

New SAT Guide, 2nd Edition

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New SAT Guide, 2nd Edition

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Introduction

Chapter 1

What is the SAT?

Part 1

Introduction

The SAT is a standardized examination designed to measure students' abilities in three areas: reading, writing, and mathematical reasoning. The SAT is written and administered by the College Board. Many American colleges and universities require SAT scores for admission and consider these scores an important factor in assessing applications.

Why do colleges care about the SAT? Since grading standards vary from one high school to another, it can be hard for colleges to know whether two applicants with the same grades are performing at the same level. Therefore, having everyone take the same standardized test gives colleges another metric for comparing students' abilities.

Of course, SAT scores aren't the only things that colleges consider when assessing applicants. Your high school grades, course selection, extracurricular activities, recommendation letters, and application essays are all factors that colleges will use to decide whether you are a good fit for their school. However, in today's highly competitive admissions process, a solid SAT score may provide you with the extra edge needed to be successful.

What's New?

The College Board is implementing significant changes to the SAT that will take effect in the spring of 2016. If you're already familiar with the old SAT, you should review the table below about the differences. If this is your first time learning about the SAT, skip ahead to The New SAT in Detail.

| The Old SAT vs. The New SAT | | |
|-----------------------------|--|---|
| Category | Old SAT | New SAT |
| Timing | <ul style="list-style-type: none">• 3 hours 45 minutes | <ul style="list-style-type: none">• 3 hours 50 minutes (including the optional 50 minute Essay) |
| Sections | <ul style="list-style-type: none">• Critical Reading• Writing (includes the Essay)• Math | <ul style="list-style-type: none">• Evidence-Based Reading and Writing• Math• Essay (optional and separate from the Writing Test) |

| | | |
|-------------------|--|---|
| Areas of Emphasis | <ul style="list-style-type: none"> • General reasoning skills • Understanding challenging vocabulary used in limited contexts • Using logic to solve unfamiliar and abstract math problems | <ul style="list-style-type: none"> • Applying reasoning and knowledge to real-world situations • Using reading, writing, and math skills to analyze evidence • Understanding vocabulary and word choice in a greater range of contexts • Demonstrating core applied reasoning skills in algebra and data analysis |
| Question Types | <ul style="list-style-type: none"> • 161 multiple choice • 10 grid-in | <ul style="list-style-type: none"> • 141 multiple choice • 13 grid-in |
| Answer Choices | <ul style="list-style-type: none"> • 5 answer choices (A to E) for multiple choice questions | <ul style="list-style-type: none"> • 4 answer choices (A to D) for multiple choice questions |
| Penalty | <ul style="list-style-type: none"> • Guessing penalty: quarter-point deduction for wrong answers | <ul style="list-style-type: none"> • No penalty for wrong answers |
| Scoring | <ul style="list-style-type: none"> • Total scaled score from 600 to 2400, comprised of area scores from 200-800 in Critical Reading, Mathematics, and Writing • Essay score factored into Writing scaled score | <ul style="list-style-type: none"> • Total scaled score from 400 to 1600, comprised of area scores from 200-800 in Math and in Evidence-Based Reading and Writing • Essay score reported separately • Subscores and cross-test scores based on demonstration of skills in more specific areas |

The New SAT in Detail

Part 2

Understanding the format and scoring of the new SAT will help you pick appropriate strategies and know what to expect on test day.

The Format

The SAT is 3 hours long (plus 50 minutes for the optional Essay). It is composed of the following sections:

- 100-minute Evidence-based Reading and Writing section
 - Reading Test (65 minutes, 52 questions)
 - Writing and Language Test (35 minutes, 44 questions)
- 80-minute Math section
 - Calculator allowed section (55 minutes, 38 questions)
 - No-calculator allowed section (25 minutes, 20 questions)
- Optional Essay-writing section (50 minutes)

The Scoring System

The new SAT will have three **test scores** on a scale from 10 to 40. There will be one test score for each test: the Reading Test, the Writing Test, and the Math Test. The Reading Test score and the Writing and Language Test score will be added together and converted to a single **area score** in Evidence-Based Reading and Writing; there will also be an area score in Math based on the Math Test Score.

The area scores will be on a scale from 200 to 800. Added together, they will form the **composite score** for the whole test, on a scale from 400 to 1600. The Essay will be scored separately and will not affect your scores in other areas.

SAT Scoring

| | |
|-------------------------------|--|
| Test Scores (10 to 40) | <ul style="list-style-type: none">• Reading Test• Writing Test• Math Test |
| Area Scores (200 to 800) | <ul style="list-style-type: none">• Evidence-Based Reading and Writing• Math |
| Composite Score (400 to 1600) | <ul style="list-style-type: none">• Math (Area Score) + Evidence-Based Reading and Writing (Area Score) |
| Essay Scores (1 to 4) | <ul style="list-style-type: none">• Reading• Analysis• Writing |
| Cross-test Scores (10 to 40) | <ul style="list-style-type: none">• Analysis in Science• Analysis in History/Social Studies |
| Subscores (1 to 15) | <ul style="list-style-type: none">• Words in Context• Command of Evidence• Expression of Ideas• Standard English Conventions• Heart of Algebra• Problem Solving and Data Analysis• Passport to Advanced Math |

The College Board will also be reporting new types of scores. **Cross-test scores** for **Analysis in Science** and **Analysis in History/Social Studies** will be based on performance on specific questions across different tests relating to specific types of content. For example, your cross-test score in Analysis in Science will be based on your performance on questions relating to science passages on the Reading Test as well as questions using scientific data on the Math Test. These scores will be on a scale from 10 to 40.

There will also be seven **subscores** based on particular question types within each test section. Subscores will be reported on a scale from 1 to 15. Four will be related to particular questions in the Reading and Writing Test: Words in Context, Command of Evidence, Expression of Ideas, and Standard English Conventions. The other three relate to specific types of questions on the Math Test: Heart of Algebra, Problem Solving and Data Analysis, and Passport to Advanced Math. You'll learn more about what these subscores are measuring in the chapters explaining what these questions are like.

Test-Taking Basics

Part 1

Now that you're familiar with the SAT, there are a few more things you need to know about how to take the test. These strategies include knowing what you're going to see on the test, managing your time, guessing effectively, and entering your answers.

Know the Test

The first step to tackling the SAT is to know the test. Because it is a standardized exam, the format of the SAT is the same every time it's administered. By knowing the time limit, number of questions, and directions for each section, you will be ahead of the game. Review these key details for each portion of the test until you know them inside out. On test day, you'll save time by skipping over the directions, and can relax knowing there won't be any surprises!

It is also important to know that the SAT is not like certain tests that require you to show your work or explain your answers. Except for the optional essay, you will enter all of your answers on an answer sheet that will be graded by a machine. Thus, it is important to correctly enter your answer choices on your answer sheet; otherwise, you will not receive credit for them.

Also remember that there is a set time limit. Even though the test is broken up into multiple parts, you do not have control over how to divide the total time among the individual sections. Once time is up for a certain section, you have to move on and can't work on previous sections.

Manage Your Time

Similarly, to do well on the SAT, you need to know the length of the test, the time allowed for each section, and the time allotted for snack/bathroom breaks so you can work strategically and be prepared for test day.

Unlike a normal hour-long high school test, the SAT runs between three and four hours long—so you'll want to practice building your stamina! Doing timed practice tests or timed sections will help you learn to stay focused for the duration of the test.

Remember that time between sections isn't transferable; you're given a set amount of time for each section and you can't proceed to the next section or look at previous sections if you finish early. Time yourself while practicing in order to develop a sense of what "a quarter-of-the-way through" and

“halfway through” feels like in each section. Finished early? Use that leftover time to go over your answers and make sure you entered them correctly.

To maximize your time, it’s important not to get too stuck on any single question and to move through the test at a steady pace. Don’t waste 10 minutes on a question that stumps you, only to find that you do not have enough time to answer the things you know inside out. Each question is only worth one point, regardless of its difficulty. If you are stuck on a problem, you should make your best guess and move on quickly. Circle the problem in your question booklet so you can look at it again if you have time. You don’t want to leave any question unanswered, as there’s no penalty for guessing!

You should try to answer every question because you have nothing to lose—just more points to gain! At the same time, you should strike a balance between quality and quantity. Budget your time so you can get to every or almost every question, but you also have the opportunity to read each question carefully and consider each answer choice.

Guess Effectively

The new SAT will no longer deduct a quarter point for each wrong answer choice. That means that there is no downside to guessing! You should always guess on any questions you cannot answer with certainty.

But how can you guess to maximize your chances of gaining a few extra points? First, attempt each question using the processes discussed below and in the chapters that follow. Even if a question is difficult, eliminating any wrong answers will improve your odds of guessing correctly.

If you aren’t sure of the answer, bubble in a guess on your answer sheet, circle the question in your test booklet, and return to it later. Once you have attempted all the other questions in the section, come back to any circled questions and re-read them carefully. Then, try again to answer them. Eliminate any wrong answers, and see if you want to change the answer you originally guessed.

It is possible you will not have time to attempt every question in a section. Because of this, it is a good idea to choose a letter beforehand that you will always use when guessing. This will save you from spending time deciding what answer choice to pick, and makes it easier to bubble in guesses. For any questions you do not have time to answer, simply fill in your bubble sheet using your chosen answer choice. Make sure you have time to enter a guess for every question you do not attempt before time is up for that section.

