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Contents at a Glance

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Introduction

Just like going to the senior prom or getting a driver's license, the SAT is one of those milestones in the life of a high school student. I wish I could say it was as much fun as those other things, but if I did, you probably wouldn't believe anything else I say in the rest of the book.

But any way you slice it, the SAT is still there, scheduled for some Saturday morning a few weeks or months from now. Most colleges require you to submit an SAT score as part of your application process. So because there's no getting around it and it's not going away, your best bet is to do some preparation and get the best possible SAT score you can.

That's where this book comes in. The entire book you have in your hot little hands right now is devoted to refining the math skills you need most to succeed on that all-important SATurday.

About This Book

A lot of SAT prep books divide their attention among all three sections of the SAT: English, math, and the writing sample. This is fine as far as it goes, because you probably want to boost all three scores. But in this book, I focus exclusively on math, math, and more math to help you achieve the best score you can on this — what can I say? — most often dreaded part of the test.

The SAT covers a variety of areas, including algebra, geometry, trigonometry, functions and graphs, and statistics and probability. This book focuses on those SAT topics and helps you get used to problem-solving so that you can turn facts and formulas into useful tools.

I wrote this book to give you the best possible advantage at achieving a good score on the math portion of your SAT. There's no shortcut, but most of what you need to work on comes down to four key factors:

- Knowing the basics inside and out
- Strengthening SAT-specific math skills
- Practicing answering SAT questions
- Time yourself taking SAT practice tests

For that last point, almost every example and problem here is written in SAT format — either as a multiple-choice question or as a student-produced grid-in question. Chapters 3 to 15 contain math skills that are essential to the SAT. And to give you that test-day experience, this book also includes two practice tests, with access to an additional online practice test. That's hundreds and hundreds of questions designed to strengthen your "SAT muscle," so to speak.

This book also has a few conventions to keep in mind:

- New terms introduced in a chapter, as well as variables, are in *italics.*
- Keywords in lists and numbered steps are in **boldface.**
- Any websites appear in `monofont`.
- For multiple-choice questions, that's a letter from (A) to (D). For grid-in questions, I write the answer as you'd fill it in on the test. So as a test answer, I give $\frac{7}{9}$ as 7/9 or .777 or .778, which are all acceptable ways to write it on your answer sheet.

Foolish Assumptions

This is an SAT prep book, so my first assumption is that you or someone you love (your son or daughter, mom or granddad, or perhaps your cat) is thinking about taking the SAT sometime in the future. If not, you're still welcome to buy the book.

My second assumption is that you're currently taking or have in your life at some point taken an algebra course, even if you feel like it's all a blur. Now, I *wish* I could tell you that algebra isn't very important on the SAT — oh, a mere trifle, hardly a thought. But this would be like saying you can play NFL football without getting rushed at by a bunch of 250-pound guys trying to pulverize you. It just ain't so.

But don't worry — this book is all about the blur and, more importantly, what lies beyond it. Read on, walk through the examples, and then try out the practice problems at the end of each chapter. I can virtually guarantee that if you do this, the stuff will start to make sense.

Icons Used in This Book

In this book, I use these four icons to signal what's most important along the way:


REMEMBER

This icon points out important information that you need to focus on. Make sure you understand this information fully before moving on. You can skim through these icons when reading a chapter to make sure you remember the highlights.


EXAMPLE

Each example is a formal SAT-style question followed by a step-by-step solution. Work through these examples and then refer to them to help you solve the practice problems at the end of the chapter.


TIP

Tips are hints that can help speed you along when answering a question. See whether you find them useful when working on practice problems.


WARNING

This icon flags common mistakes that students make if they're not careful. Take note and proceed with caution!

Beyond the Book

In addition to what you're reading right now, this book comes with a free access-anywhere Cheat Sheet that includes tips to help you prepare for the math sections of the SAT. To get this Cheat Sheet, simply go to www.dummies.com and type **SAT Math For Dummies Cheat Sheet** in the Search box.

