like "Though genetics has produced advancements in the field of medicine, our understanding of DNA is imperfect and other factors in understanding health must still be attended to." Again, note that there is a table, and be prepared to attend to it when you come to a question that addresses it.

21 **B** RC  This question is an ideal example of a question to write in your own answer for before looking at the answer choices. When you go back to the first paragraph, you will find that it is full of facts about what has happened recently in genetics. Thus, you want to write down "background info," and then choose (B), which is a perfect match.

 Choices (C) and (D) are somewhat tempting if you do not figure this out for yourself at first, as they all are at least partially accurate, so be sure to trust your own reading ability (*and the answer you wrote down*), and not the answer choices on the test.

22 C WIC  This is a WIC question: follow the strategy of going back to the passage, considering what the term means in context, and writing down your own answer before you look at the answer choices. While "cloud" can mean darken, the literal meaning of darken makes no sense in this context, so choice (B) is not a good answer.

 In context, both choices (A) and (D) make good sense of the sentence as a whole with these words swapped in for "cloud." However, "cloud" simply does *not* mean either limit or hamper, and so they are both incorrect.

23 **A** COE  This is a paired COE question, so you want to go on and do the next question first. Onward to #24!

24 **C** COE To get this question correct, you want to read the previous question and look through these lines to see which one provides a specific benefit of genetic research. Choice (C) gives one—the possibility of identifying and being proactive about certain diseases—and this matches choice (A) in #23 perfectly.

25 **B** RC This question requires you to understand the larger structure of the passage as a whole, as the paragraph referenced is the one in which the author shifts from the advances offered by genetic research to the dangers and limitations of such research. If you write this in as your own answer to the question, you will easily recognize Choice (B) is a perfect fit for the idea.

26 **D** RC

Always write in your own answers for all questions about tone. In this case, if you re-read the paragraph in which this idea is mentioned, you will find that the author disagrees with the notion that "DNA is destiny" and warns against accepting the view. Thus, a word like "warning" would be a good answer, and "cautionary" is the best fit.

We can also get this correct by thinking about the main idea of the passage as a whole and eliminating answers that don't fit. Choice (B) is too positive about the idea, and choices (A) and (C) are too negative, as the author is neither disinterested nor cynical.

27 **C** RC

This is another question to use the strategy of writing in your own answer based on the passage before going to the answer choices. The passage uses quotation marks to indicate that the term is a misnomer, as the sentence says it was "previously thought" of in this way but is not seen as "vital." Choice (C) exactly matches this idea.

Choice (A) might seem like a close fit for the idea, but the author of the passage never "mocks" anything in the passage. Remember to read closely and make sure that every word of the answer fits properly with the passage as a whole.

28 **D** COE

This question is very close to the main idea of the passage as a whole, and so you may be able to answer it based on a strong understanding of the passage, which makes clear that choice (D) is correct.

However, the strategy of treating COE questions as a pair makes this question even easier. Thus, you can also just go on to question 29…

29 **D** COE

After reading the previous question, you can read through these four choices and see which offers the author's response to the overemphasis upon genetic factors in dealing with diseases, and Choice (D) offers the clearest answer to the question. These lines also clearly match choice (D) on question 28. Choice (A) is too early in the passage, when the author is still just reporting advances. Choice (B) merely indicates that there is an overemphasis, not a response to it. Choice (C) indicates one of the limitations of genetic research, not a way of limiting the dependence upon it.

30 **B** WIC

In this WIC question, choices (B) and (D) both give more common alternative meanings of "stock," so be sure to go back to the passage to understand its use in line 88. When we re-read the full sentence, we find a familiar word in an odd context, in this case the idiomatic phrase "putting too much stock into," which means depending upon too much or having too much faith in. When we consider the context of this idiom, it is easy to choose (B), which fits well with the word "faith."

31 **D** IG This an IG question, but it is a particularly difficult one, because it requires you to work with both the passage and the table. In order to get it correct, you need to read through the answers and carefully eliminate any that are incorrect. So let's do that, in order:

Choice (A) is tempting, because the table divides up cases between the general population and those with BRCA mutations, but there are two problems: first, the table never gives a total for us to determine percentages from, and second, the passage never suggests that these mutations are solely responsible for causing breast cancer in those who have them.

Choice (B) is probably easier to rule out, because the table gives only percents, no numbers of cases at all.

Choice (C) is also tempting but is incorrect because we do not have the "average" age for any population, only the median, and we don't have a way to calculate the median between the various groups listed in the table.

Choice (D) is correct—the passage tells us in line 85 that only 10% of patients diagnosed with breast cancer have BRCA mutations, and so 90% of cases are from the general population, which has only an 11% risk of breast cancer.

Passage 4

This is a paired history passage that falls into the "great global conversation" category that the SAT is using on each test. These readings are OLD and HARD. Be sure to read the introductions to each passage on the test: they convey essential information, such as the date and author. In this case, many test takers should notice the dates 1790 and 1791 and skip this passage for the time being. For a test taker who is not going for a top score and is not a very strong reader, simply gridding in answers for each question and moving to the next passage saves time and energy and will likely allow the last passage to be finished in its entirety. For a test taker who is going for a top score, skipping this passage will allow you to come back to it and do it last, when you can take all the time you have left and not worry about still needing to finish the (much easier) last passage. This passage is drawn from the opposed political writings of Thomas Paine and Edmund Burke. Both passages are highly rhetorical, using imagery and metaphor to express complex political and historical ideas, further increasing the difficulty of these passages for most readers. Burke writes a lament of the loss of the traditional order that took place in the French Revolution, focusing on Marie Antoinette to illustrate his point. Paine responds directly to Burke in this excerpt, calling attention to the abuses of the system that Burke praises.

32 **A** COE This is the first of a COE pair—remember always to check through all the questions and mark these pairs before you start, because those sneaky test makers will put the first of a pair at the bottom of a page so that you will try it without using the second question. Don't do it! Go on to #33, and you will find this question fairly easy, despite the difficulty of the language in the selection.

33 **B** COE

Once you have read question 32, read through these options to see which gives the author's initial assessment of Marie Antoinette. Choice (A) does not give any assessment, it merely affirms the author's having seen her at a particular time and place. Choice (C) refers to a later time, as he claims that he could not dream of her later troubles upon first seeing her. Choice (D) is back to that initial moment of seeing her, but he references the response he expected from others, not his own assessment of her. Choice (B) is the author's rapturously poetic description of Antoinette, which admires her beauty in claiming that she "decorated" the world around her and her charm in saying that she "cheered" that world as well. Her physical beauty is also suggested in comparing her to a glittering star, and her personality is indicated as "full of life, splendor and joy." This is the correct answer and clearly points to choice (A) in #32.

34 **C** RC

This question asks you to analyze the author's use of the rhetorical scheme of repetition at the opening of clauses (that's anaphora, for those of you who love Greek words). For this type of question, you always want to re-read the referenced sentences and then answer the question in your own words. Here, you might write something like "to show his surprise." This neatly matches choice (C).

35 **C** RC

This is another question to use the strategy of re-reading and writing down an answer for yourself before looking over the answer choices. In looking back at the paragraph in which Burke rhapsodizes about "the age of chivalry," we find that he laments the loss of "generous loyalty," "dignified obedience," and "the spirit of exalted freedom" which were the marks of the age. So, he likes it. A lot. And he's sad that it's gone. Only choice (C) is unabashedly positive about the age itself, and that is the best answer.

36 **C** WIC

This WIC question asks about a word that may be familiar to some, but it is used in a very specific way by the author, so we want to go back to the passage and put our own word into the sentence before looking at the answers.

In the sentence, we find that Burke claims that, in the age of chivalry, "vice" was less evil, because it had no "grossness." Based on what he has said about the age prior to this sentence, its emphasis upon order, gentility, and honor, we can assume that he means that vice was not vulgar in that previous age, which leads us to choice (C).

If you have a hard time with the context on your own, you can try reading the four answer choices into the sentence and see which might be said to make vice seem less evil. Choice (A) should seem very unlikely, as well-washed sinners should hardly be less evil, and choice (B) cannot sensibly be possessed by vice, as it cannot be disgusted in reaction to itself. Choice (D) is likely tougher to rule out, especially if you don't know what "largess" is, so you may have to take a guess between (B) and (D). If you do know what largess is—generosity—this answer is way off, as losing generosity would only make something worse.

37 **A** RC

This question is somewhat atypical, in that it is most readily answered by simply working carefully through the answer choices. A sharp reader may read answer choice (A) and immediately recollect that this analogy is used repeatedly in the passage (the whole of the first paragraph and the last sentence of the selection in particular).

However, if that answer doesn't immediately strike you as correct, you can eliminate the others by simply checking if they are true.

Choice (B) is perhaps the most tempting, as lines 56–59 are certainly a fairly personal attack; however, in order to be prevalent, we should expect to find more than a single instance. Choice (C) is simply inaccurate: if you try to find parallel logical claims or uses of evidence, you will not find them! Choice (D) misunderstands the theatrical references—they are all accusations of Burke, not his own attempt to be theatrical.

38 **A** WIC

This is a WIC question that is just a hard word. If you know the term—perhaps from studying Poe's "Purloined Letter" in an English class—you can readily choose (A), as it is the only meaning of the word.

If you don't know the word, you can still get this question by process of elimination. Reading the choices into the sentence, you will find that choices (A) and (C) are sensible substitutions in the sentence as a whole because both make a negative meaning and could be done by a hand. From there, you can choose one and have a 50/50 chance, or, if you have time to come back to this question at the end and can give it more time, you can choose (A) because being "stolen" from oneself would be more likely to cause "degeneration" than simply being "hidden," which isn't negative enough.