Write and Bubble Clearly

As noted above, except for the Essay, all of your work on the SAT will be graded by a machine. What you write in your answer sheet determines whether you'll get a point or not, so you don't want to make a mistake when it comes to bubbling your answers!

Always mark your answer in your answer sheet. Your exam booklet will not be graded, but this will provide you with a reference so you can correctly and confidently transfer your responses to your answer sheet. Make sure to fill in each bubble completely using only a No. 2 pencil. Also, always make sure you are filling in the correct section of the answer sheet. Before beginning each section, double check that you are working on the corresponding section of the answer sheet.

You can either bubble your answers in after every question, or bubble them in in groups. If you bubble your answers in groups, you may disrupt your concentration less and be more efficient. Fill in your answers after completing a specific portion of the test, such as all of the questions on one or two pages, or after finishing all the questions for a Reading passage. If you are feeling frustrated during the test, you can also take a quick 'break' to fill in your answers and clear your head, and then return to the questions feeling refreshed.

When you write your essay, write as legibly as you can. Even though you're trying to write quickly, your readers need to be able to read your handwriting in order to give you points. Remember to write your essay only in the lines of the lined pages provided in your answer sheet—your readers won't be able to see anything you write outside of these margins! Don't write any part of your essay in your test booklet, though you can use this space for jotting down notes or an outline for your essay.

While you are not given credit for anything written in your test booklet, you are not penalized either. The test booklet is yours to use how you choose, so mark it up however will help you do your best. Cross out answer choices you know are wrong. Use margins and blank space in the test booklet to work out math problems and outline your essay. Underline key words, phrases, or sections of reading passages.

Reading

Chapter 2

Reading the Questions

Part 2

You can answer every question on the SAT Reading Test with information from the passage. Don't answer the questions using outside knowledge or opinions. Applying all the strategies you learned for understanding passages is the first step to answering questions quickly and correctly. Keep reading for more strategies to help you conquer reading questions.

Refer Back to the Passage

For every question, the correct answer will be based on something stated explicitly in the passage, or that can be inferred by reading between the lines of the text. Take advantage of the fact that in the SAT Reading Test, you can refer back to the material you are being asked about!

Don't answer the questions by memory alone, and don't rely on your own knowledge or opinion of the subject, which might lead you to the wrong answer. You should always be able to support your answer choice with specific lines or words in the text, even if none are specified in the question.

Some questions use **line references** to indicate which part of the passage they are asking you about. When you are given a line reference, always return to the passage to review that line, as well as two to three lines before and after the one you are asked about. This helps you understand the context of the line in question, and there are often clues there that will help you find the correct answer.

Let's see how this works with a line reference question from the Cavallini passage.

Example

The author mentions “an impish Christ child with charmingly flushed cheeks” (lines 54-55) in order to

- A) provide an example of the fresco's lifelike figures.
- B) describe Giotto's naturalistic style.
- C) rescue Cavallini's name from obscurity.
- D) suggest that it could help solve the “St. Francis Legend.”

You may not remember this line from the passage, but if you refer back to the text, you can easily answer this question. Here is the paragraph:

| | | | |
|----|---|----|---|
| 50 | Mr. Strinati has grand ambitions for his discovery. He hopes that in a few years the fully restored fresco will not only rescue Cavallini’s name from obscurity, but also upend the widespread notion that the first flowers of the Renaissance budded in Florence, not Rome. For the | 55 | fresco’s lifelike figures—in particular, an impish Christ child with charmingly flushed cheeks—suggest to Strinati that Cavallini may have anticipated some of the extraordinary naturalistic innovations that have long been credited to the Florentine artist Giotto. |
|----|---|----|---|

If you read the lines referenced and skim the two lines above and below it, you learn that this fresco has particularly lifelike figures and is a good indicator of the naturalistic innovations in Cavallini’s work. Thus, only answer choice (A) matches the passage.

The other answer choices are all ideas mentioned at different points of the passage, but not in reference to the painting of the child or in the lines you were asked about. Therefore, you know they do not match and you can eliminate them.

When you answer questions that do not provide line references, you should still refer back to the passage. Because you will have marked up your passage, you will likely know where to find the evidence you need. If a question asks you something general about the passage, you can refer back to the summaries you made while reading, and any notes you made in the margins.

Pick & Skip

Generally, the question set will begin with more general questions on central ideas, tone, and structure, and then move onto more detailed questions that follow the order of the passage. However, just like the passages themselves, the questions will not necessarily be presented in order of difficulty. As you learned in Chapter 1, if you are unsure of the answer to any one question, you can mark it in your test booklet, bubble in your best guess, and come back to it later if you have time.

Part 2 Practice: Reading the Questions

Consider how you will approach the passage and questions below. Think about what strategies you might use if you cannot answer a question. Practice marking up this passage and making paragraph summaries the way you learned to earlier in this section.

This passage is adapted from Robert Lee Hotz, "A Wandering Mind Heads Straight Toward Insight." ©2009 by Dow Jones & Company.

Line
5
10
15
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25
In our fables of science and discovery, the crucial role of insight is a cherished theme. To these epiphanies, we owe the concept of alternating electrical current, the discovery of penicillin, and on a less lofty note, the invention of Post-its, ice-cream cones, and Velcro. The burst of mental clarity can be so powerful that, as legend would have it, Archimedes jumped out of his tub and ran naked through the streets, shouting to his startled neighbors: "Eureka! I've got it."

15
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In today's innovation economy, engineers, economists and policy makers are eager to foster creative thinking among knowledge workers. Until recently, these sorts of revelations were too elusive for serious scientific study. Scholars suspect the story of Archimedes isn't even entirely true. Lately, though, researchers have been able to document the brain's behavior during Eureka moments by recording brain-wave patterns and imaging the neural circuits that become active as volunteers struggle to solve anagrams, riddles, and other brain teasers.

Following the brain as it rises to a mental challenge, scientists are seeking

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their own insights into these light-bulb flashes of understanding, but they are as hard to define clinically as they are to study in a lab.

To be sure, we've all had our "aha" moments. They materialize without warning, often through an unconscious shift in mental perspective that can abruptly alter how we perceive a problem. "An 'aha' moment is any sudden comprehension that allows you to see something in a different light," says psychologist John Kounios at Drexel University in Philadelphia. "It could be the solution to a problem; it could be getting a joke; or suddenly recognizing a face. It could be realizing that a friend of yours is not really a friend."

50
55
These sudden insights, they found, are the culmination of an intense and complex series of brain states that require more neural resources than methodical reasoning. People who solve problems through insight generate different patterns of brain waves than those who solve problems analytically. "Your brain is really working quite hard before this moment of insight," says psychologist Mark Wheeler at the University of Pittsburgh. "There is a lot going on behind the scenes."

1

Which of the following can be inferred from the passage about anagrams, riddles, and other brain teasers?

- A) It is possible to experience insight while solving them.
- B) They can only be solved through insight.
- C) They are best solved by thinking analytically.
- D) They are best solved in a lab setting.

2

The purpose of the first paragraph (lines 1-12) is to

- A) highlight the inventions created through insight.
- B) introduce the general concept of insight.
- C) describe the story of Archimedes.
- D) explain the origin of the phrase “Eureka!”

3

As used in line 50, “resources” most nearly means

- A) capital.
- B) energy.
- C) resort.
- D) finances.

4

The author quotes John Kounios in order to

- A) prove that numerous scientists are studying insight.
- B) suggest that research on insight is very basic.
- C) offer a definition and examples of insight.
- D) demonstrate that people often do not recognize insight.

Passages with Graphics

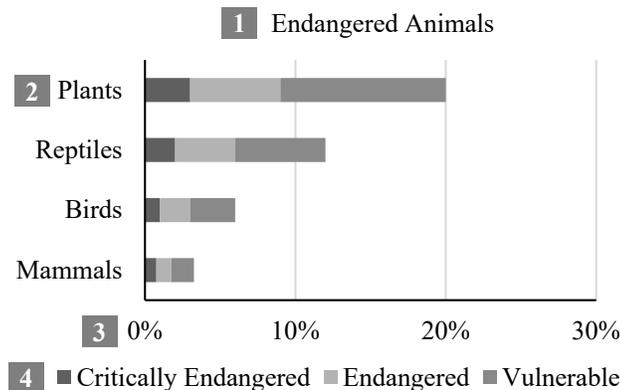
Part 2

Two reading passages on the SAT will include graphics. One of the passages will be a Science passage, and the other will be a Social Studies passage. There will be one or two graphics accompanying each passage. The graphics will contain additional information that supplements the passage, and will always be related to the main topic of the passage. Most often, the graphics will be representations of statistical data—including bar graphs, tables, and pie charts.

Graphics may provide supporting evidence for the passage, with accompanying questions that require you to correctly interpret the graphic in relation to the passage. You may also be asked questions that will require you to interpret information presented *only* in the graphic.

Reading the Graphics

Graphs can contain a lot of information. Here are some of the key elements to look for.



5 This chart shows the percentage of various species, by group, on the IUNC Red List as of 2007. The Red List is an online listing of endangered species categorized by taxonomy, type of threat and other criteria.

