

12 Key SAT Math Concepts

1. Definitions of

Integer: Negative and positive whole numbers

ex) ..., -3, -2, -1, 0, 1, 2, 3, ...

Rational Number: Real numbers that can be written as simple fractions

ex) 15, 0.33333..., $\frac{7}{2}$

Irrational Number: Real numbers that cannot be written as simple fractions

ex) pi (π), 0.35671482...

Prime Number: A number that can only be divided by 1 or itself

ex) 2, 13, 71

Imaginary Number: Numbers that when squared give a negative result

ex) $i = \sqrt{-1}$, $i^2 = -1$

Undefined Number: A number divided by zero is undefined

ex) $\frac{12}{0} = \text{undefined}$, $\frac{139}{0} = \text{undefined}$

2. PEMDAS = Order of Operations

Parentheses | Exponents | Multiplication | Division | Addition | Subtraction

ex) $5 * (2+6) - 12 / 6 + 4^2$ Evaluate Parenthesis

$5 * 8 - 12 / 6 + 4^2$ Evaluate Exponents

$5 * 8 - 12 / 6 + 16$ Evaluate Multiplication/Division from left to right

$40 - 2 + 16$ Evaluate Addition/Subtraction from left to right

54 You've found the answer!

3. Operations with Negative Numbers

Adding and subtracting

To add a negative number, *subtract* its opposite

ex) $5 + (-2) = 5 - 2 = 3$

To subtract a negative number, *add* its opposite

ex) $11 - (-2) = 11 + 2 = 13$

Multiplying and dividing

Multiply or divide with their signs removed

Make the result positive if the total number of negative signs is even

ex) $(-5) * (-4) \rightarrow \text{think: } 5 * 4 = 20 \rightarrow \text{stays positive (result is 20)}$

Make the result negative if the total number of negative signs is odd

ex) $(-3) * (4) \rightarrow \text{think: } 3 * 4 = 12 \rightarrow \text{becomes negative (result is -12)}$

4. Divisibility

A number is divisible by 3 if the sum of its digits is divisible by 3

ex) $102 \rightarrow 1+0+2 = 3 \rightarrow 102$ is divisible by 3

A number is divisible by 4 if the last two digits are divisible by 4

ex) 112 → the last two digits, 12, are divisible by 4 → 112 is divisible by 4

A number is divisible by 5 if the last digit is a 0 or a 5

ex) 95 → the last digit is 5 → 95 is divisible by 5

A number is divisible by 9 if the sum of the digits are evenly divisible by 9

ex) 4518 → $4+5+1+8=18$ and $18/9=2$ → 4518 is divisible by 9

5. Factors and Multiples

Factors are the numbers we can **multiply together** to get another number

ex) 1, 2, 3, 4, 6, and 12 are factors of 12

Multiples are the result of **multiplying** a number **by an integer** (not a fraction)

ex) 9, 18, 27, 36, 45,... are multiples of 9

6. Remainder: The amount left over after division

ex) $17/5$ has a remainder of 2

7. Absolute Value: $|u| = a$ is the same as $u = \pm a$ and vice versa

ex) Solve $|x + 5| = 12$

$x + 5 = \pm 12$ will have two solutions

$$x + 5 = 12$$

$$x = 7$$

$$x + 5 = -12$$

$$x = -17$$

8. Finding the missing number in a sequence

Determine the difference between two numbers, count the number of jumps to get there, and write out several terms

ex) Find the missing number: 37, 30, 23, ?, 9

The difference is -7 between each term

The missing term is 16 (because $23 - 7 = 16$)

* Note: - This tip is for arithmetic sequences

- Geometric sequences on this test are often very easy {1, 2, 4, 8, 16,...} and are typically defined within the question

9. Finding a particular digit in a repeating decimal

Write out enough digits to see where the pattern repeats.

Once you determine the pattern, think remainder!

ex) Find the 55th digit for the decimal 0.15242524...

This repeats every four digits → Divide 55 by 4 → remainder of 3

Want the third term of the repeating sequence: The 55th digit is 2

10. Finding the new Mean/Average

To bring the average UP, add a number LARGER than current average

ex) The average of {7, 8, 12} is 9 → the new average of {7, 8, 12, **13**} is **10**

To bring the average DOWN, add a number SMALLER than current average

ex) The average of {7, 8, 12} is 9 → the new average of {7, 8, 12, **5**} is **8**

11. Working with Sets

When determining the number of integers from one to another, be careful about counting inclusively or exclusively. Counting inclusively includes the starting number.

ex) How many numbers are from 1 to 5 inclusive? Exclusive?