39 **B** RC

This is a main idea question in disguise.
It can be solved by understanding Paine's specific metaphor at this point, but it can also be solved by recognizing how this fits into the overall point that Paine makes, that Burke is more interested in externals of the old system that he sees as glorious than the real suffering of human beings. Only choice (B) gets at this idea. If you understand his metaphor, that a bird's plumage—the visible feathers—are the external aspects of the old system that Burke laments losing, while the bird's death refers to the suffering the system caused, you can readily choose (B) as well, which reflects this idea exactly.

40 **B** RC

If you wrote down a quick sentence comparing these two passages before you started the questions, it should show that these two are directly opposed, with Burke on the royalist/aristocratic side of the French Revolution and Paine on the common people's side. This makes (B) the obvious choice.

Another way to solve this question is to use process of elimination. Because the two do not agree, you can eliminate (C) and (D) immediately. If you waver between (A) and (B), re-read the introductory information: since the passages are from 1790 and 1791, respectively, they cannot be from "very different times."

41 **A** COE

This is the first of a COE pair. You know the drill: go on to the next question, and don't waste time here! This is probably the hardest question in this set, as it asks you to understand a difficult part of the first passage and then connect it to the second passage. Let the test do the work by reading through those choices, and then you will easily be able to choose (A).

42 **B** COE Once you read over question 41, read these excerpts and ask yourself: does Paine talk about the experience of the lower classes (those "in servitude") in these lines? Lines 39–42 criticize Burke's writing style, but does not address any issue of the Revolution itself. Lines 51–52 again criticize Burke's writing as "unkind to nature," but does not address specifics. Lines 59–60 speak of Burke's "hero," which is an aristocrat, not one of those "in servitude." Thus, only choice (B), which discusses the "wretched lives" of those imprisoned in the Bastille, addresses the question, and it is the correct answer. It also clearly points to choice (A) in #41.

Passage 5

This is a science passage that references two books to discuss a biological concept, "flexibility in behavior response." The passage's structure is easy to recognize and you should mark its parts as you read: it opens with wasps as a counter example, then identifies the advantage humans have over such wasps, and then articulates three "complex and interrelated sources" for this biological advantage, each neatly discussed in its own numbered paragraph. Circling terms and names is a very helpful strategy here, as there are a few of both, and the questions ask about specifics in many cases.

43 **C** COE  This question might not be too difficult to answer if you read the whole passage and understood the rhetorical function of this introduction, but you can still use the answer choices to the second part of this COE pair. Choice (C) reflects the structure of the passage—the author uses an example to illustrate a biological concept and then illustrates how humans and certain other species can transcend that tendency.

44 **C** COE Lines 25–27 clearly articulate the relevance of the wasps in the initial example to the passage as a whole, so this is the correct answer. Choice (A) is within the paragraph, but it draws the central conclusion of this paragraph rather than indicating its significance in terms of the passage as a whole. Choice (B) reinforces the idea of determinism that is central to the first paragraph, but still does not situate it within the context of the passage as a whole. Choice (D) is too late in the passage, as it doesn't discuss the wasp example at all.

45 **A** RC Answer this question by using process of elimination. All of the information to answer the question is contained in the first paragraph, so doing so won't take long. When you check the first choice, you will see that each egg is in its own partition, which makes this NOT a part of the cycle.

 Be sure to underline the word NOT in the question. If you go through all the answer choices and mark those you are not sure about, confirm that you have chosen the one that is FALSE when you bubble in your answer choice.

46 **D** WIC This is a WIC question with a fairly difficult word and a few difficult choices.

If you know that steadfast means constant, you can readily pick (D), assuming that you also know that assiduously means the same thing. If your knowledge of these somewhat difficult words is not certain, you can still get this question by reading through the answers and using process of elimination. Choice (A) doesn't make sense—although steadfast can suggest bravery, the wasps are certainly not brave. Choice (B) is a harder word, but you can break it into pieces to get an idea of its meaning. The root word "vocal" means something related to the voice, and "un" means not, and "equi" means equal. So the whole must mean something like "not equally voiced," which is a poor fit here. (By the way, "unequivocal" actually means completely clear, not in any way ambiguous.) Choice (C) may be tempting, because digging to its own death certainly is unfortunate, but the word is a poor match with our original word, which seems to be made up of the words "steady" and "fast," neither of which suggests "unfortunate." Thus, you are left with choice (D), and you can choose it even though you may not have any idea what "assiduously" means.

47 **D** RC This is a question that demands re-reading, and it is a great example of why the strategy of writing down an answer for yourself before reading the answer choices is so important. The direct discussion of these two books is in the second paragraph, so you will want to re-read lines 25–40 and then write down what you find to be the relationship between the two. First, you will see that the author mentions a "common theme" between the two books in lines 26–27. Then, you will see that one of Bonner's aspects of "culture" is "freedom from…'single response behaviors'" in lines 33–34. Then, Gould goes on to discuss Wilson's use of "freedom from genetic programming of specific behaviors" (lines 36–37)—the same concept Gould just mentioned in Bonner—as central to human potential. Thus, we could write something like the following: "Bonner's concept of culture includes the aspect that Wilson's book is all about." That is a perfect match for choice (D).

While (A) and (B) are fairly easy to reject, choice (C) may be tempting. It includes many of the correct concepts, but does not put them into the proper relationship, as neither says that flexibility determines brain size.

This is a fairly difficult question. On questions you are not sure of, always mark the question on the packet and return to it after you complete all the questions for the passage. Often, later questions will help you understand earlier ones better, and you may even re-read a part of the passage on a later question that makes the answer quite clear. In this case, answering question 48, which also refers to both writers, will almost certainly make this question easier.

48 **B** RC If you already answered 47 correctly, this question should be very easy, as it is based on the same paragraph in the passage but asks an easier question.

If you weren't sure about 47, you can use process of elimination to answer this question. Choice (A) says that these are "exclusively" human traits, meaning that they can never be found in any other creature, and the passage directly contradicts this idea, even in the title of Bonner's book. Choice (C) is not supported by the passage—larger brains are an aspect of flexibility, but there is no suggestion that it directly determines either culture or flexibility. Choice (D) is directly contradicted by the passage—the main idea of the passage is an exploration of the biological benefits of culture and flexibility. Thus, choice (B) is correct.

49 **C** COE This is a difficult COE question because it makes you think analogically, which many test takers find challenging.

In order to give yourself the best chance, go on to the next question and read through the line number options to see which gives the best answer to how a larger brain is beneficial, and then it will be much easier to choose which of these options is most analogous to the specific reference given in the passage. Once we know that a larger brain is better because its size allows for more circuitry, we can see that this corresponds best with a larger puppet having more strings to allow for greater movement.

50 **B** COE Use process of elimination here. Choice (A) claims that humans have a proportionally larger brain but doesn't give a specific benefit of our sizable grey matter.

Choice (C) is probably the most tempting wrong answer. It doesn't give a specific benefit to a larger brain; it simply gives an impressive fact about the amount of information the brain holds. Choice (D) is an easier answer to rule out, because it asserts what allowed our brains to become large, not a benefit of that size. Choice (B) is the correct answer, but it is hard because of the specific language used, which doesn't appear to correspond directly to the language of the question. The "material substrate" is the size of the brain itself, and so these lines suggest that the advantage of larger brains is the greater growth in circuitry that comes along with the larger brain.

51 **B** RC

Use process of elimination on any question that asks "which of the following." In order to eliminate answers here, you want to read each and then check the fourth paragraph of the passage, the one in which Gould discusses neotony. We can find support for each of the answers (A), (C), and (D), but choice (B) is not supported by the passage, which says that human brains are slowed by neotony. The passage says in lines 62–63 that the process of maturation is slowed down, not that the brain itself is slower.

If you are running out of time as you get to the end of the test, you can also get this question correct by reading through the choices with the basic idea that neotony=good, and then choose (B), which is negative.

52 **B** WIC

This is a WIC question, and it is best to solve it using our strategy of writing in your own word in place of the word the question asks about. The sentence reads "A bat has committed its forelimbs to flight…" Gould is saying that a bat must use its forelimbs for flight, so a good fill in might be "devoted," which makes (B) an obvious choice.

Writing and Language Test

1 **B** SEC In this question, only the punctuation changes, so you want to recognize that this question tests punctuation. It is probably easiest to start with the semi-colon, because all semi-colons must have a complete sentence both before and after. The part before the semi-colon is not a complete sentence, so we can eliminate (A); however, since we do need a comma, we can also eliminate choice (C). The second punctuation mark determines the right answer between (B) and (D), and the "comma FANBOYS" in (B) is a correct way to combine independent clauses, while (D)'s "semicolon FANBOYS" is, for the purposes of the SAT, always wrong.

2 **B** SEC This is a tricky parallelism question. The original version is incorrect because one cannot compile volunteers. Choice (C) is incorrect because it lacks a coordinating conjunction.

This is a tricky choice to rule out because it looks okay on its own, but if you read through the sentence, you will "hear" the lacking conjunction and realize that it cannot be correct. Choice (D) is incorrect both because it puts an extra comma after "records" and because it commits a parallelism fault by adding the gerund phrase "supervising volunteers" in a list of objective nouns.

3 **A** SEC This is another sentence structure punctuation question. The easiest way to get this is to conduct an independent clause inspection on both sides of the semi-colon—each part could be its own sentence, so it is correct as it is!

4 **A** EOI  For all add/delete questions, first decide about adding or deleting it based on the larger context of the passage. Since this detail is irrelevant, it has to go, meaning that (C) and (D) are wrong. Choice (A) directly articulates this exact reason for deleting the underlined portion, so it is correct.

5 **D** EOI  For ordering questions on the SAT, it is essential to read the entire passage rather than skipping from one question to the next. If you were reading the entire passage, you probably noticed not only that sentence 2 was out of place when you read it but also that it needed to be moved down. This leaves us with only choices (C) and (D).