- 1 **Title.** The title of a graphic usually tells you what the graphic is intended to show.
- 2 **Labels.** Be sure to read all of the labels in a graphic, and make sure that you understand which elements they refer to and what they say about them.
- 3 **Units.** Be sure you know what units a graphic is using for data. The number ten will mean something very different on a chart showing distances in feet than on one showing distance in *thousands* of feet.
- 4 **Legend.** A legend is a guide to the graphic that shows you what different shades, images, or patterns mean in the image. Always read legends carefully when they're available.

5 Caption. If there's a caption below the graphic, read it carefully. The captions often provide directions for how to properly read the graphic, and extra details about the information provided in the graph.

6 References in the Passage. If the passage refers to the graphic, or to information in the graphic, pay attention to which information the passage is referring to and how the author is using the information from the graphic in the passage.

Sometimes, a graphic might contain a lot of information. You don't need to scrutinize every detail: just try to understand the graphic's relationship to the passage, and look for the essential elements described above so that when you need to check the graphic to get a specific piece of information, you'll be able to find it quickly.

Analyzing Quantitative Info

Be careful not to make any assumptions about information that you are not given, or to assume that trends presented in the graphic will remain true for other scenarios.

Let's look at an example to see how this works.

Example

| Temperatures in Singapore | | |
|---------------------------|----------------|-----------------|
| Month | Record High °F | Average High °F |
| Jan | 93.7 | 86.2 |
| Feb | 95.4 | 88.2 |
| Mar | 96.8 | 88.9 |
| Apr | 96.4 | 89.1 |
| May | 95.7 | 88.9 |
| Year | 96.8 | 86.2 |

This chart shows temperatures in Singapore for the years 1929–1941 and 1948–2011.

2

Which claim about Singapore's weather is supported by the graphic?

- A) January is on average the coldest month of the year in Singapore.
- B) There have been higher record temperatures in April than in March.
- C) The average high in March is lower than the yearly average.
- D) The average high in March is higher than the yearly average.

Here only answer choice (D) is actually supported by the chart. You can easily compare the average temperatures for given for March and for the year overall, and see that 88.9 is higher than 86.2. Answer choice (C) gives the opposite answer, so you know it is incorrect.

You can also use the Process of Elimination to knock out answer choice (A) because even though January is the coldest month according to the chart, the chart does not include data for the entire year.

Answer choice (B) can be eliminated as it confuses average temperature for the record temperature; the record high for March is higher than that for April.

Relating Graphics to Passages

To relate a graphic back to information in the passage, look for lines in the passage that discuss the same subjects being measured and presented in the graphic. You may have marked up these lines as you first read the passage. Then, compare the information from the passage to what is presented in the graphic. You can underline or circle the items on the graphic that you are asked about or that are repeated from the passage.

The graphic may present slightly different information than the passage, and you may need to combine these two sources of information in order to reach a broader conclusion than what you could support from just one source.

Let's look at an example of a passage excerpt and graphic to see how this works.

Example

Gross domestic product (GDP) is the market value of all goods and services produced within a country in a year.

Line GDP is an aggregate figure, which does
5 not consider the differing sizes of nations. Therefore, GDP can be stated as GDP per capita, in which the total GDP is divided by the resident population on a given date. GDP per capita is not a
10 measure of personal income, as it is measured by dividing the total amount of GDP equally among all citizens. However, a high GDP per capita is generally considered an indicator of the
15 economic health of a nation and the living standards of its citizens generally.

3

It can reasonably be inferred from the passage and graphic that

- A) the United States produced more goods and services than the United Kingdom for all years measured.
- B) the United Kingdom produced more goods and services than the United States for all years measured.
- C) the United States likely experienced better economic health than the United Kingdom for all years measured.
- D) the United Kingdom had a lower GDP than the United States in 2008.

| GDP per Capita in US Dollars | | |
|------------------------------|---------------|----------------|
| Year | United States | United Kingdom |
| 2008 | 46,760 | 43,147 |
| 2009 | 45,305 | 35,331 |
| 2010 | 46,612 | 36,238 |
| 2011 | 48,112 | 38,974 |
| 2012 | 49,641 | 39,090 |

To answer this question, you need to combine information given in the chart with information stated in the text of the passage. Only answer choice (C) is supported by information from both sources. The chart shows you that the United States had a higher GDP per capita, and the passage tells you this is usually “considered an indicator of the economic health of a nation” (lines 14-15). By combining these pieces of information, you can select this answer.

Answer choice (A) is contradicted by information in the passage, which clarifies that GDP per capita does not measure total goods and services, but divides that number by the number of total citizens. Without knowing the population of the two countries for the years measured, it is not possible to determine which country produced more goods and services. There is a similar issue with answer choice (B). Answer choice (D) is incorrect as the chart only indicates GDP per capita, which is different from regular GDP as defined by the passage.

Part 2 Practice: Passages with Graphics

Below are two example passages. Read the passages, paying special attention to the elements we have discussed, and then answer the accompanying practice questions.

This passage is adapted from Justin Gillis, “Heat-Trapping Gas Passes Milestone, Raising Fears.” ©2013 by The New York Times Company.

Line 5 The level of the most important heat-trapping gas in the atmosphere, carbon dioxide, passed a long-feared milestone, scientists reported in May 2013, reaching a concentration not seen on the earth for millions of years.

10 Scientific instruments showed that the gas had reached an average daily level above 400 parts per million—just an odometer moment in one sense, but also a sobering reminder that decades of efforts to bring human-produced emissions under control are faltering.

15 “It symbolizes that so far we have failed miserably in tackling this problem,” said Pieter P. Tans, who runs the monitoring program at the National Oceanic and Atmospheric Administration (NOAA) that reported the new reading.

20 Ralph Keeling, who runs another monitoring program at the Scripps Institution of Oceanography in San

Diego, said a continuing rise could be catastrophic. “It means we are quickly losing the possibility of keeping the climate below what people thought were possibly tolerable thresholds,” he said.

25 China is now the largest emitter, but Americans have been consuming fossil fuels extensively for far longer, and experts say the United States is more responsible than any other nation for the high level.

30 The new measurement came from analyzers atop Mauna Loa, the volcano on the big island of Hawaii that has long been ground zero for monitoring the worldwide trend on carbon dioxide, or CO₂. Devices there sample clean, crisp air that has blown thousands of miles across the Pacific Ocean, producing a record of rising carbon dioxide levels that has been closely tracked for half a century.

35 Carbon dioxide above 400 parts per million was first seen in the Arctic last year, and had also spiked above that level in hourly readings at Mauna Loa.

But the average reading for an entire day surpassed that level at Mauna Loa for the first time in the 24 hours that ended at 8 p.m. Eastern Daylight Time on Thursday, May 9, 2013. The two monitoring programs use slightly different protocols; NOAA reported an average for the period of 400.03 parts per million, while Scripps reported 400.08.

Carbon dioxide rises and falls on a seasonal cycle, and the level will dip below 400 this summer as leaf growth in the Northern Hemisphere pulls about 10 billion tons of carbon out of the air. But experts say that will be a brief reprieve—the moment is approaching when no measurement of the ambient air anywhere on earth, in any season, will produce a reading below 400.

From studying air bubbles trapped in Antarctic ice, scientists know that going back 800,000 years, the carbon dioxide level oscillated in a tight band, from about 180 parts per million in the depths of ice ages to about 280 during the warm periods between. The evidence shows that global temperatures and CO₂ levels are tightly linked.

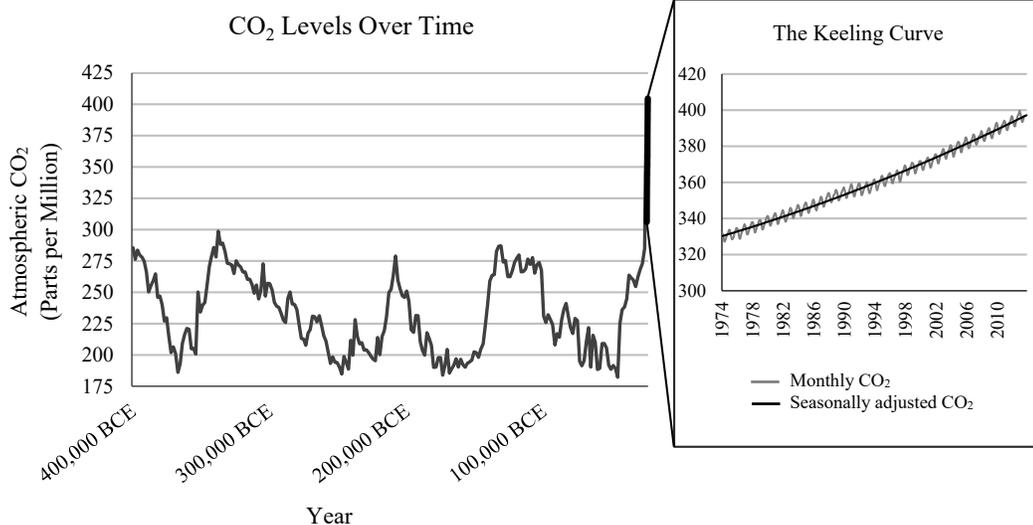
For the entire period of human civilization, roughly 8,000 years, the carbon dioxide level was relatively

stable near that upper bound. But the burning of fossil fuels has caused a 41 percent increase in the heat-trapping gas since the Industrial Revolution, a mere geological instant, and scientists say the climate is beginning to react, though they expect far larger changes in the future.