Inclusive: 1, 2, 3, 4, 5 → 5 numbers

Exclusive: 2, 3, 4, 5 → 4 numbers

For a set containing evenly spaced numbers, the *mean and median are the same* and equal to the average of the first and last term of the set

ex) For the set {2, 4, 6, 8, 10}

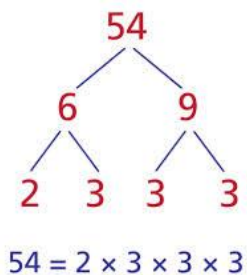
The mean and median are both 6

Which is also equal to the average of 2 and 10 → $(2 + 10) / 2 = 6$

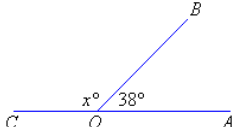
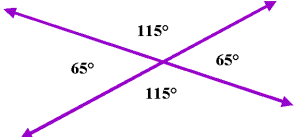
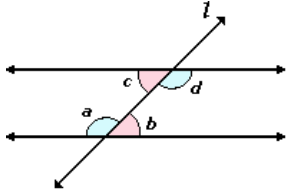
12. Prime factorization: Finding **which prime numbers** multiply together to make the original number

Use a factor tree

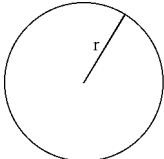
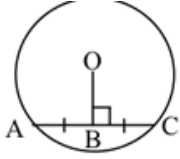
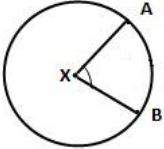
ex)



SAT Math Formulas

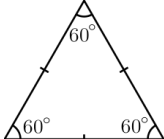
Supplementary angles add up to 180 degrees	
Vertical angles are congruent	
For parallel lines cut by a transversal, alternate interior angles are congruent	

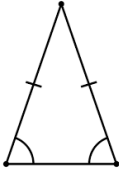
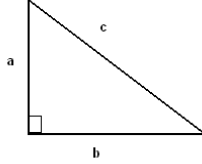
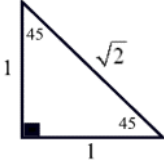
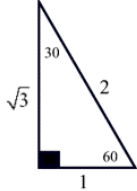
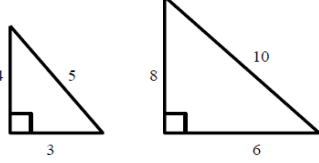
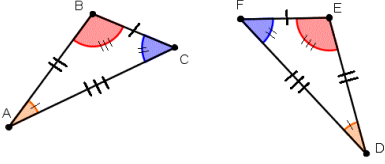
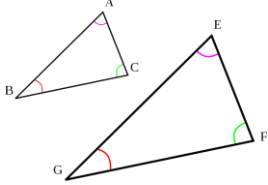
Circles

Area $A = \pi r^2$ Circumference $C = 2\pi r$ Diameter $d = 2r$	
The perpendicular bisector of a chord in a circle passes through the center of the circle	
Measure of arc $AB = x$ Length of arc $AB = 2\pi r \left(\frac{x}{360}\right)$	

Triangles:

For ALL TRIANGLES, the 3 angles add to 180 degrees and Area $A = (\frac{1}{2}) \text{ base} * \text{height}$

Equilateral Triangle has 3 identical sides and 3 identical angles of 60 degrees (since $60 + 60 + 60 = 180$)	
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<p>Isosceles Triangle has 2 identical sides and 2 identical angles</p>	
<p>Right Triangle has one 90 degree angle, sides that satisfy $a^2+b^2=c^2$ (Pythag. Thm.), and the other 2 angles are <90 degrees</p>	
<p>45-45-90 Right Triangle has sides with ratio 1:1:$\sqrt{2}$</p>	
<p>30-60-90 Right Triangle has sides with ratio 1:2:$\sqrt{3}$ (hypotenuse = 2)</p>	
<p>3-4-5 Right Triangle has sides proportional to 3, 4, & 5</p>	
<p>Congruent Triangles have identical side lengths and angles. They may have been rotated or reflected relative to one another and still be congruent.</p>	
<p>Similar Triangles have identical corresponding angles & proportional side lengths</p>	

Polygons

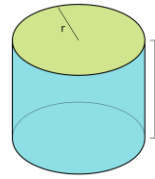
Interior angles of n-sided polygon add up to $(n-2)*180$