Choice (C) is not easy to eliminate: if you assume that the tasks listed at the close of sentence 3 are exhausting and repetitive, then the beginning of sentence 2 might seem to fit there. However, those tasks were listed as specifically assigned to the writer, not to "everyone in the office," so the second half does not fit. Further, if sentence 2 is put before sentence 4, that sentence seems to be merely redundant. Thus, choice (D) is the only answer that puts the entire paragraph into a logical and coherent order.

6 **C** SEC This is a subject–verb agreement and verb tense question. The correct answer is (C), which gives the present tense singular form.

Don't be fooled by the fact that the start of the sentence is in past tense—it refers to a specific past action, while the rest of the sentence and the following one use present tense to discuss canvassing in general. Further, the test gives no simple past option, so don't pick past perfect or present perfect (choices (B) and (D), respectively) in an effort to try to put this in the past.

7 **B** EOI Answer the basic question for yourself first: does this fit here, and is it relevant? The answer is yes, so we can eliminate choice (C) and (D) immediately. Once we do so, it is not hard to determine that choice (A) does not provide a sound rationale for the addition, while choice (B) does.

If you are not sure whether this should be added, you can also use process of elimination. We have already rejected (A) as unsuitable, and (C) and (D) are also easy to eliminate. Choice (C) suggests that the information is already implicit in the passage, and this is simply untrue. Choice (D) provides a reason that doesn't make sense—if this clause doesn't add enough detail, how does not adding it solve that problem?

8 **B** SEC This is a misplaced modifier question. According to the original version of the sentence, the voters were canvassing, but the sentence is talking about the writer canvassing, so that is incorrect. Choices (B) and (D) correct this problem, but choice (D) introduces a new problem, because there is no subject for the verb "got." Thus, choice (B) is correct.

9 **A** EOI Remember to underline the key words in the question: you want to pick the answer with the most vivid depiction of the week's experience. Only choice (A) gives specific details about what activities the writer did during this week, and so that is the correct answer.

10 **A** EOI This is a transition word question, so you need to understand the sentence before the underlined word as well as the one that follows it. In this case, the sentence before discusses the low success rate of the calls made, while the sentence after emphasizes that the work was worth doing anyway. Thus, we want a word that suggests contrast, and only "Nonetheless" does so.

11 **C** SEC This is another verb tense question. Because the end of the passage is discussing the way the author felt in the past about something further in the past, we need to use past perfect tense, which places events further in the relative past than other events, here.

If you don't know your tenses that well, don't despair. You can also get this correct by simply reading through the full sentence with each choice in place. You will find that choices (A), (B), and (D) all make it sound like it is happening at the moment, which doesn't make sense in context.

12 **A** SEC This question tests the use of the coordinating conjunction "and." When "and" is used to join two independent clauses (an independent clause is a group of words that could function as an independent sentence), then the SAT requires the use of a comma before the "and." Choice (A) is the only answer choice that uses a comma before "and."

13 **C** SEC This is a tricky question because nothing sounds wrong in the part of the sentence that has been underlined. However, the sentence as a whole has a comma splice problem. A comma splice occurs when two independent clauses are joined by just a comma and no coordinating conjunction. In this sentence, the comma is not underlined, and so there is no error in the comma. So we have to change the underlined part to make it work with the rest of the sentence. Answer choices (A) and (D) create independent clauses after the comma, so they are both incorrect. Answer choice (B) "of whom" is incorrect because "whom" can only be used to refer to a person, not a benefit. Thus the correct answer is (C).

14 **D** EOI This is a vocabulary in context question. Answer choices (A), (B), and (C) are incorrect, because you can't have large "numbers" of power, large "totals" of power, or large "aggregates" of power. The correct answer is "quantities," because it is the only answer choice that is idiomatically correct when used with the adjective large and applied to nuclear power.

15 **C** EOI This is a sentence combining question, often one of the most difficult question types on the writing test.

Use process of elimination to make your choice. Read each choice carefully and remember that you want to choose the answer that most concisely and clearly shows the correct relationship between the ideas. Choices (B) and (D) both contain some repetition, and choice (A) is incorrect because it emphasizes the energy produced rather than the danger of the waste.

16 **B** EOI

For all yes/yes/no/no questions, start by answering the question for yourself. Is this a good addition here? Yes, because it explains the disaster referenced in the preceding sentence. Once you know this, you can cross off (C) and (D), and then choose (B) after reading over the two remaining options, because it fits best with your own answer.

17 **C** EOI

This is a transition word question.
In order to get this question, read the sentence before the underlined word and the sentence that follows it, and then determine the relationship for yourself. In this case, the previous sentence gave a death toll of 4,000, but the following sentence suggests a much higher number. Therefore, we want to choose a word which will emphasize this disparity, which is choice (C).

18 **B** SEC

This is a subject–verb agreement question.
To answer such questions, always find the subject of the underlined verb and make sure that the verb fits with it. The subject here is "book," which is singular, and we say that a "book reveals" rather than a "book reveal." Thus, answer (B) is correct.

19 **A** SEC This is a punctuation question with many punctuation marks in the underlined portion. However, only the first and last punctuation marks are changed in any of the answers, so those are the only ones you need to consider. In the original version of the sentence, a pair of dashes sets apart an interrupting element—a list of types of energy sources—from the rest of the sentence, which is a correct use of dashes, so you want to choose "NO CHANGE."

20 **B** EOI Like question 14, this question asks you to choose the best word based on the context of the sentence.

Just read each choice in the sentence and choose the one that is most natural sounding. Although each word is nearly synonymous, when you read each in the full sentence, you will find that only "supplying" makes sense to convey the idea of meeting the energy needs of the world, so the best answer is choice (B).

21 **C** SEC This question combines two elements of usage: affect vs. effect and a prepositional idiom. Take these two on one at a time. Most people find the second element easier, especially if they are not sure about the difference between affect/effect. To most readers, "of" simply sounds like the correct idiom, and it is. Unfortunately, there is no rule to memorize for idiom questions, because idioms are elements of correct usage in any language that are not dictated by any clear logic or rule, but simply are deemed correct due to accepted use. Once you have ruled out choice (B) and (D), you need to know the difference between "affect," which is usually a verb, and "effect," which is usually a noun. (The relationship is actually more complex than this, but, for the purposes of the test, this distinction should be all you need.) In this case, we want "effect" because the word is preceded by "the," which is a signifier of a noun.

If this rule seems confusing, try to replace the "effects" with "consequences" and "affects" with "alters." In this case, you would say "… be mindful of the consequences of our actions" not "… be mindful of the alters of our actions."

22 **D** EOI This is an informational graphic question, so you want to read through the choices and check each against the graph. Choice (A) is incorrect because petroleum is less than double either coal or natural gas, not double the two combined. Choice (B) is incorrect because the two amounts are equal. Choice (C) is incorrect because it says 1 "million," while the graph is in quadrillions. Choice (D) is correct, which can be determined fairly quickly by seeing that the three largest sources alone are more than 80 quadrillion Btu, so the 8 indicated for nuclear power is necessarily less than 10%.

23 **C** SEC This is another misplaced modifier question, and it is a tricky one, because the original version seems to make sense. However, since the introductory phrase suggests standing in Shakespeare's shadow, not that of his plays, only another person, not that person's work, can stand in Shakespeare's shadow. Only choice (C) makes Marlowe the subject of the sentence, and he is the one who is so cursed as to stand in the shadow of the bard of Avon.

24 **C** EOI Underline the key words in the question, "Marlowe was an influence," and this question becomes quite easy. Choices (A) and (B) merely suggest that both playwrights wrote histories, without any reference to influence, while choice (D) suggests the influence is in the other direction. Only choice (C) suggests that Marlowe influenced Shakespeare, and so that is the right answer.

25 **B** EOI

Holy irrelevant (and annoyingly pedantic) information, Batman! You should know before reading the answer choices that this has got to go, and thus only even look at choices (A) and (B). Since (A) is not true, the right answer is (B).

26 **C** EOI

Each of these choices is grammatically correct, and so you must choose the option that is the most concise and relevant. Choice (A) has repetition of ideas in claiming that the plays are "unstructured," made of "loosely connected" actions, and lack "dramatic unity." That's three ways to say roughly the same thing, which is a trifle excessive. Further, the phrase "seem to exist merely" is needlessly wordy. Choice (B) also offers three similar descriptors and adds and awkward phrase tacked on to the end. Choice (D) sends us off-topic, bringing up later plays that are irrelevant to the paragraph. Choice (C) reduces the total number of words and limits repetition of ideas without losing any essential meaning, and so is the best answer.

27 **A** SEC

This question requires you to decide whether to use singular or plural nouns and pronouns and also to decide about the correct form of the verb. Rather than worrying about both at once, divide and conquer. First, check out the verb form. We want past tense—both "made" and all other verb forms in the sentence are also past—and only choice (A) has it. Thus, the singular/plural question is an irrelevant distraction.

28 **B** SEC

Another grammar-based question that tests two concepts at once, this also requires addressing one error at a time.

Start with the decision between who and whom, and use "he" and "him" in the clause to check which is correct. If "he" is correct, choose "who," and if "him" is correct, choose "whom." Since we would say "he was a weak…" not "him was a weak…" you want to rule out (A) and (C). The comma tests whether the information in the "who" clause is essential—if it is, you don't put a comma before who, but if it is non-essential, you must put a comma before who.

There are two ways to make this decision. The first is logical—you can ask yourself, is this information needed to know who is being talked about, or is it just extra fun facts about him? Since this is just extra info, we want to put a comma there. The second is grammatical—if I read the sentence with this clause dropped out, does it sound like a complete sentence? Since the answer to this is yes, the information is non-essential, and we need a comma. Either way, the answer is (B).

29 **C** SEC This is a third "two-fer" grammar question, testing punctuation and parallelism. However, since the punctuation is easier to differentiate, start by using the differences in punctuation to rule out wrong answers.