Indirect measurements suggest that the last time the carbon dioxide level was this high was at least three million years ago, during an epoch called the Pliocene. Geological research shows that the climate then was far warmer than today, the world's ice caps were smaller, and the sea level might have been as much as 60 or 80 feet higher.

Countries have adopted an official target to limit the damage from global warming, with 450 parts per million seen as the maximum level compatible with that goal. “Unless things slow down, we’ll probably get there in well under 25 years,” Ralph Keeling said.

Yet many countries, including China and the United States, have refused to adopt binding national targets. Scientists say that unless far greater efforts are made soon, the goal of limiting the warming will become impossible without severe economic disruption.



1

The passage indicates that, during the winter, which of the following is true?

- A) Dropping temperatures will also cause a drop in carbon dioxide levels.
- B) Atmospheric sampling is less likely to produce accurate results.
- C) Atmospheric carbon dioxide levels are higher than at other times in the year.
- D) Scientists are able to sample air bubbles trapped in ice.

2

Based on information from the passage and graph, carbon dioxide levels

- A) never reached 400 parts per million before the Industrial Revolution.
- B) never reached levels as high as today in the preceding 400,000 years.
- C) have been as high as 400,000 parts per million in the past.
- D) are usually around 200 parts per million.

3

Information from the graph best supports which of the following statements?

- A) From 1974 to 2010, carbon dioxide levels rose more slowly but to a higher point than at any other time in the past 400,000 years.
- B) Seasonally adjusted carbon dioxide levels have been above 300 parts-per-million for more than 200,000 years.
- C) Due to increasing carbon dioxide, sea levels in 2010 most likely rose to levels similar to those in the Pliocene.
- D) Between 1974 and 2010, carbon dioxide levels sometimes dropped from month-to-month, but seasonally adjusted levels rose steadily.

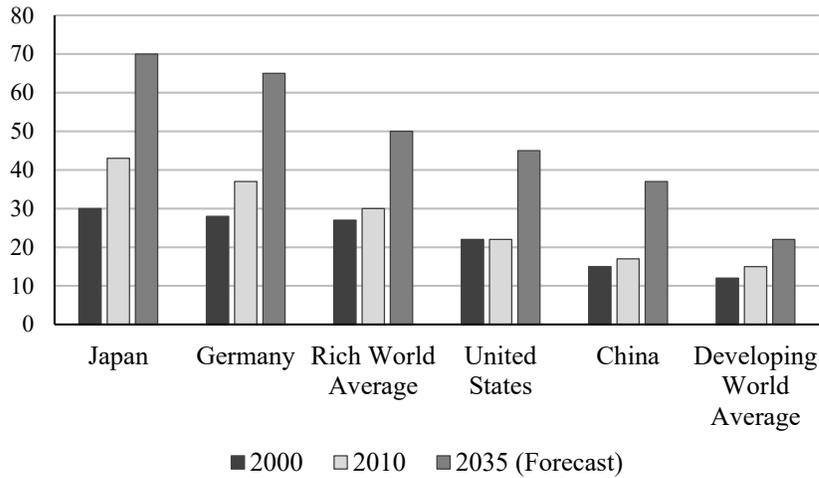
This passage is adapted from “Age Invaders.” ©2014 by The Economist.

According to the UN’s population projections, the standard source for demographic estimates, there are around 600 million people aged 65 or older alive today. That is in itself remarkable; the author Fred Pearce claims it is possible that half of all the humans who have ever been over 65 are alive today. But as a share of the total population, at 8%, it is not that different to what it was a few decades ago.

By 2035, however, more than 1.1 billion people—13% of the population—will be above the age of 65. This is a natural corollary of the dropping birth rates that are slowing overall population growth; they mean there are proportionally fewer young people around. The “old-age dependency ratio”—the ratio of old people to those of working age—will grow even faster. In 2010 the world had 16 people aged 65 and over for every 100 adults between the ages of 25 and 64, almost the same ratio it had in 1980. By 2035 the UN expects that number to have risen to 26.

In rich countries it will be much higher. Japan will have 69 old people for every 100 of working age by 2035 (up from 43 in 2010), Germany 66 (from 38). Even America, which has a relatively high fertility rate, will see its old-age dependency rate rise by more than 70%, to 44. Developing countries, where today’s ratio is much lower, will not see absolute levels rise that high, but the proportional growth will be higher. Over the same time period, the old-age dependency rate in China will more than double from 15 to 36. Latin America will see a shift from 14 to 27.

The Big Shift; Old-age dependency, population aged 65 and over per 100 people aged 25-64



Adapted from "Age Invaders." ©2014 by The Economist

4

It can reasonably be inferred from the passage and graphic that

- A) Latin America will have a lower old-age dependency ratio than the rich world average in 2035.
- B) Latin America had a lower old-age dependency ratio than the developing world average in 2000.
- C) Japan will have 70 old people for every 100 of working age by 2040.
- D) the United States will never have as high an old-age dependency ratio as Germany.

5

Which claim about old-age dependency is supported by the graphic?

- A) Japan has historically had a lower old-age dependency ratio than the United States.
- B) The developing world will have a lower old-age dependency ratio than China in 2035.
- C) The developing world had a higher old-age dependency ratio than China in 2010.
- D) Germany's growing old-age dependency ratio is representative of rich countries overall.

Writing

Chapter 3

Reading the Passages

Part 1

Strategies

The first step in the Writing Test is to read the passages. Here are some strategies to help you read the passages effectively.

1. **Read the whole passage.** On the Writing Test, every sentence is important. Even if sentences don't have underlined portions, they may give you valuable information that you will use to answer the questions. Don't skip portions of the passage just because they don't include questions.
2. **Work on one passage at a time.** Make sure you attempt all questions for a passage before moving on. It is easiest to answer the questions while the passage is fresh in your mind. If you're not sure about a question, circle it in your test booklet and enter a guess on your answer sheet. That way, you can easily go back to the question if you have extra time to check your answers.
3. **Put your Pencil on Paper:** mark up the passages in your test booklet as you read them to help keep track of important elements that will help you correctly answer questions.
4. **You're allowed to read passages out of order.** This is a helpful strategy if you feel rushed. Skim the first paragraph of each passage, and start with the passage that seems most interesting or least difficult. Taking the passages out of order can make it easy to make avoidable mistakes, so always be sure that you're bubbling in for the correct number on your answer sheet.

The practice tests at the back of this book will help you determine which strategies work best for you.

Pacing

No matter which strategies you choose to use, make sure to give yourself enough time to read the passage and answer the questions before moving on to the next passage. You have 35 minutes for the entire Writing Test. This is about 8.5 minutes per passage but it's not a deadline: don't panic if you spend more than 8.5 minutes per passage, but try not to spend more than 10 minutes on a single passage. When you have spent 10 minutes on a passage, it's time to move on to the next passage. Skim the rest of the passage you're working on, take the time to answer easy questions, bubble in your best guesses for harder questions, and circle problems that you guessed on in your booklet so that you can come back to them later if you have time.

However, keep in mind that it's always better to answer a question than to leave it blank: try to answer every question carefully, but bubble in a guess for every question before time is up for that section.

Section 3

SAT Grammar

Before we can talk about grammar questions you'll have to tackle on the SAT, we're going to go through a quick review of basic grammar concepts. Don't be scared by the technical names for these concepts—the SAT won't test you on any technical grammar terms. However, knowing these concepts will help you to understand and correct the grammar errors in SAT questions. In this section, you will review common grammar errors that you might see on the Writing and Language Test, and learn how to correct them.

In order to work with all of the materials in this chapter, you will need to have some foundational skills. Additional materials are available online at ivyglobal.com/study. If you need extra review of any of the following concepts, please refer to the supplemental materials online and work through the practice exercises.

- **Nouns and pronouns:** concrete and abstract nouns, proper and improper nouns, possessive nouns, pronouns and antecedents
- **Verbs:** verb number and tense, action verbs and linking verbs
- **Adjectives and adverbs**
- **Sentences:** subject and objects, direct and indirect objects, clauses, subordination and coordination, conjunctions
- **Punctuation:** using colons and semicolons, using commas



For additional resources, please visit ivyglobal.com/study.

Common Grammar Errors

Part 1

Let's take a look at some of the specific kinds of errors the SAT will ask you to correct. We'll begin with some of the more straightforward error types that the SAT will include in its Writing and Language Test passages. Though the SAT will try to trick you by disguising these errors, most of them will be fairly easy to spot once you know what to look for. Many of them will sound wrong to your ear, or they would if you spoke them out loud.

Complete Sentences and their Boundaries

Some of the errors you'll have to correct on the SAT will ask you to rearrange or combine **clauses** in order to fix a sentence that is incorrectly structured.

You may encounter sentence fragments on the SAT. A **fragment** is a set of words or clause that cannot stand on its own, but that a writer has tried to use as a complete sentence.

Example

✗ Emma didn't show up until 9 PM. Even though she said she'd arrive at 7.

