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Chapter 1
Welcome to SAT Math

In this chapter, I give you a general overview of the new SAT. Then I provide you with a more thorough look at the SAT Math test, including the math topics you're most likely to find there. I discuss the Reference and Calculator tabs you'll have access to. I also help you avoid a few unnecessary errors you may encounter when entering answers to fill-in-the-blank questions.

After that, I 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.

Quick Overview of the New Online SAT Format

The SAT is a college readiness test and, in some U.S. states, is now being used as a skills test required for high school graduation.

It covers two main subjects in four sections: two Reading and Writing sections, followed by two Math sections. Each subject is scored on a 200-to-800 point scale, resulting in a composite SAT score from 400 to 1,600 points.

The big news is that starting in March of 2024, the SAT will be changing to an exclusively online format. In this section, I give you a basic overview of the SAT in its new online format.

Knowing how many questions you'll face and how much time you'll have to answer them

REMEMBER

Starting in March of 2024, the wise elders of the SAT are changing its format from a paper-based to online format.

The new version will comprise 98 questions (down from 154), for which you'll be given a total of 134 minutes (down from 180). I've summed up the information you'll need most in Table 1-1.

TABLE 1-1 Overview of the New SAT Format

Section	Subject	Time in Minutes	Number of Questions	Minutes Per Question
Section 1	Reading and Writing	35	27	1:20
Section 2	Reading and Writing	35	27	1:20
Section 3	Math	32	22	1:30
Section 4	Math	32	22	1:30

This is all fairly good news for students. You'll spend *less* time answering *fewer* questions, but you'll have a little less time pressure, with tad *more* time to answer each question. To me, that looks like a win-win-win.

Understanding key changes found in the SAT online format

The new online SAT format provides a few important upgrades to the previous paper-based version of the SAT.

For starters, the SAT questions that you answer will be drawn from a large pool of SAT questions, rather than printed in booklets and distributed to students. This change means that the test you take will literally be different from the test that the person sitting next to you is taking — or that your best friend will take the following week.

One result of this change is that cheating becomes a lot more difficult. Students may (and probably will) still post SAT questions and answers online, and other students like yourself may still read them. But if you do, you'll probably just end up figuring out how to answer a lot of questions that will never actually appear on your test. (Another word for this practice is *studying*, which virtually all teachers encourage, so please have at it!)

Furthermore, the SAT is now *adaptive*, which means that it adjusts its difficulty level depending upon how well you perform. So, after you complete your Section 1 Reading and Writing Test, an algorithm adjusts the type and difficulty levels of the questions that you'll see on Section 2 just

for you. Likewise, after you finish your Section 3 Math Test, a similar algorithm performs the same magic, adjusting the questions on Section 4.

The good news here is that this new feature makes it possible for the system to produce a reliable score using 56 fewer questions and using 41 fewer minutes of your valuable time compared with the paper-based test.

SAT Math Basics

In the new format, both SAT Math sections will include 22 questions.

That's a total of 44 questions, each of which counts for 1 point on your raw score of correct answers (from 0 to 44). This raw score is converted to a scaled score (from 200 to 800), which becomes your SAT math score.

Using the Reference tab

The SAT math test 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.

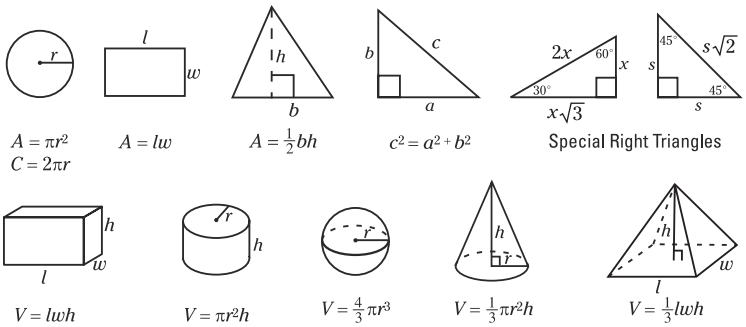

FIGURE 1-1: The Reference list of formulas for the SAT.

To access this list at any time, click the Reference tab at the top right of the test page.

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.

Clicking the Calculator tab

On the new version of the SAT, you can use a calculator on *every question*! This marks a big change from the previous paper-based version of the test, which had a No Calculator section.

The test itself provides an online calculator. To open it, click the Calculator tab at the top right of the page. The calculator is relatively self-explanatory, with a variety of calculator functions available to you. It also includes a graphing component to help you answer more difficult questions.

You can also use an SAT approved calculator, such as the one that you're using in your current math class. It should go without saying (but I'll say it anyway) that you're not allowed to use any non-approved calculator — especially the one on your phone! — while you're taking the SAT.

Answering student produced response (fill-in-the-blank) questions

The SAT math test includes 44 questions:

- 33 multiple-choice questions (Answer A through D)
- 11 student-produced response questions (sometimes called open-ended questions or fill-in-the-blank questions)

From your online adventures as a math student, you're almost certainly familiar with both of these types of test questions.

Multiple-choice questions are just about foolproof. What can I say to be helpful? Don't click *B* when you meant to click *C*.

Fill-in-the-blank questions aren't all that much more difficult to handle. The new online SAT has, fortunately for you test takers out there, done away with the confusing grid that it used to employ in its paper-based format. (And we don't miss it one bit!) So, in most cases, entering positive or negative integer answers should be a no-brainer.