Choice (A) puts a colon before the list of things to be combined, and many students have memorized that a colon can be used to introduce a list. However, that use of a colon demands that a grammatically complete independent clause precede the colon, and that is not the case here, so (A) is incorrect. Choice (B) puts a comma before a prepositional phrase, setting it apart from the rest of the sentence. There is no reason to put a comma there, so this answer is wrong.

Remember to ask, "Why would I NEED a comma here?" not "Could I conceive of a world in which someone might put a comma here?" or—even more dangerous—"Do I hear a 'pause' here?" Choice (D) is almost identical to choice (B), except that it adds a word and changes the comma to a dash. Since we didn't need a comma, we certainly don't need a dash either. Choice (C) is the right answer because it doesn't add unnecessary punctuation and it is displays proper parallelism. Notice that, again, you don't actually need to deal with the parallelism issue, because punctuation alone leads you to the right answer.

30 **D** EOI This is a word choice question, in which you must choose the best word for the context. Logically, one cannot be shrouded, drowned, or inundated by a corrupting influence: all of these are suggestive of metaphorical meanings that the text does not support. Thus, choice (D), overcome, is the best answer in this context.

31 **A** SEC This is a difficult question, because it is based on making a logical comparison. The introductory phrase creates a comparison with Edward, who is a character in the play discussed in the passage. Only choice (A) makes a comparison between two characters—Edward and one in a morality play—while all the others compare Edward to a type of play, which is not logical.

32 **A** EOI If you have been reading the whole passage, this question should be fairly simple. When you get to sentence 6, there is nothing jarring or out of place, so it is correct where it is.

Many students will miss this question, because they are sure that any ordering question must require moving the selected element. There is no reason that this must be so: if there is nothing wrong with where it is, it's probably in the right place.

If you are not confident enough to choose (A) without trying out the others, you can put the sentence in each of the other spots and find good reason to reject each: putting it before sentence 1 would be very confusing: there is not yet any context to make this claim, because the author hasn't told us anything about the play yet. Putting the sentence after 3 or 4 would interrupt the ongoing discussion of Marlowe's play in sentences 1–5 with a sentence that brings up Shakespeare, so (C) and (D) are also not good choices.

33 **D** EOI Notice that there is no grammatical difference between the verbs, which means that this is not a verb agreement question. Once you realize that fact, you should recognize that this is a redundancy question and pick choice (D), which avoids repeating information already implicit earlier in the sentence.

34 **B** EOI This question combines redundancy and style. Choice (A) is wrong because it is needlessly wordy and redundant in using more and more unneeded words, while choices (C) and (D) both are stylistically inappropriate. Choice (C) is both horrifyingly opinionated and a bit superciliously pedantic in its choice of expression, while choice (D) sounds like a stupid slang way to say stuff.

35 **A** EOI  Underline the key words of the question—"specific support" and "main idea"—and then choose the one that meets those specifications. The main idea of this paragraph is that the use of GM crops is on the rise, and only choice (A) gives specific, statistical data to support that idea.

36 **C** SEC This is a punctuation question based on sentence structure. Because the sentence is a dependent clause followed by an independent clause, we need only a comma, and choice (C) provides it.

 Some students just try to memorize patterns, and so assume that (D), with its "comma FANBOYS" use, must be correct. Remember to figure out the structure of the whole sentence first, and then make your choice, rather than trying to just look at the answer choices in isolation.

37 **D** EOI This is a transition word question that tests the best way to introduce the new idea of this paragraph relative to the previous paragraph. In this case, the relationship is basically a continuation of the previous paragraph's topic with a specific example, but none of the choices that provide a transition word show this relationship. Thus, you want choice (D), which starts the paragraph without any specific transition word.

38 **B** SEC This is a fairly basic pronoun question. "They" is incorrect because there is no plural antecedent, so we need to choose "He," which refers to the single researcher, Seralini.

39 **C** EOI Remember that sentence combining questions are not about connecting the ideas in a grammatically correct way but about most concisely and clearly expressing the relationship between the ideas of the sentences. Choice (C) is the only choice that does so.

40 **C** SEC This is a tricky question, because it looks like a transition word question, but it isn't.

 First, underline the word "LEAST" in the question, so that you make sure that you are approaching the question correctly, and then double check your underlined word before gridding your answer in, just to make sure that you chose the least acceptable answer. Choice (C) is unacceptable because starting the sentence with "Though" makes this sentence a fragment.

41 **A** SEC This question tests both subject–verb agreement and verb tense. Attack one problem at a time: first, find the subject, which is "size," and then cross off (B) and (D), both of which use "were." "Size were" does not work, and it doesn't sound correct, either.

Don't just look at the noun closest to the verb to determine subject–verb agreement. Remember that any word in a prepositional phrase can never be the subject of a sentence, so you can ignore all the words from "of 200" to "of 10." Now you have to decide on the tense. To determine the correct tense, you must look at the other verbs in the sentence. This sentence says that scientists "pointed out"—past tense—this problem, so you need to make this verb past tense as well, which means that choice (A) is correct.

Don't be distracted by the present tense verb later in the sentence. Although "recommends" is in present tense, it switches to present tense to indicate that the recommendation is still true, whereas the details of this specific experiment are completed in the past, so you need to use past tense for verbs regarding the experiment.

42 **D** EOI This ordering question is fairly easy to get if you pay close attention to the key words in the sentence to add. Because it discusses concerns about the experiment, it must be after sentence 4, which is the first sentence that suggests that there were concerns about it. With choices (C) and (D) remaining, we can confidently choose (D), because the sentence starts by bringing up "Another concern," and so has to be added after the first concern was explained, which takes place in sentence 5.

43 **A** SEC This is an apostrophe question, and the easiest way to get it is to recognize that there is nothing wrong with the original version and choose (A) right away. The sentence calls for singular possession—there is only one Seralini in the passage and it is his experiment, which makes "Seralini's" correct.

However, if you are not so sure, you can use process of elimination to see why each of the other choices does not work. (B) and (C) both use plural possessives, but there is only one Seralini involved in the experiment and only one team, so these do not make sense. Choice (D) is incorrect because the word "teams" needs to be possessive in order to be correct.

44 **B** EOI

Underline the key words in the question: the answer to the question the essay asks is both "uncertain" and "essential to determine." Choices (A) and (C) fail to emphasize the importance of finding the answer, while choice (D) suggests that the answer is clearly that GM foods are unsafe. Thus, choice (B) is correct.

Math Test – No Calculator

Multiple-Choice Questions

1 **B** HOA The expression for total expenses includes two costs that vary from flight to flight, t and g, which express the time flown and fuel consumption, respectively, of a given flight. Neither of those values would be impacted by a rise in fuel costs. The letter C represents a fixed cost related to servicing and storing a plane, which is also not affected by fuel price changes. Only X, a rate which is described to be in dollars per gallon, could be a fuel price. The other rates involved, namely t and g, make no mention of a monetary unit like dollars.

2 **D** ATM Although this question identifies i as the imaginary base number equivalent to $\sqrt{-1}$, you can treat the i like a variable here. You can distribute the 3 and combine like terms, so that $3(4-3i)+2i=12-9i+2i=12-7i$. It's true that when i is squared it calculates to –1, but that doesn't happen in this problem.

In each math section of the SAT, the multiple-choice questions graduate from easy ones to medium ones to hard ones. Though difficulty is somewhat subjective, you can take for granted that a question numbered 2 will be simpler than most. The Imaginary Number System is not a basic concept and is often not taught until the later years of high school, so any question about imaginaries that comes this early in a section should involve only simple calculations on i.

3 **D** PAM The rule for fractional exponents is $x^{\frac{a}{b}}=\sqrt[b]{x^a}$ or $\left(\sqrt[b]{x}\right)^a$. Therefore, $x^{\frac{3}{4}}=\sqrt[4]{x^3}$.

The fractional exponent rule is easily confused with the negative exponent rule because negative exponents give you fractions. Many of the exponent rules feel unnatural or counterintuitive, so take the extra second when applying them on SAT problems.

If you start with the basic premise that anything taken to the power of 1 does not change, then it is easy to see how whole numbers taken to powers greater than 1 increase where those taken to powers less than 1 decrease. Roots, like square roots and cube roots, also tend to make numbers smaller. Armed with these concepts, if you don't know how to apply the exponent rule stated above you can tackle this problem by first recognizing that $x^{\frac{3}{4}}$ should be smaller than x (assuming x is a whole number) but not significantly so. Choice (A) provides two operations that each make x smaller, so you can rationalize that it would decrease the value of x too much. The same can be said for choice (C). Choice (B) has an increasing step that seems to override its decreasing step since the exponent 4 is greater than the root 3. Since plugging in numbers is difficult in a problem like this, particularly since you don't have the use of your calculator, this kind of size estimation can come in handy in a pinch.

4 **C** HOA To find the total dollar amount paid by the group, add the entree sales to the soda sales. The entree sales will equal the number of entrees, d, times the price per entree, \$5.25, which will give $5.25d$. Add this to the soda sales, $1.50p$, and you get $5.25d + 1.5p$.

5 **D** PAM Factoring the trinomial is the most direct way to arrive at the answer, but you don't have to factor blindly. The choices make clear that the answer will be the square of a binomial, so you know that the two factors must be identical. Since the first and last terms of the trinomial are each perfect squares, you can simply look to their square roots to fill the binomials:

$$\begin{aligned} & 4x^4 + 20x^2y + 25y^2 \\ &= (2x^2 + 5y)(2x^2 + 5y) \\ &= (2x^2 + 5y)^2 \end{aligned}$$

Though plugging in numbers is an option here, the numbers might get too large to do so comfortably without a calculator. Backsolving the choices, however, is a decent alternative. Just remember that squaring a binomial requires FOILing (double distributing).