Although the second "sentence" has a subject and a verb, it is not complete. You can see that it is a dependent clause. To fix this problem, you can attach it to the first sentence with a comma.

✓ Emma didn't show up until 9 PM, even though she said she'd arrive at 7.

Sometimes phrases will occur as fragments as well. A **phrase** isn't even a clause—it doesn't have both a subject and a verb.

Example

✗ She said she got stuck in traffic, but tried her hardest to get there. Driving like a maniac and weaving in and out of traffic.

You'll notice that the second "sentence" here doesn't have a subject. In general, if you see a "sentence" whose verbs are all in "-ing" form, chances are there is a problem with it. To fix the sentence in this example, you have a couple of options. Attaching it to the main sentence with a comma makes it clear that "she" was the one driving like a maniac and weaving in and out of traffic:

- ✓ She said she got stuck in traffic, but tried her hardest to get there, driving like a maniac and weaving in and out of traffic.

You can also resolve it by making the fragment into a stand-alone sentence:

- ✓ She said she got stuck in traffic, but tried her hardest to get there. She drove like a maniac and weaved in and out of traffic.

The second sentence now has a subject (“she”) and two verbs that agree with it (“drove” and “weaved”). Both are appropriately in the past tense, since the narrator is describing a completed past event.

Some sentences you encounter on the SAT will try to pack *too much* into one sentence. These include **run-on sentences**, which occur when two independent clauses are mashed together without proper conjunctions or punctuation.

Example

- ✗ My cat is very mischievous she likes to climb where she’s not supposed to be.
- ✗ My cat is very mischievous, she likes to climb where she’s not supposed to be.

These sentences are both wrong because they combine two independent clauses in an inappropriate way. With no punctuation, the sentence is a run-on. With just a comma, it is a **comma splice**. In either case, the SAT will ask you to correct the mistake. Look for multiple-choice options that accomplish the following changes.

You can break a run-on into two sentences:

- ✓ My cat is very mischievous. She likes to climb where she’s not supposed to be.

You can also split it up with a semicolon:

- ✓ My cat is very mischievous; she likes to climb where she’s not supposed to be.

You can also make one of the clauses into a dependent clause:

- ✓ Because my cat is very mischievous, she likes to climb where she’s not supposed to be.

Part 1 Practice: Common Grammar Errors

1 Carolyn Doty has loved baking since she was a child. When she spent weekends and vacations at her grandparents' farm. “My grandmother cooked every meal we ate and she did all of her own baking,” Doty explained. “I spent a lot of time in her kitchen, where she **2** teach me how make cookies, cakes, pies, and bread.” Doty, inspired to take what **3** they had learned from her grandmother to the next **4** level, decided to make baking her career. She attended a culinary institute, graduating with a bachelor’s degree in pastry arts. Now, she works as a pastry chef in one of America’s best restaurants, a job **5** one loves.

- 1**
- A) NO CHANGE
 - B) When she spent weekends and vacations at her grandparents’ farm; Carolyn Doty has loved baking since she was a child.
 - C) Carolyn Doty has loved baking since she was a child, and when she spent weekends and vacations at her grandparents’ farm.
 - D) Carolyn Doty has loved baking since she was a child, when she spent weekends and vacations at her grandparents’ farm.

- 2**
- A) NO CHANGE
 - B) is teaching
 - C) teaches
 - D) taught

- 3**
- A) NO CHANGE
 - B) them
 - C) she
 - D) those

- 4**
- A) NO CHANGE
 - B) level. decided
 - C) level and decided
 - D) level, and decided

- 5**
- A) NO CHANGE
 - B) she loves
 - C) they love
 - D) she loved

Nevertheless, she has decided that she wants to use her expertise to become a food entrepreneur. She has permission to use the kitchen at her restaurant for her own projects, and the many pieces of large-scale cooking equipment in the restaurant's kitchen

6 makes it possible for her to cook large batches of cookies and pies, which **7** are sold by Doty at the local farmer's market. Now, she wants to make this her full-time job. Doty is taking courses in food entrepreneurship offered by her **8** alma mater, during which she is learning more about how to scale up her baking business, find financial backers, and market her products effectively.

6

- A) NO CHANGE
- B) make
- C) has made
- D) is making

7

- A) NO CHANGE
- B) have been sold by Doty
- C) Doty sells
- D) is sold by Doty

8

- A) NO CHANGE
- B) alma mater. During which
- C) alma mater; during which,
- D) alma mater and during which

Harder Grammar Errors

Part 2

The errors discussed in this part may be a little more difficult for you to spot. In fact, some of them may not sound wrong when you read through them in your head! Nevertheless, our tips will help you detect and correct these errors when you see them on the SAT.

Parallel Structure

Some sentences in the Writing and Language Test passages will be missing parallel structure. **Parallel structure** is a way of constructing a sentence so that different parts of the sentence all have the same grammatical structure. Parallel structure makes long sentences easy to read and gives them a natural flow. On SAT questions, you will sometimes be asked to change a part of a sentence to fix a broken parallel structure. Let's take a look at some examples.

Example

✓ After a long day, I like listening to music, reading, and talking with friends.

This sentence has three elements listed in a series: “listening to music,” “reading,” and “talking with friends.” Each of these elements is an “-ing” form of a verb: “listening,” “reading,” and “talking.” Because they are all in the same form, this sentence has parallel structure. Here is the same sentence with a broken parallel structure:

✗ After a long day, I like listening to music, reading, and to talk with friends.

Now the three elements in the list are in different forms. “Listening” and “reading” are in “-ing” forms, but “to talk” is not. To answer parallel structure questions, you will need to identify the odd man out and find the multiple choice option that puts all the elements in the same form. Let's look at another example:

Example

✗ Whether you fight with Ron or giving him the silent treatment, you're going to have to resolve the argument eventually.

This example is a little less obvious than the last one we looked at. What elements are being listed here? If you're not sure, try looking for key words like “and” or “or” that suggest that things are being put

Essay

Chapter 4

SAT Essay Basics

Part 1

Because writing an SAT essay has a lot in common with writing assignments you may have received in school, some of the following guidance will be familiar. However, some of our tips will be quite specific to the SAT and what the College Board is looking for in an essay.

Use the Answer Sheet and Your Test Booklet

Write only in the designated section of the exam booklet. Use only the four lined pages provided for your essay. Remember, the only portion of your essay that the graders will see is what you write within the available lines; they won't see anything you write in the margins.

Write neatly. Unlike the other computer-graded sections of the SAT, the essay has to be read by another human being, which makes the legibility of your writing very important. Ensure that your grader sees the greatness of your essay by writing neatly and legibly. Don't use small handwriting to save space: bigger letters are easier to read.

Use your test booklet for outlining and notes. As you read, it's a good idea to underline or note the line number of quotes you'd like to use, and start outlining your essay in the margins.

Write as Much as Possible

Filling up as many of the answer pages as possible tells your graders that you have taken the time to write a thorough, well-argued essay. You have plenty of space to write; use as much of it as possible to develop your argument.

Write six full paragraphs. Fifty minutes is plenty of time to outline and write an introduction, four body paragraphs, and a conclusion. Writing six paragraphs will properly break up four pages of writing and make it easier for your graders to follow your argument; one long run-on paragraph or many short paragraphs can be difficult to follow.

Sample Essays

Part 2

In this section we apply the College Board's grading criteria to two student essays written in response to the prompt below. Recall that each criterion will be graded on a scale of 1-4. The sample essays demonstrate Reading, Analysis, and Writing scores of 2 and 4 respectively.

Your essays may merit different scores in each category. Additional sample essays are available online, including samples that demonstrate mixed scores and an example of how an incomplete essay would be scored.



For additional resources, please visit ivyglobal.com/study.

Essay Prompt

As you read the passage below, consider how Al Gore uses

- evidence, such as facts or examples, to support claims.
- reasoning to develop ideas and to connect claims and evidence.
- stylistic or persuasive elements, such as word choice or appeals to emotion, to add power to the ideas expressed.

Adapted from former Vice President Al Gore's 2004 speech "The Climate Emergency," collected in *Red, White, Blue, and Green: Politics and the Environment in the 2004 Election (2004)*, edited by members of Yale School of Forestry & Environmental Studies, James R. Lyons, Heather S. Kaplan, Fred Strebeigh, and Kathleen E. Campbell.

- 1 The environment is often felt to be relatively invulnerable because the earth is so big. People tend to assume that the earth is so big that we as human beings can't possibly have any impact on it. That is a mistake.
- 2 In Europe during the summer of 2003, we experienced an extreme heat wave that killed an estimated 20,000 people, and many predict such events will be much more commonplace as a result of increasing temperatures. The anomaly was extreme, particularly in France, with consequences that were well reported in the press. Year-to-year, decade-to-decade there's variation, but the overall upward trend worldwide since the American Civil War is really clear and really obvious, at least to me.
- 3 If you look at the glaciers around the world, you see that many are melting away. A friend of mine named Lonnie Thompson of Ohio State studies glaciers, and he reports that 15 to 20 years from now there will be no more snows of Kilimanjaro. This shrinking of glaciers is happening all

around the world, including Latin America, China, and the U.S. In our own Glacier National Park, all of the glaciers are predicted to be gone within 15 to 20 years.