You also get access to three full-length online practice tests. To gain access to the online practice, all you have to do is register. Just follow these simple steps:

1. **Register your book or ebook at Dummies.com to get your PIN (go to www.dummies.com/go/getaccess).**
2. **Select your product from the drop-down list on that page.**
3. **Follow the prompts to validate your product, and then check your email for a confirmation message that includes your PIN and instructions for logging in.**

If you do not receive this email within two hours, please check your spam folder before contacting the Technical Support website at http://support.wiley.com or by phone at 877-762-2974.

Now you're ready to go! You can come back to the practice material as often as you want — simply log on with the username and password you created during your initial login. No need to enter the access code a second time.

Your registration is good for one year from the day you activate your PIN.

Where to Go from Here

This book is organized so that you can safely jump around and dip into every chapter in whatever order you like. You can strengthen skills you feel confident in or work on those that need some attention.

If this is your first introduction to SAT math, I strongly recommend that you start out by reading Chapter 1. There, you find some simple but vital SAT-specific information that you need to know before you sit down with pencil in hand to take the test.

If you'd like to start out by getting a sense of how ready you are for the SAT, skip forward to Chapter 16 and take a practice test. When you're done, check out Chapter 17 to see how many questions you got correct, and to read through the answer explanation for every question you got wrong.

However, if it's been a while since you've taken a math course, read Chapter 2, which covers the pre-algebra math-skills you need to know before you proceed to the more difficult math later in the book. Chapters 3 and 4, which cover algebra expressions and equations, can get your math brain moving again, and you may find that a lot of this stuff looks familiar as you go along.

Finally, if you read through a few chapters and feel that the book is moving more quickly than you'd like, go ahead and pick up my earlier book, *Basic Math & Pre-Algebra For Dummies* (John Wiley & Sons). There, I adopt a more leisurely pace and spend more time filling in any gaps in understanding you may find along the way.

1 Getting Started with SAT Math

IN THIS PART . . .

Knowing SAT basics, including strategies for maximizing your score

Reviewing important pre-algebra concepts you may have forgotten

IN THIS CHAPTER

- Knowing how the SAT math test is organized
- Getting familiar with the Reference formulas provided on the first page of every math test
- Understanding how to enter answers to gridded-response questions
- Identifying the math topics tested on the SAT
- Knowing some basic SAT math strategies
- Coming up with a basic plan of action for getting the SAT math score you need

Chapter 1

Welcome to SAT Math

SAT math — what joy, what utter bliss!

Well, all right — back on Earth, you probably have some work to do before you reach this stage. I promise to do everything in my power to make your study time as painless and productive as possible. All I ask is that you trust in yourself: You already know more than you think you do.

If you've taken (or are currently taking) algebra in school, much of this book may seem like review. The task at hand is to focus your work on the skills you need to get the best SAT score you can. So in this chapter, I give you a basic overview of SAT math, including scoring, calculator use, and how to enter gridded-response questions into the grid.

I also give you a bit of essential SAT math strategy that every student needs to know. I encourage you to think about your goal for the next SAT based on the level you're currently working at.

Finally, I present three SAT success stories, in which three very different students who set and reached different SAT goals got into the colleges that they were aiming for.

SAT Math Basics

The SAT is a college readiness test and, in some U.S. states, is now being used as a skills test for high school graduation. It covers two main subject areas: English and math. Each subject area is scored on a 200-to-800 point scale, resulting in a composite SAT score from 400 to 1,600 points. (If you have any older sisters or brothers who took the SAT before 2016, they may recall that the test used to be scored on a 600- to 2,400-point scale, but that's all history now.)

Here's an overview of the two math sections of the current SAT.

- A 25-minute No Calculator section containing the following:
  - 15 multiple-choice questions, which require you to choose the right answer from among four choices, (A) through (D)
  - 5 gridded-response questions (also called student-produced response questions), which require you to record your answer in a special grid
- A 55-minute Calculator section containing the following:
  - 30 multiple-choice questions
  - 8 gridded-response questions

That's a total of 58 questions, each of which counts for 1 point on your raw score of correct answers (from 0 to 58). This raw score is converted to a scaled score (from 200 to 800), which becomes your SAT math score.