6 **B** HOA There are multiple ways to attack a system of equations. The most obvious method in this question, though not the quickest, is the elimination method (also known as linear combinations), where you multiply one or both equations by a number in order to induce the elimination of one of the two variables by adding or subtracting the equations. An example of that process follows:

$$\begin{aligned} 4(3a-4b=-14) &\Rightarrow 12a-16b=-56 \\ -3(4a-3b=-7) &\Rightarrow \underline{+\ -12a+9b=21} \\ & \quad -7b=-35 \\ & \quad b=5 \end{aligned} \qquad \begin{aligned} & 3a-4b=-14 \\ & 3a-4(5)=-14 \\ & 3a=6 \\ & a=2 \\ & a-b=2-5=-3 \end{aligned}$$

If it occurs to you that a method will call for as many steps as the one shown above, expect that there might be a shortcut. If you find that shortcut, you save time and limit the opportunities to make an error. In systems questions like this one, look for calculations on the equations that get you where you want to go. Notice that this question does not ask you to solve explicitly for a or for b. You need only solve for $a-b$, so it is fair to say that the longer solution above carried some extra steps. If you simply add the two original equations first, you will arrive at a multiple of the expression you're looking for, leaving you one step away from the finish line:

$$\begin{aligned} 3a-4b &= -14 \\ \underline{+\ 4a-3b} &\underline{= -7} \\ 7a-7b &= -21 \\ 7(a-b) &= -21 \\ a-b &= -3 \end{aligned}$$

7 **C** PAM For a quadratic function $f(x) = k(x-a)(x-b)$, where a and b are real numbers, the function will equal to 0 whenever $x=a$ or $x=b$. The graph in this question has $f(x)=0$ at $x=-1$ and $x=3$ since those are the values where the graph crosses through the x-axis. Therefore, $(x-(-1))$ and $(x-3)$ must be factors of $f(x)$. $(x-3)$ is a choice, so that is the correct answer.

8 **C** HOA Plugging in numbers is an excellent option in this question because the numbers given are small enough to allow for reasonable calculations without a calculator. When an equation is involved, the numbers you choose must make the equation true. For example, if you let $p = 8$ and $q = 6$, the proportion is valid. Using those same numbers in the expression gives:

$$\frac{12q}{p} = \frac{12(6)}{8} = \frac{72}{8} = 9$$

It is not prohibitive to do this problem algebraically, but that will involve substitution. First, cross multiply the equation to arrive at $4q = 3p$. Since the expression requires $12q$, just multiply this equation by 3 on both sides to arrive at $12q = 9p$, and substitute for the $12q$ in the expression to get

$$\frac{12q}{p} = \frac{9p}{p} = 9.$$

9 **C** PAM A quick examination of the choices can reveal the correct answer in short order. Since squaring any real number produces a non-negative result, there are no y-values for choices (A) and (B) that can ever be less than -4. Similarly, the absolute value of any real number will always produce a non-negative result, so any y-value from choice (D) will be greater than or equal to a non-negative and thus cannot be less than -4 either. Choice (C), on the other hand, will always have a positive sum within the parentheses because you are adding a positive with a squared number, and this positive sum is then negated by the negative sign on the outside. Therefore, (C) has the only chance of being the correct answer. You can check by plugging in a number for x in choice (C). For example, if $x = 2$ then $y < -8$. This check does not verify that y will always be less than -4, but it does provide a strong enough confirmation.

Questions involving a comparison of equations or inequalities can often be made clearer by sketching graphs. The graph of choice (A) is an up-facing parabola, drawn with a dotted line, with a vertex at $(4, 0)$ and shaded down. Since all of the points on this parabola have non-negative y-values, there will surely be points in the shaded area that are greater than -4. Choice (B) has a similar graph, only the parabola is drawn with a solid line and the vertex is at $(-4, 0)$. Choice (C) graphs as a down-facing parabola (dotted line), with a vertex at $(0, -4)$ and shaded down. This will clearly only encompass y-values less than -4. To make sure, you can also sketch choice (D), a V-shaped graph with a vertex at $(4, 0)$ and shaded up.

10 **D** ATM First mark the diagram to show that angles c and d have equal measures since they are vertical angles. Now, since these angles are equal and the sum of the measures of b and c equals the sum of the measures of f and d, you can conclude that the measures of angles b and f must be equal as well. This verifies statement (I). Once you know that two pairs of equal angles exist in two triangles, then the third pair must also be equal since the sum of the angles of any triangle must always total $180°$. This verifies statement (III) since angles a and e are those two remaining angles. There is no basis to state that (II) is correct, so (D) is the correct choice.

Be careful of figures that are labeled "not drawn to scale." This diagram makes it look as though the segments that are farthest from each other are parallel. If this were true, then angles e and b would have to be equal because they have an alternate interior relationship. Since you cannot assume they are parallel, you cannot make that case.

This problem is also a good candidate for plugging in numbers. If, for example you set $\angle b = 60°$ and $\angle c = 50°$, you can find all of the other angles using rules of triangles, vertical angles and the given equivalent sums. This shows statements (I) and (III) to be correct and statement (II) to be incorrect.

11 **A** HOA With a single point and the slope of a line you can always find the equation of the line. You can use either point-slope form or slope-intercept form. In slope-intercept form, plug 3 and -5 in for x and y, respectively as follows:

$$y = mx + b \Rightarrow -5 = \frac{4}{3}(3) + b$$
$$-5 = 4 + b$$
$$b = -9$$

Since the equation of the line would be $y = \frac{4}{3}x - 9$, it is clear to see that $(0, -9)$ would be a point on that line, because that is the y-intercept.

You can also use the slope formula, $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$, for this problem and plug in each of the choices (backsolving) along with $(3, -5)$ to see which works out to a slope of $\frac{4}{3}$.

12 **A** PAM

This problem can be done quickly if you know some simple but obscure formulas. No matter what type of solutions a quadratic equation of the form $ax^2 + bx + c = 0$ has—rational, irrational or imaginary—you can find the sum of the solutions by calculating $\frac{-b}{a}$ and the product of the solutions using $\frac{c}{a}$. Here you only need the sum, so $\frac{-b}{a} = \frac{-(-2)}{3} = \frac{2}{3}$.

If you don't use the sum and product formulas, you can still find the solutions to any quadratic equation using the quadratic formula (this quadratic is not factorable) and then add them together:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{2 \pm \sqrt{4 - (-48)}}{6} \Rightarrow x = \frac{2 + \sqrt{52}}{6} \text{ or } x = \frac{2 - \sqrt{52}}{6}$$

The sum of those solutions works out to

$$\frac{2 + \sqrt{52} + 2 - \sqrt{52}}{6} = \frac{4}{6} = \frac{2}{3}.$$

13 **B** PAM

First multiply both sides of the equation by $nx - 5$ to eliminate the denominators:

$$(nx - 5) \times \frac{16x^2 + 28x - 19}{nx - 5} = (-4x - 2)(nx - 5) - \frac{29}{nx - 5} \times (nx - 5)$$

$$16x^2 + 28x - 19 = -4nx^2 + 20x - 2nx + 10 - 29$$

$$16x^2 + 28x = -4nx^2 + 20x - 2nx$$

Since the coefficients of x^2 on either side are 16 and $-4n$, you can solve $16 = -4n$ for n and get $n = -4$. This is easily verified by showing that the $28x$ on the left side of the equation can be arrived at by plugging in $n = -4$ on the right to get $20x - 2(-4)x = 28x$.

You can plug in numbers on this problem as well. Though it is often wise to avoid plugging in 1 for a variable on questions where the variable is in the choices, this question has no such restriction and is hard to work out with larger numbers and no calculator assistance. If you plug 1 in for x, you will see the following:

$$\frac{16 + 28 - 19}{n - 5} = -6 - \frac{29}{n - 5}$$

$$\frac{25}{n - 5} + \frac{29}{n - 5} = -6$$

$$\frac{54}{n - 5} = -6$$

$$54 = -6n + 30$$

$$24 = -6n$$

$$-4 = n$$

14 **A** PAM If two exponential expressions in an equation can be rewritten in the same base (without having to use logarithms), the solution to such an exponential equation becomes much simpler. Since 25 can be written as 5^2, and since the powers on the left side can just be multiplied, you can change this equation to $5^{3ab} = 5^2$. Therefore, $3ab = 2$, which means $36ab = 12(2) = 24$.

Plugging in numbers can work here, but you should be very selective and chose a number for one of the variables that will make it easy to solve for the other variable. For example, letting $a = \frac{1}{3}$ makes it fairly clear that b will have to equal 2. Then working out $36ab$ just entails substituting: $36\left(\frac{1}{3}\right)(2) = 24$.

15 **D** HOA Whether the $-\frac{3}{7}$ is distributed or not, it is a coefficient of the variable A, so it can be thought of as a rate of decrease of $\frac{3}{7}$ Jagons for every increase of one Ambloo. Since statement (II) says this exactly, it must be correct. Statement (I) is stipulating a decrease of one Ambloo, which will, as stated, have the opposite affect of increasing the number of Jagons by $\frac{3}{7}$, so statement (I) is also correct. Since a decrease of one Ambloo will increase the number of Jagons by $\frac{3}{7}$, a decrease of $\frac{7}{3}$ Ambloos will increase the number of Jagons by $\left(\frac{7}{3}\right)\left(\frac{3}{7}\right)$, so the increase in Jagons will be one, as statement (III) contends. All three statements are correct.

Student-Produced Response Questions

16 PAM **1** or **3**

This problem tests your ability to distribute, recognize a quadratic, and factor. First, simplify by dividing both sides by x to give the following:

$$x^2(x^2-10)=-9$$

Then, distribute the x^2 through the parentheses on the left side, and bring the -9 over to the left side of the equation:

$$x^4-10x^2+9=0$$

From here, you need to factor and then recognize that the resulting binomials are both in 'difference of perfect squares' form which can then be further factored to give four possible solutions.

$$\begin{aligned} x^4-10x^2+9&=0\\ (x^2-9)(x^2-1)&=0\\ (x+3)(x-3)(x+1)(x-1)&=0\\ x=-3,\ x=3,\ x=-1,&\text{ or } x=1 \end{aligned}$$

Since the problem specifies that x must be greater than zero, only the positive solutions are correct.