Just a couple of words on entering rational numbers — that is, fractions and decimals:

- Enter rational numbers that are greater than 1 (or less than –1) either as decimals or as improper fractions — *never* try to enter them as mixed numbers.

  For example, suppose you want to enter the number 4.5. This decimal format works fine, or if you like, you can enter it as 9/2, which will appear as $\frac{9}{2}$. But *don't* try to enter it as 4 1/2, because this will show up incorrectly as $\frac{41}{2}$.
- Enter rational numbers that are repeating decimals either as fractions or by filling out the *entire* space available — *don't* truncate them to save space.

  For example, suppose you want to enter the number 2/3. This fractional format will show up correctly as $\frac{2}{3}$, or if you like you can enter it as a decimal in any of the following ways:

  Right: **.6666** **.6667** **0.666** **0.667**

  When entering a repeating decimal like this one, just make sure to fill in as many numbers as possible to fit in the space given — that is, four numbers and a decimal point. *Don't* truncate (cut short) your answer in any of the following ways:

  Wrong: **.666** **.667** **0.66** **0.67**

Doable, right?

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 four general areas of study: Algebra, Problem Solving and Data Analysis, Advanced Math, and Geometry and Trigonometry. In this section, I give you an overview of each of these topics.

Algebra

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 algebraic expressions (Chapter 3)
- Solving algebraic 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 linear systems have either no solution or infinitely many solutions (Chapter 6)

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

Problem Solving and Data Analysis

Problem Solving and Data Analysis focuses on a relatively 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.

Advanced Math

Advanced Math 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)

Part 4 covers these Advanced Math topics.

Geometry and Trigonometry

Geometry and Trigonometry covers math that focuses on shapes and solids in two and three dimensions:

- Solving problems using basic geometry and circles on the *xy*-plane (Chapter 14)
- Working in-depth with right triangles, the Pythagorean theorem, and trigonometric ratios such as sine, cosine, and tangent (Chapter 15)

I provide this information in Part 5.

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 Reading and Writing 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 33 questions, so by pure chance, you can expect to get about 8 of these questions right just by making wild guesses.

Let's take that thinking a step further: If you *don't* fill in 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 multiple-choice question you don't know the answer to.

What about the fill-in-the-blank 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 enter it. 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. Both sections of the new SAT are identical in this regard. Table 1-2 shows the rough breakdown of questions by difficulty levels.

TABLE 1-2 Easy, Medium, and Hard Questions

Difficulty Level	Question Number
Easy	1-7
Medium	8-16
Hard	16-22

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 of 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 of 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 60% of the questions on the test correctly. Think about it — a respectable score on the SAT would be a failing grade on a math test at school!

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 44 math questions on the SAT. Until you're already scoring 740+ on your practice

tests, answering all of the questions would likely be a poor allocation of your time. If you're answering all of the questions, you're probably rushing through questions that are within your reach, getting them wrong, and losing points you should be gaining.

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 colleges and universities prefer to enroll students who have an SAT composite score of at least 1,000, which is approximately 500 on both the Reading and Writing and the Math tests.

If you're Reading and Writing 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 26 of the 44 SAT math questions correctly. To this end, refer to Table 1-1, and then plan to do the following:

- Attempt to answer *all* 14 easy questions correctly.
- Choose 12 out of 16 medium questions to attempt to answer and guess the rest.
- Guess on the 14 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 26 easy and medium questions to focus on gives you almost two and a half minutes per question, which increases your chances of answering more questions correctly. And remember that you have a 25 percent chance of guessing each hard multiple-choice question correctly, which will give you some wiggle room to make a few mistakes along the way with the easier questions.

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 approximately 33 correct answers, which is 75% of the questions.

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

- Attempt to answer *all* 14 easy questions correctly.
- Attempt to answer *all* 16 medium questions correctly.
- Choose 3 of the 14 hard questions to attempt to answer, and guess the rest.

As when breaking 500, you still have a 25% shot at answering each hard multiple-choice question.

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 Reading and Writing test. This means answering about 38 out of 44 math questions correctly, which is just enough questions to clear 85%.

- Attempt to answer *all* 14 easy questions correctly.
- Attempt to answer *all* 16 medium questions correctly.
- Choose 8 of the 14 hard questions to attempt to answer and guess the rest.

OK, we both know that if you're aiming to break 700, you may not feel comfortable strictly "guessing" 8 hard questions. But please, please, please don't feel you have to answer every question! With limited time to allocate, almost every student will do better to focus on a subset of the hard questions and *get them right* rather than waste time on the two or three hardest questions *they'll probably get wrong anyway.*

The good news is that you're obviously a strong student with a well-practiced set of study skills. I recommend getting a private tutor if you don't already have one (but you already have one, don't you?) Take as many practice tests as you can, and then comb through your incorrect 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 — both in 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 altogether. And most of them had already begun accepting the ACT in place of the SAT to fulfill this requirement.

The pandemic mostly accelerated this trend.

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.

But here's the thing. Since the end of the pandemic, even though a lot of colleges and universities are still SAT optional, many students applying to these schools are opting to take the test. And in most cases, that decision should give them an advantage over students who choose not to take it.

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 for 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 high-school 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 Ivy League school. I bet you've heard of it!