- 4 An area of Bangladesh is due to be flooded where ten million people live. A large area of Florida is due to be flooded. The Florida Keys are very much at risk. The Everglades are at risk.
- 5 The trend is very clear. What's behind it all? I've come to believe that global warming, the disappearance of the ocean fisheries, the destruction of the rain forests, the stratospheric ozone depletion problem, the extinction crisis, all of these are really symptoms of an underlying cause. The underlying cause is a collision between our civilization and the earth. The relationship between the human species and our planet has been completely changed. All of our culture, all of our literature, all of our history, everything we've learned, was premised on one relationship between the earth and us, and now we have a different one.
- 6 Think about the subsistence that we have always drawn from the earth. The plow was a great advance, as was irrigation. But then we began to get more powerful with these tools. At the Aral Sea in Russia, something as simple as irrigation on a large scale led to the virtual disappearance of the fourth largest inland body of water in the world. We're changing the surface of the earth, and technology sometimes seems to dwarf our human scale. We now have to try to change this pattern.
- 7 There's another assumption that needs to be questioned. In contrast to the idea that the earth is so big that we can't have any impact on it, there are others who assume that the climate change problem is so big we can't solve it. I, however, believe that we can if we put our minds to it. We had a problem with the ozone hole, a big global problem that seemed too big to solve. In response, we had political leadership and the world passed a treaty outlawing chlorofluorocarbons, the chemicals that caused this problem. The United States led the way, and we brought about a dramatic drop in CFCs and are now in the process of solving that problem. We now have the ability to buy hybrid cars like the Toyota Prius and the marketplace for new sources of energy is increasing dramatically. We're also seeing new efficiencies with energy savings. If we have political leadership and the collective political will to say it is important to solve this problem, we can not only solve it, we can create more jobs, we can create higher incomes, a better way of life, and a higher quality of life by solving the problem.
- 8 Everything we have ever known—and Carl Sagan made a beautiful long statement about this—all the wars, all the heartbreak, all the romance, every triumph, every mistake, everything we've ever known is contained in this small planet. If we keep the right perspective and keep our eyes on the prize, we can solve this problem, we will solve this problem, we must solve this problem. It really is up to you.

Write an essay in which you explain how Al Gore builds an argument to persuade his audience that climate change is a serious problem we must address. In your essay, analyze how Gore uses one or more of the features listed in the box above (or features of your own choice) to strengthen the logic and persuasiveness of his argument. Be sure that your analysis focuses on the most relevant features of the passage.

Your essay should not explain whether you agree with Gore's claims, but rather explain how Gore builds an argument to persuade his audience.

Math

Chapter 5

Plan Your Approach

Part 1

When you take the SAT Math Test, you can reduce your stress by planning ahead. Know what the directions say, how you will approach each question, and how to pace yourself. We'll go through these steps with an example below.

Know the Directions

You will be given directions and reference information at the beginning of each math section of the SAT. The directions contain important information about the types of questions you will see and how much time you have to complete them. Make sure to read the directions before starting the problems so you know what to expect in each section.

The “Notes” section at the beginning of each math section will look similar to the one below. This section will tell you whether you can use a calculator on that section. It also gives you information about the figures and functions you will see and use on the test.

NOTES

1. You **may not** use a calculator.
2. Variables and expressions represent real numbers unless stated otherwise.
3. Figures are drawn to scale unless stated otherwise.
4. Figures lie in a plane unless stated otherwise.
5. The domain of a function f is defined as the set of all real numbers x for which $f(x)$ is also a real number, unless stated otherwise.

The Reference section contains important formulas and facts. To use this information to your advantage, be familiar with what formulas are provided. Use this reference information when practicing for the SAT. Remember that this information is only helpful if you know how to use it to solve problems.

There are 360° in a circle.
 The sum of the angles in a triangle is 180°.
 The number of radians of arc in a circle is 2π.

Read the Question Carefully

Read through the whole question. Don't assume you understand the question just by reading the first few words! Reading the whole question will help you avoid making assumptions that can lead to careless errors.

If you see unfamiliar or difficult-looking material, stay calm and keep reading until the end of the question. There might be more information in the question that will help you figure out the solution. If you still think a question is too difficult after you have finished reading the whole thing, you should make your best guess, circle it in your question booklet, and come back to it if you have time.

Underline Key Words

Underline or circle any information given in the question that will help you solve it. Here's an example:

Example

The width of a rectangular field is one-quarter its length. If the length is 16, what is the perimeter of the field?

A) 4

B) 24

C) 36

D) 40

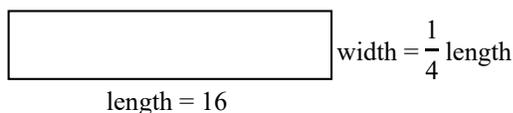
Identify What the Question is Asking

Ask yourself, "What is the question asking me to solve?" This is especially important for word problems. Sometimes the wording of a question can be confusing, so make it simpler by summarizing in your own words what the question is asking for. Focus on the meanings of the key words you have underlined.

In our example question, you are being asked to find the perimeter of the rectangle. Put this in your own words: the perimeter is the length of the outline of the rectangle.

Draw a Chart or Diagram

Charts and diagrams are great tools to help you visualize the problem and organize your information, as you saw with the Pencil on Paper strategy in Chapter 1. In our example question, you might try drawing a quick sketch of a rectangle. Fill in any information given in the question:



Come up With a Strategy

Strategize the best way to solve the question. Think about all of the information provided in the question and how it is related. Think about where you have seen this type of question before, and what methods you have used to solve similar types of questions. If there is a formula you know that could help, write it down.

Here's a strategy we could use to solve our example question.

- We know: length = 16

$$\text{width} = \frac{1}{4} \text{ of length} = \frac{1}{4} \times 16 = \frac{16}{4} = 4$$

- We want: the perimeter of the whole rectangle
- Our strategy: we can use a formula that relates a rectangle's perimeter to its length and width

$$\text{perimeter} = (2 \times \text{length}) + (2 \times \text{width})$$

We can now plug in the values and solve:

$$\text{perimeter} = (2 \times 16) + (2 \times 4) = 32 + 8 = 40$$

Is our solution one of the answer choices? It is indeed! The answer is (D) 40.

Check Your Answer

Always check your work to make sure that you picked the best answer among all of the answer choices. Double-check your arithmetic to make sure that you didn't make any avoidable errors. Check that you solved for what the question was asking. For example, if the question asked you to solve for a perimeter, make sure you didn't solve for area.

Try to determine whether or not your answer seems reasonable based on context. For example, if the length of one side of the rectangle is 16, the perimeter of the whole rectangle has to be greater than twice the length, or 32. Answers (A) and (B) in the example are less than 32, so they are unreasonable.

Finally, check that you bubbled in the answer on your answer sheet correctly. It would be a shame to have solved the question correctly and not get credit! Take a look at Part 2 to learn how to enter your answers correctly.

Pace Yourself

Remember that you will be answering questions under a time limit, and you need to leave yourself enough time to attempt every question on the test. One way to save time during the test is to be familiar with the format and instructions before the test day. Be aware of the number and types of sections that you will see. Before starting a section, look at the number of questions you will be answering and the time you have to answer them.

Here is a chart showing how many minutes you should average per question on each section of the Math Test. The questions in the multiple choice section are ordered from easy to difficult. Plan to spend less time on the early questions so that you have enough time for the more challenging ones at the end of the section.

| Pacing on the Math Test | | | |
|-------------------------|------------|-----------------|---------------------------|
| Section | Total Time | Total Questions | Time Per Question |
| Calculator Section | 55 minutes | 38 questions | 1.4 minutes per question |
| No-Calculator Section | 25 minutes | 20 questions | 1.25 minutes per question |

Finally, remember that every question is worth the same number of points. If you get stuck on any problem, make a guess and return to that question if you have time at the end. You don't lose points for guessing, so you should never leave a question blank. In Part 3, we'll talk about some strategies for guessing efficiently on the SAT Math Test.

Linear Equations

Part 2

An algebraic **equation** tells you that two expressions are equal to each other.

You can use an equation to say that $9x$ is equal to 36:

$$9x = 36$$

Often, you will be asked to solve an algebraic equation. If you are asked to “solve for x ,” you need to find a value for x that makes the equation true. For the equation above, you may know right away that $x = 4$ because $9 \times 4 = 36$.

Manipulating Equations

For more complicated algebraic equations, you may not be able to figure out the answer in your head. You will need to use a method to manipulate the equation and solve for the unknown variable. Your goal is always to **isolate** your variable—to get it by itself on one side of the equation. To do this, you can work backwards to “undo” all of the operations that are being performed on your variable until you can get it by itself.

There’s one important rule to remember when working with equations: whatever you do to one side of the equation, you must also do to the other! If you violate this rule, the two sides of your equation will no longer be equal.