Perimeter of a polygon is the sum of the side lengths



<p>Regular Polygon has equal side lengths and equal angles each measuring $\frac{(n-2) \cdot 180}{n}$</p>	
<p>Quadrilateral is a 4-sided polygon</p> <p>The angles of a quadrilateral sum to $(4-2)180 = 360$</p>	
<p>Square with side length s</p> <p>Area = s^2</p> <p>Perimeter = $4s$</p>	
<p>Rectangle</p> <p>Area = lw</p> <p>Perimeter = $2l + 2w$</p>	
<p>Trapezoid is a quadrilateral with one pair of parallel sides. Find area by dividing into simpler shapes.</p>	$A = \frac{b_1 + b_2}{2} h$
<p>Parallelogram is a quadrilateral with two pairs of parallel sides. Opposite sides are equal, opposite angles have equal measure.</p>	
<p>Regular Pentagon is a 5-sided polygon with equal sides and equal angles. The five angles each measure $(5-2)180/5=108$</p>	
<p>Cube</p> <p>$V = s^3$</p> <p>$A = 6s^2$</p>	
<p>Box</p> <p>$V = lwh$</p> <p>$A = 2lw + 2lh + 2wh$</p>	

Cylinder
 $V = \pi r^2 h$



Other Formulas to Know

Negative Exponent: $x^{-n} = 1/x^n$

Raising Power to Powers: Multiply exponents

ex) $(x^2)^3 = x^6$

Multiplying Power Exponents: Add exponents and keep the same base

ex) $(x^2)(x^3) = x^5$

Dividing Power Exponents: Subtract exponents and keep same base

ex) $x^6 / x^4 = x^2$

Factoring Difference of squares

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

FOIL: First, Outside, Inside, Last

ex) $(x-3)(x+5) =$
 $x^2 + 5x - 3x - 15 =$
 $x^2 + 2x - 15$

Midpoint Formula: $(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$

Percents: Use proportions

ex) 75% of 300

$$\frac{75}{100} = \frac{x}{300}$$

SAT Math Strategy Tips

Below are several effective and timesaving strategies. These strategies are applicable to various topics on the SAT. They can also be used on all questions, regardless of difficulty level.

1. **Pick Numbers** – Look for math questions that have variables in the answer choices. You can usually substitute simple numbers in place of the variables and solve the question using numbers, not variables. Look for the answer choice that matches your answer when you substitute.
2. **Work Backwards** – This is a multiple-choice test. Therefore, one – and only one – answer choice must be correct. For math questions that ask for a numerical answer and have numbers as answer choices you can usually plug-in the answer choices into the problem until you find the one that works. This is especially useful on questions that require you to solve an equation.
3. **Use your calculator throughout the calculator section** – NO MENTAL MATH! Avoid long calculations that your calculator can do for you simply. Familiarize yourself with the SAT Calculator Program Policy. Tedious calculations such as slope, distance, midpoint, and solving quadratics can be solved quickly, easily, and accurately using calculator programs. Ask your coach for information about how to put these programs on your calculator. You should use your calculator for even simple arithmetic problems. Use the calculator, get the correct answer and avoid silly errors. For the official SAT Calculator Policy visit: <https://collegereadiness.collegeboard.org/sat/taking-the-test/calculator-policy>
4. **Each question is worth the same** - Therefore, students who struggle should spend their time on easy/medium questions, getting them correct, and sacrificing some of the harder questions that they do not know how to do. Don't want to make silly mistakes because you are rushing to get to math questions you don't know how to do! Remember, the hardest multiple-choice questions are the last 5 before the grid-ins on the non-calculator section and the last 10 on the calculator section. Furthermore, the hardest grid-in questions on the non-calculator section are the last 2 and the hardest on the calculator section are the last 4.
5. **Sketch it** – If a question describes a physical situation or a geometric shape but a diagram is not given, you should sketch one. Visuals are key to solving many geometry and trig problems.
6. **Don't be Afraid to Guess** – There is no guessing penalty on the SAT so there is no reason to ever leave a question blank. If you can eliminate incorrect answers you should, but NEVER LEAVE A QUESTION BLANK.
7. **Know Your Formulas** – Familiarize yourself with which formulas you are provided with and which ones you are not given, but need to know. You should know basic SOH-CAH-TOA formulas and Pythagorean Theorem at a bare minimum.

8. **Trust the Picture** – Unless a diagram specifically says “Not drawn to scale” you can safely assume the picture is drawn to scale. Use the diagram then make educated guesses and eliminate incorrect answer choices.
9. **Guess 0 or 100** – On the grid-in section, if you have no idea how to even start the question, guess 0 or 100. DO not leave it blank!
10. **Use Your Test Booklet** – Fill in or label the diagram with all information that the question gives. Write out a formula or equation that goes with the picture. Circle key words within the question.