Using the Reference list of formulas

Every SAT math section (No Calculator and Calculator) includes a handy Reference list of formulas that you can use while taking the test, as shown in Figure 1-1. As you can see, this list includes a variety of geometric formulas for the area and circumference of a circle, the area of a rectangle and triangle, the Pythagorean Theorem, and other favorites.

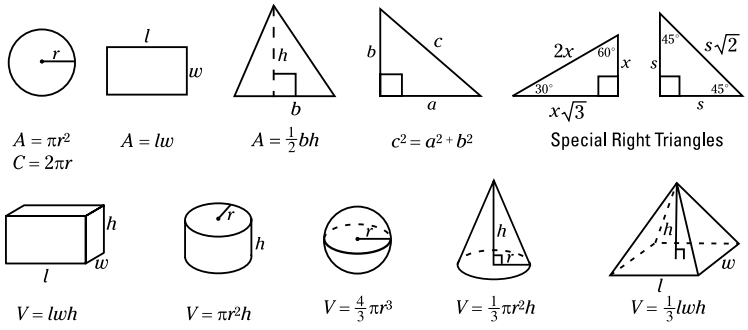

FIGURE 1-1: The Reference list of formulas for the SAT.

TIP

Before taking the SAT, be sure you're familiar with this Reference information, so you'll remember it's there when you're working under time pressure on the actual test.

Filling answers into the grid

Thirteen of the 58 math questions you'll answer when taking the SAT are gridded-response questions. These are Questions 16 to 20 of the No Calculator math test and Questions 31 to 38 of the

Calculator math test. To answer them, you need to fill in the grid provided with your answer sheet.

Most students don't find the grid too difficult to work with. The official SAT instructions for using the grid are provided on every test just before the gridded-response questions. Here are a few things to keep in mind as you work with the grid:

- The grid has four columns, into each of which you can place a digit from 0 to 9, or in some columns a fraction slash (/) or a decimal point (.).
- Be sure to fill in the appropriate bubble in each column so the computer can read your answer. If you don't, your answer will be marked wrong.
- Use the boxes at the top for recording your answer so you can read it easily and change it if necessary.
- The grid contains no minus sign, so all answers are non-negative numbers. (This includes "0".)
- If your answer is a whole number, you can enter it into the grid using any consecutive boxes. For example, here are three equally valid ways to enter the answer "23":

2	3		
	2	3	
		2	3

- If your answer is a fraction, use the fraction slash to record your answer. For example, here are two equally valid ways to enter the answer "1/2".

1	/	2	
	1	/	2

- Don't attempt to enter a mixed number such as $4\frac{1}{2}$ into the grid, because the computer will read this answer as $\frac{41}{2}$ and mark it wrong. Instead, convert mixed numbers to improper fractions or decimals ($4\frac{1}{2} = \frac{9}{2} = 4.5$) and use one of these formats to enter your answer.
- If your answer is a decimal that's less than 1, use the decimal point **without a leading zero** to record your answer. For example, you can enter the answer ".5" in any of following ways:

.	5		
	.	5	
		.	5

- If your answer is a decimal with more decimal places than will fit in the grid, fill in as many decimal places as will fit, either truncating the last decimal place or rounding it up. For example, here are the two ways you can enter the decimal 3.479 into the grid:

3	.	4	7
3	.	4	8

REMEMBER

Although these rules may seem overly complicated, in most cases your actual SAT answers will be relatively straightforward.

Overview of SAT Math Topics

The math that's covered on the SAT is very closely tracked to the math that's covered in most U.S. high school math classes. So if you're a current or recent U.S. high school student, you're probably familiar with most of this curriculum.

The SAT breaks this down into three general areas of study: Heart of Algebra, Problem Solving and Data Analysis, and Passport to Advanced Math (and Other Topics). In this section, I give you an overview of each of these topics.

Heart of Algebra

Heart of Algebra centers on the linear function $y = mx + b$ and other information covered in a typical high school Algebra I class. To answer SAT math questions in this area, you'll need to feel comfortable working with the following:

- Evaluating, simplifying, and factoring algebra expressions (Chapter 3)
- Solving algebra equations and inequalities (Chapter 4)
- Working with linear functions in four complementary ways: words, tables, graphs, and equations (Chapter 5)
- Solving systems of equations (both linear and non-linear), and identifying when such systems have either no solution or infinitely many solutions (Chapter 6)

In Part 2, I cover all these topics in depth.