17 HOA **8**

Given a system of linear equations, you can either use substitution or linear combination. It's worth noting that in this system, the first two equations can align nicely to cancel out two variables and let you solve for x.

Substitution can work for this problem, but it will take much longer and many more steps, given that there are three variables. It's generally a good idea to check for nice cancellations in the linear combination method first.

Add the first two equations:

$$\begin{aligned} w+x-y&=4\\ +(x-w+y&=6)\\ \hline 2x&=10\\ x&=5 \end{aligned}$$

Then substitute 5 for x in the third equation to arrive at $w=7$. Finally, substitute 5 for x and 7 for w into either of the first two equations to solve for y and you will get 8.

Because the most efficient way to solve this question involves finding both x and w before you arrive at y, there is a danger of stopping too early, especially since there are no answer choices. Make sure you either underline the "ask" of each question before beginning your work to help remind you what you are looking for or reread each question after the work is complete before moving on to the next.

18 HOA $\frac{5}{4}$ or **1.25**

Use common denominators to combine the fractions on each side of the equation, and then simplify both sides.

$$\frac{11}{15}x - \frac{8}{15}x = \frac{2}{12} + \frac{1}{12}$$
$$\frac{3}{15}x = \frac{3}{12}$$
$$\frac{1}{5}x = \frac{1}{4}$$

Then, simply multiply both sides by 5 to solve for x, leaving you with $x = \frac{5}{4}$ or 1.25.

19 HOA **140**

The key to this problem is correctly writing your equations based on the statements given. The statement "each football jersey costs \$40 more than each hockey jersey" can be written algebraically as $F = H + 40$.

The statement "2 hockey jerseys and 4 football jerseys cost \$1,000" can be written as $2H + 4F = 1000$.

With two equations and two variables, either linear combination or substitution will work to solve for H. In this instance, substitution is far easier since you can directly substitute $H + 40$ for F in the second equation. Solving for H yields:

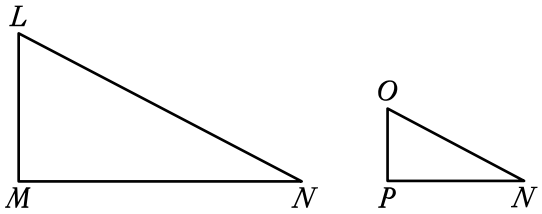
$$2H + 4(H + 40) = 1000$$
$$2H + 4H + 160 = 1000$$
$$6H = 840$$
$$H = 140$$

20 ATM $\frac{3}{5}$ or **.6**

Since the triangles are similar, $\angle L \cong \angle NOP$, so $\cos\angle L = \cos\angle NOP$. The cosine ratio is $\frac{\text{adjacent}}{\text{hypotenuse}}$, so you will need to find the hypotenuse, ON, of ΔNOP. Using the Pythagorean Theorem, you get $ON = \sqrt{a^2 + b^2} = \sqrt{6^2 + 8^2} = 10$. Thus, $\cos\angle L = \cos\angle NOP = \frac{6}{10} = \frac{3}{5}$.

First, make sure to label the segment lengths given. To find the $\cos\angle L$, you'll need the adjacent side LM, which is given, and the hypotenuse LN. The triangles are similar, so, after finding $ON = 10$ using the Pythagorean Theorem as above, you can set up a proportion to find LN.

Sometimes it is helpful to redraw and label the two triangles separately, which can make it easier to see the relationships between sides and set up the correct proportions.



$$\frac{OP}{LM} = \frac{ON}{LN} \quad \Rightarrow \quad \frac{6}{9} = \frac{10}{x}$$

Cross multiply and solve for x to get $LN = 15$. Now you have both the adjacent side and the hypotenuse for the larger triangle, so $\cos\angle L = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{LM}{LN} = \frac{9}{15} = \frac{3}{5}$.

Math Test – Calculator

Multiple-Choice Questions

1 **B** PSD Three of the most important points on this graph are the three turning points, also known as relative extrema (or maxima and minima). The first of these, at around 4 minutes, is a relative maximum. It shows Brian changing direction from moving away from his home to moving toward his home. The third turning point, at around 16 minutes, does the same. But the second turning point, a minimum at around 9 minutes, shows a change from moving toward his home to moving away again, and that is what you are looking for.

2 **D** HOA Use the equation $p = mv$ to find the object's mass based on the known momentum and velocity:

$$4 = m(12)$$

$$\frac{1}{3} = m$$

Then use this mass to determine the momentum when the velocity is 27 m/s:

$$p = \left(\frac{1}{3}\right)(27) = 9$$

3 **C** HOA The ratio "two out of every 45 people" can be put into the proportion $\frac{2}{45} = \frac{x}{675}$, where the top numbers represent how many people receive the prize out of the numbers of people represented by each bottom number. This equation can then be cross-multiplied to get $45x = 1350$ or $x = 30$.

Since this section allows the calculator, you can easily backsolve this problem. First divide $2 / 45$ to get $0.0\overline{4}$. Then divide each of the choices by 675. Only $30 / 675$ gives you the same decimal. This is a great example of how alternative methods for doing or checking problems are enhanced when you have the use of your calculator.

4 **A** PSD Probabilities can be thought of as the ratio $\frac{\text{desired outcomes}}{\text{total outcomes}}$.

In this case, the desired outcomes include club members who like both sugar and cream in their coffee (4) and those who like neither sugar nor cream (1). Since there is no overlap between these two groups you can simply add the 4 and the 1 to get 5 desired outcomes out of the 27 total outcomes.

5 **A** HOA The given velocity of 13 m/s can be plugged into the equation for v_f, giving you the equation $13 = 6 + 2t$. Solving for t yields 3.5 seconds.

Though backsolving is a fine way to do this problem, it doesn't simplify the work in any way. Still, after getting 3.5, you can plug it back into the equation for t. This should result in a v_f value of 13. Such checking is quick and guarantees that you won't miss a problem because of an unseen calculation error.

6 **C** PSD Since there is no overlap between club and premium members, you can add the two percentages to find that approximately 20% of shoppers are either one or the other, and thus 20% of the 730 purchases could reasonably have been made by club or premium members. When you have the use of your calculator, the simplest way to arrive at 20% of 730 is to multiply (0.20)(730) to get 146.

7 **C** PAM Since this problem involves the subtraction of polynomials, the most dangerous step is in the distribution of the subtraction sign to each of the terms in the second polynomial. Take the time to write out each step.

$$\begin{aligned} R - S &= (5x^2 - 13x + 2) - (-2x^2 + 2x + 7) \\ &= 5x^2 - 13x + 2 + 2x^2 - 2x - 7 \\ &= 7x^2 - 15x - 5 \end{aligned}$$

This problem can be done by plugging in numbers, but that might not be ideal because of the amount of steps involved. Still, you can plug in numbers to check your answer. Using 2 for x yields

$$(5(2)^2 - 13(2) + 2) - (-2(2)^2 + 2(2) + 7) = (-4) - (3) = -7.$$

It is best to rely on the calculator to do this work, as long as you plug the 2 into its own set of parentheses every time to avoid PEMDAS errors. Then, if you are checking choice (C), just plug 2 in to get $7(2)^2 - 15(2) - 5 = -7$ to see that your answer is correct.

8 **B** HOA When a formula is modeled by a linear equation like this, the coefficient, $-3{,}046$, is the rate at which y changes every time x increases by 1. Since the question is only asking you for the significance of 3,046, you must indicate that the rate is a decrease in value to account for the negative sign. Also, (B) is the only choice that describes a rate.

9 **B** PAM A composition of functions like this requires that you apply the inside function first and then plug the result into the outside function. Since $C(53) = 44$, you must plug 44 into the R function. $R(44) = 31$, so $R(C(53)) = 31$.

10 **D** PSD Though you could use unit conversion methods like dimensional analysis to work this problem out, the given information states a formula that will cut down on steps, $C = \frac{mg}{f}$. For the Kia Soul Hybrid, $f = 105$, so $C = \frac{(305)(\$2.50)}{105} \approx \$7.26$.

Though you should always do the busywork to be certain, a quick examination of the choices and a little common sense can lead you in the right direction too. Choices (A), (B), and (C) all indicate costs that are from less than 2 gallons of gas, and even though the Kia Soul Hybrid has the best fuel economy of all the cars listed, it is still unreasonable to expect a 300-plus mile long trip to use under 2 gallons of gas or cost under $5.00. This kind of numerical estimation and common-sense evaluation can be more useful on the non-calculator section or on a problem where you are running out of time, but they shouldn't be dismissed as at least valuable ways to double check your work on any problem.

11 **B** PSD This question mentions gas price fluctuations to remind you that you cannot assume a certain price per gallon, like, for example, the $2.50 per gallon from #10. Still, since you are asked to calculate the cost for a Ford Mustang making the same drive with the same gas price as the Ford Fusion, it really doesn't matter whether you know the gas price or the length of Route 48. Just plug the cost for the Fusion, along with its fuel economy number, into the formula: $12.97 = \frac{mg}{47}$, so $mg = 609.59$. Then use that value for mg in the formula for the cost of driving the Mustang: $C = \frac{mg}{f} = \frac{609.59}{26} \approx 23.45$.

12 **D** HOA A close examination of this equation reveals that whatever comes out of the absolute value signs must add with 1 to make 0. The only number that adds with 1 to make 0 is -1. Since absolute value signs make everything non-negative, no value will work.

You can also backsolve the answer choices. On a TI-84 calculator, press the MATH button, hit the right arrow to get to the "number" tab, and then press ENTER. You should now see absolute value signs that you can use to reconstruct the left side of the equation, using the values from the answer choices substituted in for x. You should find that none of the numbers work, and therefore only option (D) remains.