You know the equation $4 = 4$ is a true statement. However, if you add a number to one side of the equation but not to the other, the two sides are no longer equal:

$$4 + 2 \neq 4$$

You need to add the same number to both sides of the equation so they remain equal:

$$4 + 2 = 4 + 2$$

Let’s see how this works with the following algebraic equation:

Example

$$3x - 2 = 13$$

On the left side of the equation, x is being multiplied by 3, and 2 is being subtracted from the product. You need to “undo” each of these operations by adding numbers to and dividing numbers from both sides of your equation. First, work with the operations that don’t involve the variable. In this case, you can undo the subtraction by adding 2 to each side:

$$3x - 2 + 2 = 13 + 2$$

$$3x = 15$$

Then, undo the multiplication by dividing each side by 3:

$$\frac{3x}{3} = \frac{15}{3}$$

$$x = 5$$

What if the equation has variables on both sides? First, get all of the variables onto one side of the equation and combine like terms. Then, isolate the variable like you just did above.

Example

$$5a - 7 = 2a - 1$$

First, get all of your variables on one side of the equation by subtracting $2a$ from each side and combining like terms:

$$5a - 2a - 7 = 2a - 2a - 1$$

$$3a - 7 = -1$$

Then, undo the subtraction by adding 7 to each side:

$$3a - 7 + 7 = -1 + 7$$

$$3a = 6$$

And finally, undo the multiplication by dividing each side by 3:

$$\frac{3a}{3} = \frac{6}{3}$$

$$a = 2$$

To test if you got the right answer, you can plug this number back into the original equation:

$$5a - 7 = 2a - 1$$

$$5 \times 2 - 7 = 2 \times 2 - 1$$

$$10 - 7 = 4 - 1$$

$$3 = 3$$

More Complicated Equations

Some equations will look much more complicated than the ones above. Don't let this scare you! You will always use the same process for solving linear equations with one variable. Work carefully through each step. Get your variable on one side and then undo the operations.

Example

$$\frac{5(x+7)}{4} = \frac{100-5x}{5}$$

You can see there are a lot of operations in this equation. You need to get the variable x on one side, but you'll have to do some other operations first. First, cross-multiply and use the distributive property:

$$\begin{aligned}(5 \times 5)(x+7) &= 4(100-5x) \\ 25x+175 &= 400-20x\end{aligned}$$

Then, undo the operations to get your variable on one side of the equation and your constant on the other side:

$$\begin{aligned}25x+175+20x &= 400-20x+20x \\ 45x+175 &= 400 \\ 45x+175-175 &= 400-175 \\ 45x &= 225\end{aligned}$$

Finally, divide by 45 on both sides to completely solve for x .

$$\begin{aligned}\frac{45x}{45} &= \frac{225}{45} \\ x &= 5\end{aligned}$$

Equations with Two Variables

Sometimes you will see an equation that has two different variables in it, such as $y = 2x + 6$. You will not be able to find an exact number for x or y without more information, as we will see in Part 5. However, you can solve for one variable *in terms of* the other. This means that your answer will still contain a variable.

To solve for one variable in terms of the other, use the same steps as for single-variable equations and treat the second variable as if it were a number. For the equation above, let's solve for x in terms of y .

Because you're solving for x , you need to get x by itself. Start by subtracting 6 from both sides, and then divide by 2:

$$y = 2x + 6$$

$$y - 6 = 2x + 6 - 6$$

$$\frac{y - 6}{2} = \frac{2x}{2}$$

$$\frac{y - 6}{2} = x$$

$\frac{y - 6}{2}$ is how you would represent x in terms of y .

You may also be asked to use an equation to solve for another algebraic expression.

Example

If $6x + 2y = 24$, what is the value of $3x + y$?

At first it might seem like you cannot find the answer without solving for x and y individually. Luckily, there is another way. We are looking for $3x + y$, not x or y alone. Look closely at the left side of the equation. You may notice that $6x + 2y$ divided by 2 gives you $3x + y$ —the exact expression we are looking for! Therefore, divide both sides of the equation by 2:

$$\frac{6x}{2} + \frac{2y}{2} = \frac{24}{2}$$

$$3x + y = 12$$

$3x + y$ is equal to 12.

Part 2 Practice: Linear Equations

1

If $a + 20 = 5$, what is the value of a ?

- A) -25
- B) -15
- C) -4
- D) 25

2

If $2x + 8 = 14$, what is the value of x ?

- A) -3
- B) 1
- C) 3
- D) 6

3

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

Given the expression above, which of the following expresses x in terms of y ?

- A) $\frac{y}{2}$
- B) y
- C) $2y$
- D) $3y$

4

If 1 divided by $3x$ is equal to 4 divided by $7y$, which of the following expresses x in terms of y ?

- A) $\frac{7y}{12}$
- B) $\frac{12y}{7}$
- C) $7y$
- D) $12y$

5

If $y = \frac{2(x+10)}{3}$, which of the following represents $2x$ in terms of y ?

- A) $\frac{3y}{2} - 10$
- B) $\frac{3y}{2} - 5$
- C) $3y - 10$
- D) $3y - 20$

Questions 6 and 7 refer to the following information.

The number of cows, c , and the number of ducks, d , a farmer has in his 4 acres of land is represented by the equation $\frac{2c}{3} + \frac{4d}{12} = 4$.

6

Given the equation above, what is $6c$ in terms of d ?

- A) $2d$
- B) $36 - 3d$
- C) $3d$
- D) $48 - 4d$

7

If there are 6 ducks, how many cows does the farmer have?

- A) 2
- B) 3
- C) 4
- D) 5

8

If $3x - 5 = 7$, what is the value of x ?

9

Charles' Law defines the relationship between the volume of a confined gas, V , and its temperature, T . When the temperature changes to a different temperature, D , the volume of the gas also changes to another volume, A . These relationships are defined as

$\frac{V}{T} = \frac{A}{D}$. To start, V is 3 and the temperature is 2. If the temperature, T , is increased by 3, what will be the value of the new volume, A ?

10

If $5j + z = 3$ is equal to $2z = a - bj$, what is $a + b$?

Practice Tests

Chapter 6

Section 3 (No-Calculator)

| | | | | | | | | | |
|---|--------------------|---|--------------------|---|--------------------|----|--------------------|----|--------------------|
| 1 | A B C D ○ ○ ○ ○ | 4 | A B C D ○ ○ ○ ○ | 7 | A B C D ○ ○ ○ ○ | 10 | A B C D ○ ○ ○ ○ | 13 | A B C D ○ ○ ○ ○ |
| 2 | A B C D ○ ○ ○ ○ | 5 | A B C D ○ ○ ○ ○ | 8 | A B C D ○ ○ ○ ○ | 11 | A B C D ○ ○ ○ ○ | 14 | A B C D ○ ○ ○ ○ |
| 3 | A B C D ○ ○ ○ ○ | 6 | A B C D ○ ○ ○ ○ | 9 | A B C D ○ ○ ○ ○ | 12 | A B C D ○ ○ ○ ○ | 15 | A B C D ○ ○ ○ ○ |

Only answers that are gridded will be scored. You will not receive credit for anything written in the boxes.

| | | | | |
|----------------------|----------------------|----------------------|----------------------|----------------------|
| 16 | 17 | 18 | 19 | 20 |
| <input type="text"/> |
| / ○ ○ | / ○ ○ | / ○ ○ | / ○ ○ | / ○ ○ |
| . ○ ○ ○ ○ | . ○ ○ ○ ○ | . ○ ○ ○ ○ | . ○ ○ ○ ○ | . ○ ○ ○ ○ |
| 0 ○ ○ ○ ○ | 0 ○ ○ ○ ○ | 0 ○ ○ ○ ○ | 0 ○ ○ ○ ○ | 0 ○ ○ ○ ○ |
| 1 ○ ○ ○ ○ | 1 ○ ○ ○ ○ | 1 ○ ○ ○ ○ | 1 ○ ○ ○ ○ | 1 ○ ○ ○ ○ |
| 2 ○ ○ ○ ○ | 2 ○ ○ ○ ○ | 2 ○ ○ ○ ○ | 2 ○ ○ ○ ○ | 2 ○ ○ ○ ○ |
| 3 ○ ○ ○ ○ | 3 ○ ○ ○ ○ | 3 ○ ○ ○ ○ | 3 ○ ○ ○ ○ | 3 ○ ○ ○ ○ |
| 4 ○ ○ ○ ○ | 4 ○ ○ ○ ○ | 4 ○ ○ ○ ○ | 4 ○ ○ ○ ○ | 4 ○ ○ ○ ○ |
| 5 ○ ○ ○ ○ | 5 ○ ○ ○ ○ | 5 ○ ○ ○ ○ | 5 ○ ○ ○ ○ | 5 ○ ○ ○ ○ |
| 6 ○ ○ ○ ○ | 6 ○ ○ ○ ○ | 6 ○ ○ ○ ○ | 6 ○ ○ ○ ○ | 6 ○ ○ ○ ○ |
| 7 ○ ○ ○ ○ | 7 ○ ○ ○ ○ | 7 ○ ○ ○ ○ | 7 ○ ○ ○ ○ | 7 ○ ○ ○ ○ |
| 8 ○ ○ ○ ○ | 8 ○ ○ ○ ○ | 8 ○ ○ ○ ○ | 8 ○ ○ ○ ○ | 8 ○ ○ ○ ○ |
| 9 ○ ○ ○ ○ | 9 ○ ○ ○ ○ | 9 ○ ○ ○ ○ | 9 ○ ○ ○ ○ | 9 ○ ○ ○ ○ |