Problem Solving and Data Analysis

Problem Solving and Data Analysis focuses on a short list of problem-solving techniques:

- Working with ratios, proportional equations, and percentages (Chapter 7)
- Relying on a basic understanding of statistics and probability (Chapter 8)
- Applying these techniques to information presented visually in tables and graphs (Chapter 9)

Part 3 focuses exclusively on these ideas.

Passport to Advanced Math (and Other Topics)

Passport to Advanced Math (and Other Topics) requires you to understand a core of information covered in high school Algebra II:

- Working with functions using $f(x)$ notation, and knowing how to graph a core of basic functions and their most elementary transformations (Chapter 10)
- Understanding how to work with and graph polynomials, especially linear, quadratic, cubic, and quartic polynomials (Chapter 11)

- Graphing quadratic functions using standard, vertex, and factored forms (Chapter 12)
- Graphing exponential and radical equations (Chapter 13)
- Solving problems using basic geometry and trigonometry (Chapter 14)
- Working with complex numbers and circles on the *xy*-plane (Chapter 15)

I provide this information in Part 4.

SAT Math Strategy

When it comes to doing well on the SAT, your test-taking strategy is a small but important piece of the puzzle. And this strategy also extends to knowing which questions to answer and which to skip, depending on the score you're currently striving for.

In this section, I fill you in on this essential information.

Isn't there some way to get a good SAT Math score without actually knowing math?

No.

I'd love to tell you otherwise, but no.

If the key to getting a great score were, say, choosing Answer C on every question, the name of this book would be Answer C Math For Dummies and it would be a ***lot*** shorter.

While you fully absorb that difficult truth, I will add that there's a reasonable amount of strategy you should absolutely know before taking your first SAT. And while you may think that lots of students already know this stuff, plenty of others don't — yet.

I don't want you to be one of them.

So read on.

Is there a penalty for guessing?

If you have an older brother or sister who took the SAT before 2016, they may remember the old format, which had a penalty for filling in a wrong answer.

So please take note: **The SAT in its current form has no penalty for filling in a wrong answer.** This goes for all four sections, the English as well as the math sections.

Obviously, then, you want to make sure that you fill in at least some answer for each multiple-choice question on the two math sections. That's 45 questions, so by pure chance, you can expect to get about 11 questions right just by making wild guesses.

Let's take that thinking a step further: If you ***don't*** fill guesses for all the questions you don't have time to think about, you'll be competing against a ton of other students who *are* guessing. So, bottom line, you can't afford ***not*** to guess every question you don't know the answer to.

What about the gridded-response questions? Well, because these questions are entirely open ended, you don't have much chance of answering them correctly with a wild guess. But if you have any idea what the answer might be, go ahead and grid it in. Worst case, doing this won't lose you any points.

Are some questions harder than others?

Generally speaking, SAT Math questions fall into three categories of difficulty: easy, medium, and hard.

In both the No Calculator and Calculator sections of the test, the multiple-choice questions are roughly in order from easy, to medium, to hard. And then this pattern repeats, with the shorter grid-in question section also progressing from easy, to medium, to hard.

Table 1-1 shows the rough breakdown of questions by difficulty levels.

TABLE 1-1 Easy, Medium, and Hard Questions

Section 3 — No Calculator			Section 4 — Calculator		
Question Type	Question Number	Difficulty Level	Question Type	Question Number	Difficulty Level
Multiple Choice	1-5	Easy	Multiple Choice	1-10	Easy
	6-10	Medium		11-20	Medium
	11-15	Hard		20-30	Hard
Grid-In	16-17	Easy	Grid-In	31-33	Easy
	18	Medium		34-35	Medium
	19-20	Hard		36-38	Hard

Remember that *every* question counts for one point toward your raw score, which directly affects your scaled score (200–800). So, unlike the tests you take in school, the easiest and hardest questions on the SAT both have the same value.

Do I have to answer every question?