If you ever forget how to get to a particular function, like absolute value, on the calculator, remember that there is an alphabetized catalog of all the calculator's functions that can be accessed by hitting 2ND + CATALOG (0).

13 **C** PAM If you feel the least bit shaky about your algebraic fraction skills, then this problem is best approached by plugging in numbers. Since there is more going on in the left side, you should assign easy numbers to d_i and d_o such as $d_i = 2$ and $d_o = 3$. The equation $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$ becomes $\frac{1}{3} + \frac{1}{2} = \frac{1}{f}$, and using your calculator you can find $0.8\overline{3} = \frac{5}{6} = \frac{1}{f}$ which yields $f = 1.2$. From there, plug your values of $d_o = 3$ and $1.2 = f$ into the answer choices until you get our answer of $d_i = 2$. This happens with choice (C) because $\frac{f\,d_o}{d_o - f} = \frac{1.2(3)}{3 - 1.2} = \frac{3.6}{1.8} = 2$.

The most dynamic algebraic way to do this problem is to multiply the entire equation through by the least common denominator of all three fractions, $d_o d_i f$. That will give you $d_i f + d_o f = d_o d_i$. To solve for d_i bring the terms that have d_i in them to one side and factor d_i out so it can be isolated:

$$d_o f = d_o d_i - d_i f$$
$$d_o f = d_i (d_o - f)$$
$$\frac{d_o f}{d_o - f} = d_i$$

14 **D** PSD Though you can backsolve this problem by determining the percentage that the number represented by each choice comes out to when taken out of the 300 total students, it is even simpler to just take 26% of 300 by typing (.26)(300) on your calculator. That will result in the number 78, which is the number of males who prefer peanut butter and jelly.

15 **A** PSD At a rate of 280 eggs per year, m months yields the following unit conversion:

$$\frac{m \text{ months}}{1} \times \frac{1 \text{ year}}{12 \text{ months}} \times \frac{280 \text{ eggs}}{1 \text{ year}} \times \frac{1 \text{ dozen}}{12 \text{ eggs}} = \frac{280m}{(12)(12)}$$

Performing unit conversions on rates can be tricky for some test takers, so you may want to try plugging in a number for m to tease out n. For example, say the number of months, m, is 1. You can find the number of dozens of eggs, n, the chicken lays in that 1 month, by calculating

$$\frac{280}{12} = 23.\overline{3}, \text{ and } \frac{23.\overline{3}}{12} \approx 1.94 \text{ dozen.}$$

This means that you are looking for a number close to two when you plug $m = 1$ into the choices. Only choice (A) comes close.

16 **B** PSD

When you encounter a large table like this on the SAT, make sure to take the time to carefully examine all table headings and descriptions. Otherwise, it can be very easy to get confused by mismatched units. For example, there are numbers in the millions and hundreds of thousands in the table and numbers in the hundreds of millions offered in the answer choices. The values in the table are actually in thousands of dollars, so you can add three zeros to the end of each one. The question is asking how much the values for Education (second column) changed on average from Fiscal Year 13 to Fiscal Year 16. The easiest way to do this is to find out how much the total change was and then divide that value by the three years over which the change occurred:

$$\frac{\$7,718,943,000 - \$6,933,564,000}{3} \approx \$261,793,000$$

This number is closest to choice (B).

17 **B** PSD

This problem asks for the answer choice that is closest to the following ratio:

$$\frac{\text{Human Services FY15}}{\text{Human Services FY14}} = \frac{3,956,955}{3,696,711} \approx 1.07$$

Note that it's okay both to drop the last three zeros for the data points (as long as you do it for both numbers in the ratio) and to round the answer, since you are just looking for the choice that comes closest. From there, work out the ratio of each of the answer choices to see which ratio is closest to 1.07.

Choice (B) yields $\frac{211,233}{197,421} \approx 1.07$.

18 **D** PAM

To understand this question, it's important to know that $f(x)$ represents the *y*-values for the curved graph and $g(x)$ represents the *y*-values for the line graph. So the question is essentially asking you to find how many *x*-values yield the result that the sum of these *y*-values equals twice the *y*-value for the curve. Another way of putting that is to say that $f(x) = g(x)$.

You can also reach this conclusion by doing a little algebra, subtracting $f(x)$ from both sides of the given equation:

$$\begin{array}{r} f(x) + g(x) = 2f(x) \\ \underline{-f(x) \qquad\quad -f(x)} \\ g(x) = f(x) \end{array}$$

These *y*-values will be equal when the graphs intersect. There are three such points.

19 **C** PSD Probability questions often require you to find a desired outcome and place it in a ratio over total possible outcomes for a given circumstance. In this question, you should only consider shoppers who spent under a $100 (the middle column of the table), and you are asked for the probability that one of these shoppers made their purchases at the mall. So your ratio should look like this:

$$\frac{\text{People who shopped at the mall and spent under \$100}}{\text{All people who spent under \$100}} = \frac{36}{19+36} = \frac{36}{55}$$

Make sure to use only the 36 mall shoppers who spent under $100 and not include the 39 shoppers who spent over $100.

20 **A** HOA Since the question is asking about Jasmine's profit, be careful to examine the correct equation, $J(n) = 4n - 30$. Remember that the constant term -30 represents her initial profit before she sells any orange juice, and the coefficient 4 reflects the rate at which the profit increases for each cup of orange juice sold. The question asks for the number that describes how Jasmine's profit changes with number of cups sold, so 4 is correct.

21 **A** HOA There are many ways to approach this problem, but the quickest way may be to graph the functions for Perry's and Jasmine's profits in your graphing calculator to see where each has a higher profit. In the Y= window, enter $4x - 30$ into $Y_1=$ and $(5/2)x - 12$ into $Y_2=$, hit the WINDOW button to adjust your Xmax to 32 and your Ymax to a number large enough to see where the lines cross, and then hit GRAPH. You can hit the TRACE button to move your cursor along the graphs. Read the coordinates along the bottom of the screen to determine which function starts with a higher value, and an approximation of where they cross. You should notice that Y_2=(5/2)X - 12 (Perry) initially has a higher profit, but after $x = 12$, Y_1=4X - 30 (Jasmine) has a higher profit. Though it is not necessary for this problem, you can use the "calculate" feature to find the exact value of the graphs' intersection.

This problem can be approached algebraically as well. If you set Perry's and Jasmine's functions equal to each other, you can solve for the number of cups they would each have to sell for their profit to be the same:

$$\frac{5}{2}n - 12 = 4n - 30$$
$$-12 = \frac{3}{2}n - 30$$
$$18 = \frac{3}{2}n$$
$$12 = n$$

Since their profits are equal when each sell 12 cups, you can limit your choices to (A) and (B). Then recognize that early on, for example when neither has sold any cups so Perry's profit equals -12 and Jasmine's profit equals -30, Perry has greater profits than Jasmine. Therefore (A) is the only correct choice.

22 **B** ATM In order to be an endpoint of the diameter of a circle, a point must be on that circle, and thus make the equation work out, so you can backsolve this problem by plugging the points into each choice. The point $(-2, 6)$ works in choice (B) because $((-2)-2)^2+(6-3)^2=(-4)^2+(3)^2=16+9=25,$ but you must be careful because $(-2, 6)$ also works in choice (D) since $((-2)-6)^2+6^2=64+36=100.$ However, if you try $(6, 0)$ in both of these choices, you'll see that it only works in choice (B).

While this problem may have been good for backsolving, other circle problems may not be. Make sure you remember the equation for a circle is $(x-h)^2+(y-k)^2=r^2$ where (h, k) is the center point of the circle and r represents its radius. You can determine the length of the diameter by using the distance formula with the two given points:

$$d^2=(x_2-x_1)^2+(y_2-y_1)^2$$
$$d^2=(6-(-2))^2+(0-6)^2$$
$$d^2=100$$
$$d=10$$

If 10 is the diameter, then the radius is 5, and only choice (B) has the correct value for $r^2=25.$ Alternatively, you could have focused on finding the center of the circle, which will be at the midpoint of the diameter, but since there are two choices with the same center point you would still have to figure out the radius to distinguish between them.

23 **C** PAM To understand this question, it's important to know that $g(0)$ represents the y-value when $x=0.$ By looking at the graph, you can see that this y-value is 3. In other words, $g(0)=3.$ The question is asking for options that have a y-value of 3, which include option I as shown, option II since $g(3)=3,$ and option III since $g\left(\frac{11}{2}\right)=g(5.5)=3.$

24 **B** PAM You can put this function into the graphing calculator alongside the function $y = 2$ (since David's friend will catch the stone at a height of 2 meters) and then ask the calculator to find the intersection between the resulting line and parabola. There will, of course, be one intersection when $x = 0$ —this is when David originally throws the stone. The other occurs at 2.857, which rounds to 2.9.

On a TI-84 calculator you can use 2ND + CALC TRACE → `intersect` to find this.

If you try to backsolve this problem, it may look as though none of the answers work. When the correct answer, 2.857, is rounded to the nearest tenth, you most certainly get 2.9, but if you were to plug in 2.9 for t, the resulting value of h will be 1.391. That is still closer to 2 than any of the other choices, but it makes it look as if you've done something wrong.

This problem can also be solved using algebra. You can plug in 2 for h and solve for t as follows:

$$2 = -4.9t^2 + 14t + 2$$
$$0 = -4.9t^2 + 14t$$
$$0 = -t(4.9t - 14)$$

Then isolate the binomial to find the solution that doesn't represent David's initial throw at $t = 0$:

$$4.9t - 14 = 0$$
$$4.9t = 14$$
$$t = \frac{14}{4.9} \approx 2.9$$

25 **C** HOA 

A good way to understand a subtraction sign inside of an absolute value is to translate it as follows: $|a - b| < 4$ means the distance between a and b on a number line is less than 4. Another way to express the exact same idea is $-4 < a - b < 4$.

