MasterLeap Tuition SAT formula sheet

2024-2025 DIGITAL SAT FORMAT

- 44 questions | 70 minutes total (two 35-minute modules)
- 4 Content Domains: Algebra, Advanced Math, Problem-Solving & Data Analysis, Geometry & Trigonometry

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SECTION 1: OFFICIAL SAT REFERENCE SHEET (PROVIDED ON TEST)

The following formulas appear at the beginning of both SAT Math modules. Familiarize yourself now to save time on test day .

Circle Formulas

Formula	Description
Area of a Circle	$A = \pi r^2$
Circumference	$C = 2\pi r$

Rectangle and Triangle

Formula	Description
Area of a Rectangle	$A = lw$

Area of a Triangle	$A = \frac{1}{2}bh$

Pythagorean Theorem

Formula	Description
Right Triangle	$a^2 + b^2 = c^2$

Special Right Triangles

Triangle Type	Side Ratios
30°-60°-90°	$x : x\sqrt{3} : 2x$
45°-45°-90°	$x : x : x\sqrt{2}$

Volume Formulas

Shape	Formula
Rectangular Prism	$V = lwh$
Cylinder	$V = \pi r^2 h$
Cone	$V = \frac{1}{3}\pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$

Pyramid	$V = \frac{1}{3} \times (\text{Base Area}) \times h$

SECTION 2: ALGEBRA (13-15 Questions)

The Algebra domain covers linear equations, inequalities, and systems .

Linear Equations and Slope

Formula	Expression
Slope	$m = (y_2 - y_1)/(x_2 - x_1)$
Slope-Intercept Form	$y = mx + b$
Point-Slope Form	$y - y_1 = m(x - x_1)$
Standard Form	$Ax + By = C$
Horizontal Line	y = constant (slope = 0)
Vertical Line	x = constant (slope undefined)

Linear Inequalities

- Solving rules: Same as equations, but FLIP inequality sign when multiplying or dividing by a negative number
- Graphing:
  - $y > mx + b$ → dashed line, shaded above
  - $y \geq mx + b$ → solid line, shaded above
  - $y < mx + b$ → dashed line, shaded below

- $y \leq mx + b \rightarrow$ solid line, shaded below

Systems of Linear Equations

Relationship	Condition	Solution Type
Intersecting	$a_1/a_2 \neq b_1/b_2$	One unique solution
Parallel	$a_1/a_2 = b_1/b_2 \neq c_1/c_2$	No solution
Same Line	$a_1/a_2 = b_1/b_2 = c_1/c_2$	Infinite solutions

Absolute Value

- $|x| = a$ means $x = a$ or $x = -a$ (where $a \geq 0$)
- $|x| < a$ means $-a < x < a$
- $|x| > a$ means $x < -a$ or $x > a$

SECTION 3: ADVANCED MATH (13-15 Questions)

Advanced math covers nonlinear equations, quadratics, polynomials, and functions .

Quadratic Equations

Formula	Expression
Standard Form	$ax^2 + bx + c = 0$
Quadratic Formula	$x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$

Vertex x-coordinate	$x = -b/(2a)$
Vertex y-coordinate	Substitute x back into equation

The Discriminant

- $D = b^2 - 4ac$ tells you about solutions :

Discriminant	Number of Real Solutions
$D > 0$	Two distinct real solutions
$D = 0$	One real solution (double root)
$D < 0$	No real solutions

Forms of Quadratic Functions

Form	Expression	Key Information
Standard	$f(x) = ax^2 + bx + c$	y-intercept at (0, c)
Vertex	$f(x) = a(x - h)^2 + k$	Vertex at (h, k)
Factored	$f(x) = a(x - r_1)(x - r_2)$	x-intercepts at r_1, r_2

Exponent Rules

Rule	Formula
Product	$a^m \times a^n = a^{m+n}$
Quotient	$a^m / a^n = a^{m-n}$
Power of Power	$(a^m)^n = a^{mn}$
Negative Exponent	$a^{-n} = 1/a^n$
Zero Exponent	$a^0 = 1$ $(a \neq 0)$
Fractional Exponent	$a^{(m/n)} = \sqrt[n]{(a^m)}$
Product to Power	$(ab)^n = a^n b^n$

Exponential Functions

- Growth/Decay: $y = a(b)^x$
  - $b > 1 \rightarrow$ exponential growth
  - $0 < b < 1 \rightarrow$ exponential decay
- Percent Change: If something increases by r% per period: $y = a(1 + r/100)^t$
- If something decreases by r% per period: $y = a(1 - r/100)^t$

Function Notation and Operations

- $f(x)$ represents the output for input x
- $f(a) = b$ means point (a, b) lies on the graph
- Composite functions: $f(g(x))$ means apply g first, then f
- Inverse functions: $f^{-1}(f(x)) = x$

Function Transformations

Transformation	Equation	Effect
Vertical shift up	f(x) + k	Shift up k units
Vertical shift down	f(x) - k	Shift down k units
Horizontal shift right	f(x - h)	Shift right h units
Horizontal shift left	f(x + h)	Shift left h units
Reflection over x-axis	-f(x)	Flip vertically
Reflection over y-axis	f(-x)	Flip horizontally
Vertical stretch	a·f(x) (a > 1)	Steeper
Vertical compression	a·f(x) (0 < a < 1)	Flatter

SECTION 4: PROBLEM-SOLVING AND DATA ANALYSIS (5-7 Questions)

This domain covers ratios, percentages, statistics, and probability .

Ratios and Proportions

- Ratio: a : b = a/b
- Proportion: a/b = c/d means ad = bc
- Unit rates: miles per hour, cost per item, etc.