The short answer is, no, you don't have to answer every SAT math question to get a good score.

In fact, depending on your current performance level on practice tests, it may very well be to your benefit ***not*** to answer all the questions.

This piece of strategy definitely goes against a lot of your training as a high school student. After all, in most of your classes, you can't get an A or even a B on a test without answering just about all the questions. If you only answer 75 percent and skip the rest, even if you answer perfectly, probably the best you can hope for is a C.

However, the situation with the SAT is entirely different.

On the SAT, you can get a 500 math score by answering only about 55 percent of the questions on the test correctly.

I dive more deeply into this aspect of strategy later in this section, when I ask you to consider your own personal starting point, path, and goal for the SAT.

For now — and this goes double if you're a perfectionist — simply let go of the compulsive need to answer all 58 math questions on the SAT. Until you're **already** scoring 740+ on your practice tests, answering all the questions would be a poor allocation of your time. If you're answering all the questions, you're probably rushing through questions that are within your reach, and losing points you should be getting.

So, how many questions should I answer?

The answer to this question depends on your current score, which I break down into three basic scenarios.

Clearing 500

Most schools prefer to enroll students who have an SAT composite score of at least 1,000, which is approximately 500 on both the English and the math tests.

If your English score is 550 or higher, you may be able to get away with a math score that's slightly less than 500. Even so, a good first goal would be to break 500 on the math test.

To get this score, you need to answer about 32 of the 58 SAT math questions correctly. To this end, refer to Table 1-1, and then plan to do the following:

- Attempt to answer *all* 20 easy questions correctly.
- Choose 12 out of 18 medium questions to answer correctly, and guess the rest.
- Guess on the 20 hard questions.

I know it seems weird to guess so many questions. But the SAT is different from the tests you take in school, where you need to get at least 80 percent right to get a decent grade.

Choosing 32 easy and medium questions to focus on gives you almost three minutes per question, which increases your changes of answering more questions correctly. And remember that you have a 25 percent chance of guessing each multiple-choice question correctly, which will also help increase your score a bit.

Believe me, in my experience working with hundreds of students, if you're simply trying to break 500, you probably need to give yourself *more* time by answering *fewer* questions.

Breaking solidly beyond 600

At the next level are students applying for colleges that strongly encourage a composite SAT score of 1,200 or more. That means aiming for at least a 600 score in math, which requires 42 to 45 correct answers.

Here's what I recommend (again, referring to Table 1-1 for question difficulty):

- Attempt to answer *all* 20 easy questions correctly.
- Attempt to answer *all* 18 medium questions correctly.
- Choose 5 to 7 hard questions to attempt to answer, and guess the rest.

In picking the hard questions, aim for familiar-looking problems that you think you've got a shot at answering. Don't spend too much time on any single problem!

Reaching 700 and beyond

If you're striving to break 1,400 or even 1,500 on your SAT composite score, you know that there's no easy answer. You'll want to get a math score of 700 or more, with a little wiggle room if you're confident of scoring 750 or more on the English test.

The good news is that you're obviously a strong student with a well-practiced set of study skills. So, you know that you'll need to at least attempt to answer just about every question on the test, leaving perhaps the two or three hardest questions until the very end.

I recommend getting a private tutor if you don't already have one. Take as many practice tests as you can, and then comb through your wrong answers and do your best to figure out where you went wrong. If your math teacher is supportive, bring especially hard SAT problems to them — they'll almost certainly be willing to help!

When's the latest I can take the SAT and still get into school?

Most students take the SAT with their class in May or June of their junior year. They may try it out before that, but somehow, it doesn't feel real until their whole class is doing it, too.

But if that's the beginning, it doesn't have to be the end.

Usually, December of your senior year is your last shot at the SAT if you want to start college the following fall. Unless you're applying for early acceptance, most colleges don't make their final decisions until after the December SAT scores have been posted.

Hey wait — do I even have to take the SAT to go to college?

I've saved this question for last because if you've read this far, you're clearly an engaged student who's looking for a quality answer to this question rather than an easy one. But in these obviously changing times in education — in both the U.S. and throughout the world — this is a valid question that's worth thinking about.