For this question, you need an expression that shows the difference in hours between Jane's predicted time x and her actual time y as being less than 0.25 hours (15 minutes converted into hours). Choices (A) and (B) do not work because they essentially say that the difference between x and y is equal to and less than 15 hours, respectively. Choice (D) tries to describe the difference between x and y as being less than 2.75 hours, which means the discrepancy between her prediction and the actual amount of time it takes her to finish her homework could be large, like two and a half hours. Only choice (C) properly limits the difference to something less than 0.25 hours.

26 **C** PSD This experiment's design suffers from a selection bias. Participants in a study should not know whether they are part of a control or experimental group. Allowing them to decide whether they receive the generic or name-brand medicine might influence how effective they perceive the medication to be and skew the results of the study.

27 **C** PSD In order to solve this problem in an accurate and time-efficient manner, it is very important to be organized with your calculations. Using the table to arrange the information is highly recommended. You can represent the *Space Battles* regular tickets with the variable x, which means the 3D tickets sold for that movie should be $2x$. Similarly, you can call the *Servitors* 3D tickets sold y and its regular tickets sold $1.25y$ (25% more than a value equals 1.25 times it). In each cell, multiply the amount of tickets sold by the price per ticket:

	Regular Sales ($)	3D Sales ($)	Total Sales ($)
Space Battles	$(10)(x)$	$(14)(2x)$	3040
Servitors	$(10)(1.25y)$	$(14)(y)$	1272

For each movie you can add Regular Sales to 3D Sales to get Total Sales, so

$$10x+14(2x)=3040 \qquad 10(1.25y)+14y=1272$$
$$38x=3040 \qquad 26.5y=1272$$
$$x=80 \qquad y=48$$

Now plug these variables back into the third column of the table to determine the 3D sales for both movies: $14(2(80))+14(48)=2912$. So the percent of 3D movie sales is

$$\frac{\text{3D Sales}}{\text{Total Sales}}=\frac{2912}{3040+1272}\approx .6753\approx 68\%.$$

28 **A** PSD You can backsolve this problem, but the algebraic way is also handy. Since you are looking for how the number of miles *changed* from one day to the next, you can use the percent change formula, $\text{New}=\text{Old}(1\pm\%\text{change})$. Plug in the percent as a decimal and 428 miles as your *New* value:

$$428=\text{Old}(1+.35)$$
$$\text{Old}=\frac{428}{1.35}\approx 317$$

29 **A** ATM One way to think about this problem is to envision the volume of the ring as the volume of a wide, flat cylinder with a smaller cylinder cut out of the middle of it. The larger cylinder would have a diameter of 24mm (obtained from the figure: 20mm + 2mm +2mm). This would make its radius 12mm, so you can calculate its volume:

$$V=\pi r^2h=\pi(12)^2(6)=864\pi.$$

The smaller cylinder is the empty region in the middle of the ring that has a diameter of 20mm, a radius of 10mm, and a volume of $V=\pi(10)^2(6)=600\pi$.

So the volume of the hollowed out cylinder comes out to $864\pi-600\pi=264\pi\approx 830\text{mm}^3$. Since you are looking for the choice that comes *closest* to the volume of gold used to make the ring, there is no need to worry about the curved edges. All other choices are significantly larger than choice (A), and technically the curved edges would make the volume of gold a little smaller.

30 **C** HOA Perhaps the quickest way to attack this problem is to use your graphing calculator. Backsolve each of the choices by plugging them in for the slope, m, in $y = mx$ using the Y= feature. Then go to the table by hitting 2ND + GRAPH (TABLE) and check so see if the y-value when $x = 27$ is the same as the x-value when $y = 48$. Choice (C) yields the points $(27, 36)$ and $(36, 48)$.

You can also plug the points $(27, k)$ and $(k, 48)$ into the equation $y = mx$ to get the equations $k = 27m$ and $48 = km$. If you now substitute by plugging $27m$ in for k in the second equation, you get the following:

$$48 = (27m)(m) = 27m^2$$
$$m^2 = \frac{48}{27} = \frac{16}{9}$$
$$m = \sqrt{\frac{16}{9}} = \frac{4}{3}$$

Student-Produced Response Questions

31 PSD **2.5** or $\frac{5}{2}$

Since the question asks about the median, it's a good idea to re-write the data set in order. Because there is an even number of numbers in the set, the median is the average of the two middle numbers:

35, 36, 36, **37, 40**, 44, 46, 83

$$\text{median} = \frac{37 + 40}{2} = 38.5.$$

The mode is the number which appears most often in a data set, which in this case is 36. Therefore the difference between the median and mode is $38.5 - 36 = 2.5$.

32 HOA **200**

This problem requires careful reading to avoid getting mixed up by the given information. The easiest way to get to the answer is to recognize that since the player lost 3 points for every chip remaining and had 50 chips left, the player must have lost a total of 150 points to arrive at the final score. Since the player ended with 50 points, he must have started with 200.

You can also create an equation based on the information given about the game, showing that the player started with a certain amount of points (P), the player lost 3 points for every chip he had at the end of the game (c), and that the player ended up with 50 points:

$$P - 3c = 50$$

Substituting 50 for c, since we're told the player had 50 chips remaining, gives an equation that can be solved for *P*.

$$\begin{aligned} P - 3(50) &= 50 \\ P - 150 &= 50 \\ P &= 200 \end{aligned}$$

33 PAM **5**

First distribute and combine like terms, and then organize the terms in the form $ax^2 + bx + c$ as shown:

$$\begin{aligned} &-x(2x+1) + x(7+x) = \\ &-2x^2 - x + 7x + x^2 = \\ &-x^2 + 6x \end{aligned}$$

Then, since a is the coefficient on the x^2 term and b is the coefficient on the x term, you know that $a = -1$ and $b = 6$, so $a + b = 5$.

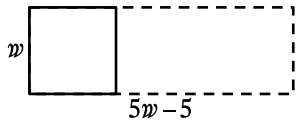
34 PSD **6.48**

Understanding how the data is represented in the histogram is key to solving this problem. The *x*-axis represents numbers of hours of sleep, and the *y*-axis represents how many students got a certain number of hours of sleep. So, the first bar shows that 2 students got 4 hours of sleep, the second bar shows that 3 students got 5 hours of sleep, and so on. To find the average (arithmetic mean) number of hours slept, you'll want to add up the total number of hours slept and divide by the total number of students. You can write out each data point to do this, but it is simpler to multiply each number of students by the corresponding number of hours:

$$\text{Average} = \frac{\text{Sum}}{\text{Number of Students}} = \frac{2(4) + 3(5) + 8(6) + 6(7) + 5(8) + 1(9)}{2 + 3 + 8 + 6 + 5 + 1} = \frac{162}{25} = 6.48$$

35 ATM **15**

It's important to understand in this problem that the original square patio is only being extended in one direction, so what is referred to as the width of the new rectangular patio will be the original side length of the square. The new length is "5 feet shorter than 5 times the width," which can be written $L = 5w - 5$. Drawing a picture for this problem is immensely helpful:



Since you're given that the area of the rectangular patio will be $1050\ \text{ft}^2$, and the area of a rectangle is simply its length times its width, you can create the equation $w(5w - 5) = 1050$. This is a quadratic equation, $5w^2 - 5w - 1050 = 0$, which you can solve in multiple ways (factoring, graphing, the quadratic formula). Since you are allowed the calculator on this section, it is most efficient to graph $y = 5x^2 - 5x - 1050$ and find the x-intercepts either by analyzing the table or using 2ND + CALC TRACE → `zero`. You'll see that both -14 and 15 are correct algebraic answers, and since you can't have a negative distance, the width must be 15. The width of the rectangle is also the side length of the original square patio, and therefore 15 is the answer.

If you don't recognize the opportunity to use the graphing element of the calculator to solve the quadratic equation above, one algebraic option is to factor:

$$5w^2 - 5w - 1050 = 0$$
$$5(w^2 - w - 210) = 0$$
$$5(w - 15)(w + 14) = 0$$
$$w = 15 \text{ or } \cancel{w = -14}$$

36 PSD **650**

You are given that the average price per guitar needs to be \$500. Ignacio has already sold 14 guitars and has 6 more to sell for a total of 20 guitars. The total amount of money brought in from all guitars sold will be $11(425)+3(475)+6(x)$, where x represents the average price of the 6 remaining guitars to be sold. The formula for average yields:

$$\text{Average Price} = \frac{\text{Sum of Prices}}{\text{Number of Guitars}} = \frac{11(425)+3(475)+6x}{20} = 500$$

$$6100+6x = 10{,}000$$

$$6x = 3900$$

$$x = 650$$

37 PAM **8**

Since the units don't match up, first convert the 2 million calculations per second into a number of calculations per minute:

$$\frac{2\times10^6 \text{ calculations}}{1 \text{ second}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} = 1.2\times10^8 \text{ calculations per minute}$$

Then, dividing the desired rate of calculations, 1.92 billion per minute, by the current rate tells you that the rate must increase $\frac{1.92\times10^9}{1.2\times10^8} = 16$ times over. Since you know that the technology doubles every two years, it will take 4 years to increase to 4 times as fast, 6 years to increase to 8 times as fast, and 8 years to increase to 16 times as fast.

38 PAM **1024**

Referring to the given information that the supercomputer doubles its computing power every two years, you know that in 20 years it will have doubled ten times. This is the same as 2^{10} or 1024, which will be the multiple by which the computing power has increased.

Since you are looking for a relative increase in computing power over 20 years, you can also assign an initial computing value of, for example, 1 calculation per second, and then multiply that number by 2 ten times, an easy enough task with your calculator. This will yield 1024, and since you started at 1 calculation per second, you can say that the supercomputer is now 1024 times as powerful.