

New SAT Math F.A.Qs

- Do I need to read the directions?**
Be familiar with the directions ahead of time to allow more time for answering questions.
- Are all the questions hard?**
No. The questions become increasingly more difficult as you progress through a section.
- Should I guess?**
Yes. It's easier at times to pick-out wrong answers than it is right ones. By crossing out the wrong answers, it is easier to make an educated guess at what the right answer is.

- Do I lose points for wrong answers on the New SAT?**
No. You don't lose points for wrong answers on the New SAT, as a result make sure to answer every question and leave none blank.
- Is the entire test multiple choice?**
No. Part of the SAT Math requires student produced answers. Only answers entered into the grid-in are scored; your handwritten answers at the top of the grid are not scored.

ALGEBRA REVIEW

Combining Variables

Adding, subtracting, multiplying, dividing

When adding or subtracting a variable, add or subtract the **coefficient** (number in front of a variable).

$$\begin{aligned} a + a &= 2a & a \times a &= a^2 \\ ab + ab &= 2ab & ab \times ab &= a^2b^2 \\ a + c &= a + c & a \times c &= ac \\ a^2 + a^3 &\neq a^5 & a^2 \times a^3 &= a^5 \\ b^9 - b^2 &\neq b^7 & \frac{b^9}{b^2} &= b^7 \end{aligned}$$

Examples

$$\begin{aligned} 4^{17} - 2^{28} &= 2^{2(17)} - 2^{28} = 2^{34} - 2^{28} = 2^{28}(2^6 - 1) \\ 2^2 + 2^2 + 3^6 + 3^6 + 3^6 &= 2(2^2) + 3(3^6) = 2^3 + 3^7 \end{aligned}$$

Factoring

Difference of two squares

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

F.O.I.L (First-Outer-Inner-Last)

$$\begin{aligned} (a - b)^2 &= (a - b)(a - b) \\ (a + b)^2 &= (a + b)(a + b) \end{aligned}$$

$$\begin{aligned} a^3 + b^3 &= (a + b)(a^2 - ab + b^2) \\ a^3 - b^3 &= (a - b)(a^2 + ab + b^2) \end{aligned}$$

Note: $(a - b)^2$ is NOT equal to $(a^2 - b^2)$

Also remember...

Anything with a zero exponent is equal to 1

$$a^0 = 1$$

$$m^{-5} = \frac{1}{m^5} \quad m^{\frac{x}{y}} = (\sqrt[y]{m})^x \quad n^{\frac{1}{2}} = \sqrt{n}$$

Word Problems

Translating word problems into math equations

WORDS	SYMBOL	EXAMPLE	EQUATION
it, was, has	=	Eva is the same age as Wall-E.	$E = W$
more than, older than, sum of	+	Eva has four more cookies than Wall-E.	$E = 4 + W$
less than, differences, fewer than	-	Eva is 50 centimeters less than Wall-E's height.	$E = W - 50$
of, product	×	Eva ate $\frac{2}{5}$ of the cake.	$E = \frac{2}{5} \times C$
for, per	/	The car was traveling 20 miles per hour.	$20 \frac{\text{miles}}{\text{hour}}$
what percent	$\frac{x}{100}$	What percent of 50 is 10?	$\frac{x}{100} \cdot 50 = 10$

Extra Tips

Assign variables to each person or object compared or identified in the problem using the first letter of the person's (or object's) name.

Also remember...

$$\begin{aligned} \text{If } 0 < x < 1 \text{ (i.e. } 0.75) & \quad \text{But } x > 1 \text{ (i.e. } 0.75) \\ (0.75)^2 < \sqrt{0.75} & \quad (2.5)^2 > \sqrt{2.5} \\ \sqrt{2} = 1.4 & \quad \sqrt{3} = 1.7 \end{aligned}$$

Speed-Distance-Time



NUMBERS & OPERATIONS

Integers

Integers are all whole numbers and their negatives (including zeros)

$$\text{e.g. } -2, -1, 0, 1, 2, 3$$

Integers do not include fractions & decimals. Zero is neither a positive or negative integer.

Consecutive Integers

Consecutive integer expression

$$n, n+1, n+2 \text{ (} n = \text{any integer)}$$

Consecutive EVEN/ODD integer expression

$$n, n+2, n+4 \text{ (} n = \text{any even / odd integer)}$$

The average of a consecutive set of numbers is the middle number.

$$10, 11, 12, 13, 14$$

When you divide the sum of a consecutive set by the number of values, the result is the **middle number = Average**.

$$5 + 6 + 7 + 8 + 9 = \frac{35}{5} = 7$$

Prime Numbers

A prime number is a positive integer greater than 1, which is only divisible by itself and 1. The number 1 itself is not a prime number.

$$2, 3, 5, 7, \dots$$

Note: 2 is the first and only even prime number.