The short answer is "Definitely maybe."

Even before the COVID-19 pandemic began, a significant number of U.S. colleges and universities had started de-emphasizing the SAT in their entrance requirements and, in some cases, dropping the requirement. And most of them had already begun accepting the ACT in place of the SAT to fulfill this requirement.

The pandemic mostly accelerated these trends.

So a slightly longer answer to the above question would be, "Check the current requirements for the college(s) you're applying to." These requirements may be in flux for the next few years, so stay attuned to any changes as they may be announced.

As for my own humble opinion, I would say that a good SAT (or ACT) score is still likely to open the ivy-draped gates you seek to enter for the foreseeable future. Entrance exams such as these have been around a long, long time. Arguably, they aren't the best statistical indicator of future college success. (That, by the way, would be past success in high school — so keep those grades up!) But large educational institutions — and the institution of education as a whole — tend to be about as responsive and quick to change course as aircraft carriers.

Furthermore, even as colleges weigh the pros and cons of their SAT/ACT requirements, some state school systems have begun requiring the SAT as part of their graduation requirements. And this trend appears to be growing in popularity, at least for the time being.

So to sum up, while your grandchildren may not end up having to take the SAT, if you want to keep your educational options open, you probably won't have the same luxury.

Three SAT Success Stories

Finally, here are three SAT success stories from my recent years of teaching and tutoring. Each of them is a composite of several similar students, with the names changed and all that. But I'm very proud of them all!

Jay's story — clearing 500

When Jay started studying with me, his goal was very straightforward. A gifted lacrosse player, he was already being recruited by a coach at a college where several of his former teammates were already going. They loved it, and he wanted to join them.

So his high school plan was simple: play hard on the lacrosse field, keep his grades up, and break 1,000 on the SAT.

Jay and I worked together for two or three months, and when he took the test for the first time, he got a 520 in English and a 510 in math. With a 1,030 composite SAT score to work with, the coach advocated for him, and Jay received an early acceptance letter a few weeks later.

As much as he enjoyed working with me on SAT math, he was done. As I write this, he's the captain of his college lacrosse team.

Shaun's story — breaking solidly beyond 600

I met Shaun when he was a sophomore, in an SAT class full of all juniors and seniors. He was likeable, quirky, and smart, definitely holding his own in a class full of kids one and two years older than him. His real interest was engineering, and he had a garage full of cool projects in various states of completion.

After the SAT class was done, I started working with him one-on-one over the summer between his sophomore and junior years. He did well on the practice tests, but missed math questions he should have gotten, mostly because he misread the question or made a minor calculation error.

He and I worked together to solidify his skills in the areas of math that most SAT questions focus on: linear functions, linear systems of equations, and quadratic functions. I also encouraged him

to spend more time answering the easy-to-medium questions and skipping over the difficult, time-consuming ones.

Shaun thought he was ready to take the SAT for real at the beginning of his junior year. His father thought he needed more practice. I recommended that he take it, if only to resolve their difference of opinion with an actual score. On his first try, he got a 1,340 — 680 in English, 660 in math.

"If you'd like to break 1,400," I suggested, "we can keep on going."

But instead, Shaun just kept his grades up, applied to a good engineering program, and got early acceptance. Case closed.

Amy's story — reaching 700 and beyond

Amy was a bright student, at the top of her class at a very competitive private school. She was already just about killing her SAT practice tests when I began to tutor with her.

We worked together for three or four months, and then she took the SAT with the rest of her class in May of her junior year. On her first try, she got a 750 in English and a 730 in math.

For any other student, that would have been the ballgame. For Amy, getting a 1,480 just about drove her crazy. "Twenty more points! That's all I need!"

We continued through the summer, and she worked tirelessly. For a day or two, just a couple weeks before the August test, I thought she might crack. "You don't have to do this." I explained. "You already have an amazing score. But if you're going to the SAT Olympics, I'm going to coach you at that level."

She pressed on, took the test — and got a 1,530 composite, with a 770 in English and a 760 in math. With her grades, extra-curricular activities, and a tremendous common app essay, she was accepted to her first-choice school. I bet you've heard of it!