Section 4 (Calculator)

| | | | | | | | | | |
|---|--------------------|----|--------------------|----|--------------------|----|--------------------|----|--------------------|
| 1 | A B C D ○ ○ ○ ○ | 7 | A B C D ○ ○ ○ ○ | 13 | A B C D ○ ○ ○ ○ | 19 | A B C D ○ ○ ○ ○ | 25 | A B C D ○ ○ ○ ○ |
| 2 | A B C D ○ ○ ○ ○ | 8 | A B C D ○ ○ ○ ○ | 14 | A B C D ○ ○ ○ ○ | 20 | A B C D ○ ○ ○ ○ | 26 | A B C D ○ ○ ○ ○ |
| 3 | A B C D ○ ○ ○ ○ | 9 | A B C D ○ ○ ○ ○ | 15 | A B C D ○ ○ ○ ○ | 21 | A B C D ○ ○ ○ ○ | 27 | A B C D ○ ○ ○ ○ |
| 4 | A B C D ○ ○ ○ ○ | 10 | A B C D ○ ○ ○ ○ | 16 | A B C D ○ ○ ○ ○ | 22 | A B C D ○ ○ ○ ○ | 28 | A B C D ○ ○ ○ ○ |
| 5 | A B C D ○ ○ ○ ○ | 11 | A B C D ○ ○ ○ ○ | 17 | A B C D ○ ○ ○ ○ | 23 | A B C D ○ ○ ○ ○ | 29 | A B C D ○ ○ ○ ○ |
| 6 | A B C D ○ ○ ○ ○ | 12 | A B C D ○ ○ ○ ○ | 18 | A B C D ○ ○ ○ ○ | 24 | A B C D ○ ○ ○ ○ | 30 | A B C D ○ ○ ○ ○ |

Questions 12-22 are based on the following passages.

Passage 1 and Passage 2 are adapted from Robert S. Blumenthal and Rita Redberg, "Should Healthy People Take Cholesterol Drugs to Prevent Heart Disease?" © 2014 by Dow Jones & Company.

Passage 1

Heart disease is the leading cause of death in the U.S., and people with higher cholesterol are at higher risk for heart attacks. There's good evidence that people who already have heart disease benefit from cholesterol-lowering medications, or statins. Among those people, statin treatment reduces risk of heart attack and may prolong life.

But what about healthy people with high cholesterol? Many doctors have taken the evidence from studies of people with heart disease and made a leap of logic: they've treated millions of healthy people with statins to prevent heart disease.

But there's a serious problem with that logic. For most healthy people, data show that statins do not prevent heart disease, nor extend life or improve quality of life. And they come with considerable side effects. That's why I don't recommend giving statins to healthy people, even those with higher cholesterol.

Despite research that has included tens of thousands of people, there is no evidence that taking statins prolongs life, although cholesterol levels do decrease. Using the most optimistic projections, for every 100 healthy people who take statins for five years, one or two will avoid a heart attack. One will develop diabetes. But, on average, there is no evidence that the group taking statins will live any longer than those who don't.

Some argue that clinical trials of statin use among healthy people haven't demonstrated a reduced mortality rate because each individual trial only follows patients for a few years—not long enough to show a reduction in mortality. Many doctors, including me, believe that we need clinical trials that actually follow healthy people treated with statins for the long term to see if treatment really

results in lower mortality. Statin proponents think such trials would be prohibitively expensive. That's a disappointing stance, considering the billions that have already been spent on statin prescriptions and advertising.

Some statin supporters argue that even if the data don't support the benefits of statins in healthy people, they might help and can't hurt. But that's untenable, because statins undeniably harm some people. Besides increasing the risk for developing diabetes, statins can cause memory loss, muscle weakness, stomach distress, and aches and pains. These aren't merely anecdotal results, as some critics assert; they're documented by recent studies.

Passage 2

We don't prescribe drugs to otherwise healthy people without rigorous scientific evidence. And, in this case, there is a mountain of high-quality scientific evidence.

Heart disease is an insidious process that takes decades to manifest itself. Risk factors for developing heart disease often go unrecognized and undertreated until it's too late. So, the first manifestation of cardiovascular disease is often sudden cardiac death, heart attack, or stroke—which may result in disability or death. A little late at that point to start prescribing statins.

Yet critics say we should wait until after a patient has gone through one of these life-shattering events before we prescribe a statin. It makes no sense that a medication that slows the progression of hardening of the arteries would be harmful the day or week before a heart attack, but helpful the day or week after a heart attack.

The totality of the available biologic, observational, and clinical-trial evidence strongly supports the selective use of statin therapy in adults demonstrated to be at high risk for heart disease. Studies have conclusively shown that statins prolong life and reduce the risk of heart attack, stroke, and death in patients with known heart disease. Similarly, they have been shown to do the same in

CONTINUE

patients without heart disease, but who are at high risk of developing heart disease.

- 80 For instance, a study of 6,600 Scottish men who hadn't had heart attacks showed a decrease in mortality rates after five years with statin therapy. Likewise, the recent world-wide Jupiter study of men and women without prior heart disease
- 85 showed statins significantly decreased the risk of death after two years in people with an average age of 66.

Critics raise a number of complaints about these studies—exaggerated, in my view—but

90 many other large prevention trials of people with multiple risk factors have consistently shown reductions in total cardiovascular events of 30% to 40% with the use of a statin.

12

It can be reasonably inferred from Passage 1 that the author would most likely recommend statins for a patient who

- A) is male and between the ages of 65 and 74.
- B) has an unusually high cholesterol level.
- C) is at a higher than average risk of having a heart attack.
- D) is already suffering from heart disease.

13

Which choice provides the best evidence for the answer to the previous question?

- A) Lines 3-5 (“There’s good ... statins”)
- B) Lines 9-12 (“Many doctors ... disease”)
- C) Lines 17-19 (“That’s why ... cholesterol”)
- D) Lines 33-37 (“Many ... mortality”)

14

According to Passage 1, which of the following best describes the relationship between statins and diabetes?

- A) People with diabetes are not allowed to take statins.
- B) People are more likely to develop diabetes when using statins.
- C) Statins are often prescribed for the treatment of diabetes.
- D) People are less likely to develop diabetes when using statins.

15

As used in line 31, “individual” most nearly means

- A) peculiar.
- B) personal.
- C) secluded.
- D) particular.



4

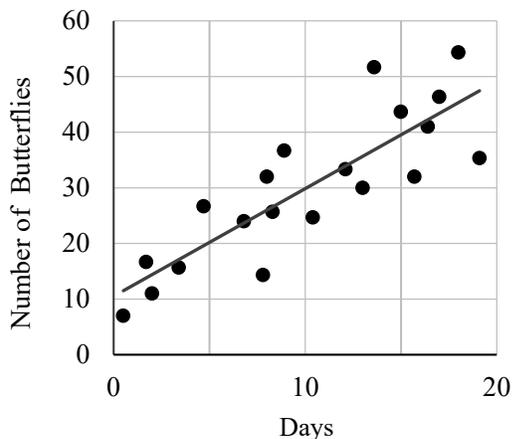
$$3x + y < 8$$

How many pairs of positive integers (x, y) satisfy the inequality above?

- A) 1
- B) 3
- C) 5
- D) 7

5

Count of Monarch Butterflies



The scatterplot above shows the number of Monarch butterflies over a three-week period. Based on the line of best fit, which of the following values is closest to the average daily increase in the number of Monarch butterflies?

- A) 0.5
- B) 2
- C) 10
- D) 40

6

a is 8% of b and b is 150% greater than c . If c is 25, what is the value of a ?

- A) 4
- B) 3
- C) 2
- D) 1

7

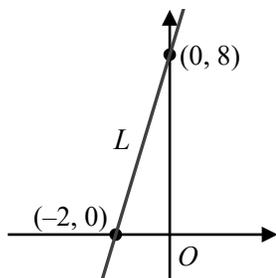
| | Symptoms | No Symptoms |
|----------------|----------|-------------|
| Vaccinated | 216 | 1134 |
| Not Vaccinated | 584 | 336 |

A hospital collected data from patients who were exposed to a certain virus. The hospital recorded whether the patients had been vaccinated for the virus and whether they showed symptoms. The data is summarized in the chart above. What percentage of patients who showed symptoms had been vaccinated?

- A) 16%
- B) 27%
- C) 37%
- D) 73%



14



Which of the following equations describes a line that is perpendicular to line L above?

- A) $y = 4x + 8$
- B) $y = -4x + 8$
- C) $y = \frac{1}{4}x + 8$
- D) $y = -\frac{1}{4}x + 8$

15

A car dealer buys a car from a manufacturer. The dealer increases the price of the car by 20% to \$36,000. The dealer then sells the car at a 5% discount. What is the dealer's total profit from the sale of the car?

- A) \$4,200
- B) \$6,000
- C) \$7,200
- D) \$9,000

16

$$\frac{4(x+1)-1}{3} = \frac{8-(5-x)}{5}$$

What is the value of x in the equation above?

- A) $-\frac{24}{17}$
- B) $-\frac{6}{17}$
- C) $-\frac{24}{23}$
- D) $-\frac{6}{23}$

17

Which of the following expressions is NOT equal to $3\sqrt{32x}$?

- A) $12\sqrt{2x}$
- B) $6\sqrt{8x}$
- C) $4\sqrt{12x}$
- D) $\sqrt{288x}$