Percentages

Formula	Expression
Percent	(Part/Whole) × 100
Percent Change	[(New - Original)/Original] × 100
Percent Increase	Multiply by (1 + percent/100)
Percent Decrease	Multiply by (1 - percent/100)

Statistics

Measure	Definition	Formula
Mean	Average	Sum of values / Number of values
Median	Middle value	Sort values; if odd count → middle; if even → average of two middle
Mode	Most frequent	Value that appears most often
Range	Spread	Maximum - Minimum
Standard Deviation	Spread around mean	Larger spread = larger deviation

Probability

Formula	Expression
Basic Probability	P(A) = (Favorable outcomes)/(Total outcomes)
Complement	P(not A) = 1 - P(A)
Combined Probability (independent)	P(A and B) = P(A) × P(B)

Data Interpretation Tips

- Scatterplots: Look for trends (positive, negative, or no correlation)
- Line of Best Fit: Use to make predictions
- Tables: Read carefully—sometimes data is out of order (reorder for median!)
- Units: Always check units (e.g., square inches vs. square feet, hours vs. minutes)

SECTION 5: GEOMETRY AND TRIGONOMETRY (5-7 Questions)

Lines and Angles

- Vertical angles are equal
- Supplementary angles sum to 180°
- Complementary angles sum to 90°
- Parallel lines cut by transversal:
    - Corresponding angles are equal
    - Alternate interior angles are equal
    - Same-side interior angles sum to 180°

Triangles

Triangle Type	Properties
Equilateral	All sides equal, all angles 60°
Isosceles	Two sides equal, base angles equal
Right Triangle	One angle 90°, Pythagorean theorem applies
Similar Triangles	Corresponding angles equal, sides proportional
Congruent Triangles	Same size and shape

Circle Theorems

- Central angle = intercepted arc measure
- Inscribed angle = ½ × intercepted arc measure
- Radius to tangent is perpendicular at point of tangency

Coordinate Geometry Formulas (NOT on reference sheet)

Formula	Expression
Distance Formula	$d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$
Midpoint Formula	$((x_1 + x_2)/2 , (y_1 + y_2)/2)$
Circle Equation	$(x - h)^2 + (y - k)^2 = r^2$ where (h,k) is center, r is radius

Basic Trigonometry (Right Triangles Only)

- SOH CAH TOA:
  - sin θ = Opposite / Hypotenuse
  - cos θ = Adjacent / Hypotenuse
  - tan θ = Opposite / Adjacent
- Key fact: In similar triangles, trig ratios are the same

SECTION 6: ESSENTIAL FORMULAS TO MEMORIZE (NOT ON REFERENCE SHEET)

These formulas appear frequently but are NOT provided on test day .

Category	Formula	Why It's Important
Algebra	Quadratic Formula	Solving any quadratic
Algebra	Vertex x = -b/(2a)	Finding parabola vertex
Algebra	Slope formula	Foundation of linear equations
Coordinate Geo	Distance formula	Finding length between points
Coordinate Geo	Midpoint formula	Finding center point
Coordinate Geo	Circle equation	Circle problems
Percentages	Percent change formula	Word problems, data analysis
Exponents	All exponent rules	Advanced math questions

Statistics	Mean, median, range	Data analysis
Probability	P(A) = favorable/total	Basic probability

SECTION 7: TEST-TAKING STRATEGIES

How to Use the Reference Sheet

1. Scan only when needed – Don't flip back constantly; trust your memory first
2. Confirm, don't learn – Use sheet to double-check, not to find formulas for the first time
3. Know what's NOT there – Many essential formulas (quadratic, distance, midpoint) are NOT provided

General Tips

- Plug in answers – For multiple choice, test each option
- Plug in numbers – For algebra problems, pick easy numbers (like 1, 2, 10)
- Draw diagrams – If no diagram is given, sketch your own
- Check units – Especially in word problems (hours vs. minutes, inches vs. feet)
- Grid-in questions: No answer choices—calculate carefully and enter precisely

Common Mistakes to Avoid

Mistake	How to Avoid
Forgetting to flip inequality sign	Always check when multiplying/dividing by negative

Mixing up area and circumference	Remember: Area is πr^2 (square units), circumference is $2\pi r$ (linear)
Misreading data order for median	Always reorder values from least to greatest
Unit conversion errors	Write out conversion steps: 18 $in^2/min \rightarrow ? ft^2/hr$
Discriminant confusion	$D > 0$ = 2 solutions; $D = 0$ = 1 solution; $D < 0$ = no real solutions

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QUICK REFERENCE: TOP 10 MOST-USED FORMULAS

Rank	Formula	Topic
1	$y = mx + b$	Linear equations
2	Slope = $(y_2 - y_1)/(x_2 - x_1)$	Slope
3	Quadratic formula: $x = [-b \pm \sqrt{(b^2 - 4ac)}]/2a$	Quadratics
4	Percent change = (New - Original)/Original × 100	Data analysis
5	$a^2 + b^2 = c^2$	Pythagorean theorem

6	Distance = $\sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$	Coordinate geometry
7	Area of triangle = ½bh	Geometry
8	Area of circle = πr^2	Geometry
9	Volume of cylinder = $\pi r^2 h$	Geometry
10	P(A) = favorable/total	Probability

SUMMARY: SAT MATH CONTENT DOMAINS

Domain	Question Count	Key Topics
Algebra	13-15	Linear equations, inequalities, systems, absolute value
Advanced Math	13-15	Quadratics, polynomials, exponents, functions, nonlinear equations
Problem-Solving & Data Analysis	5-7	Ratios, percentages, statistics, probability, data interpretation
Geometry & Trigonometry	5-7	Area, volume, triangles, circles, right triangle trig