Factors and Multiples

FACTOR		MULTIPLE
2×2	=	4
2×3	=	6
2×4	=	8

Ratios and Proportions

The following forms are all the same:

FRACTION	RATIO	RATIO
$\frac{2}{5}$	2 : 5	2 to 5

The percent sign (%) means divided by 100.

$$56\% = \frac{56}{100}$$

Proportion is when two ratios are set equal to one another:

$$\frac{x}{2} = \frac{9}{3}$$

When two ratios equal to one another (proportion), use cross multiplication to find the unknown variable. Using the above example:

$$\begin{aligned} 3x &= 18 \\ x &= 6 \end{aligned}$$

DIRECT PROPORTION	INDIRECT PROPORTION
$\frac{y_1}{x_1} = \frac{y_2}{x_2}$	$x_1y_1 = x_2y_2$

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GEOMETRY REVIEW

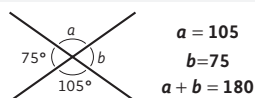
Area, Perimeter, Volume

SHAPE	Rectangle	Square	Triangle	Circle	Parallelogram	Trapezoid
AREA (A)	$A = L \times W$	$A = S^2$	$A = \frac{1}{2}Bh$	$A = \pi R^2$	$A = B \times h$	$A = \frac{1}{2}(a+b)h$
PERIMETER (P)	$P = 2L + 2W$	$P = 4S$	$P = SOS$ (sum of all sides)	$C = 2\pi R$	$P = SOS$	
VOLUME (V)	$V = LWH_{\text{of prism}}$	$V = S^2H_{\text{of prism}}$	$V = \frac{1}{2}BhH_{\text{of prism}}$	$V = \pi R^2H_{\text{of prism}}$	$V = BhH_{\text{of prism}}$	

Angles and Triangles

Sum of angles on a line = 180°
 Sum of complementary angles = 90°
 Sum of supplementary angles = 180°
 Sum of all angles in a triangle = 180°

Vertical Angles



$$\frac{\pi}{6} = 30^\circ$$

$$\frac{\pi}{3} = 60^\circ$$

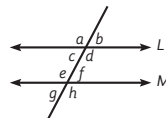
$$\frac{\pi}{4} = 45^\circ$$

$$\frac{\pi}{2} = 90^\circ$$

$$\pi = 180^\circ$$

$$2\pi = 360^\circ$$

Parallel Lines



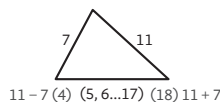
Lines L and M are parallel.

Vertical angles:

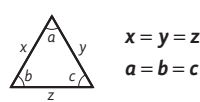
$$\begin{array}{lll} b = c & a = e & d = e \\ a = d & c = g & c = f \\ f = g & b = f & a = h \\ e = h & d = h & b = g \end{array}$$

Hence, angles a, d, e, h are equal and angles b, c, f, g are equal.

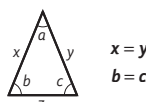
Length of 3rd Side of a Triangle



Equilateral Triangle

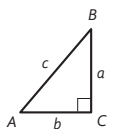


Isosceles Triangle



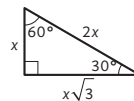
Right Triangles and the Pythagorean Theorem

30 - 60 - 90 Rule

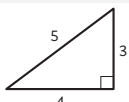


c = hypotenuse (longest side of a right triangle)
 a and b are called "legs"

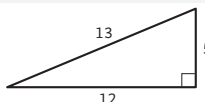
Pythagorean Theorem: $a^2 + b^2 = c^2$



3 - 4 - 5 Rule



5 - 12 - 13 Rule

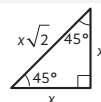


Other Pythagorean Triples

7 - 24 - 25

8 - 15 - 17

45 - 45 - 90 Rule



Slopes, Points, and Lines

Midpoint Formula

$$x_{\text{midpoint}} = \frac{x_1 + x_2}{2}$$

$$y_{\text{midpoint}} = \frac{y_1 + y_2}{2}$$

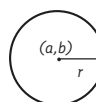
Given points (3, 1) and (6, 5)

$$x_{\text{midpoint}} = \frac{3+6}{2} = 4.5$$

$$y_{\text{midpoint}} = \frac{1+5}{2} = 3$$

Equation of a Circle

$$(x-a)^2 + (y-b)^2 = r^2$$



(a, b) - Center
 r - Radius

Slope of a Line Formula

$$m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{\Delta y}{\Delta x} = \frac{y}{x} = \frac{\text{Rise}}{\text{Run}}$$

Equation of a Line Formula

$$y = mx + b$$

m = slope of a line
 b = y-intercept of a line

Quadratic Formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sum of Zeros = $-\frac{b}{a}$ Vertex $(x) = -\frac{b}{2a}$
 Product of Zeros = c/a

Quadratic Equation

$$ax^2 + bx + c = 0$$

Trigonometry

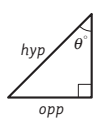
Sine Rule

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Cosine Rule

$$c^2 = a^2 + b^2 - 2ab \cos C$$

Soh-Cah-Toa



$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}}$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\csc \theta = \frac{\text{hyp}}{\text{opp}}$$

$$\sec \theta = \frac{\text{hyp}}{\text{adj}}$$

$$\cot \theta = \frac{\text{adj}}{\text{opp}}$$

$$\sin x = \cos y$$

$$x + y = 90^\circ$$

$$\frac{\sin \theta}{\cos \theta} = \tan \theta$$

$$i^2 = -1$$

$$i^4 = 1$$

$$\sin \theta \xrightarrow{\text{inverse}} \frac{1}{\sin \theta} = \csc \theta$$

$$\cos \theta \xrightarrow{\text{inverse}} \frac{1}{\cos \theta} = \sec \theta$$

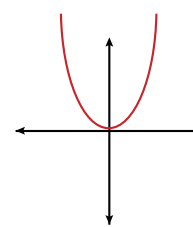
$$\tan \theta \xrightarrow{\text{inverse}} \frac{1}{\tan \theta} = \cot \theta$$

90°, $\frac{\pi}{2}$	$\sin +$	$\cos +$
	$\cos -$	$\sin +$
180°, π	$\tan -$	$\tan +$
	$\tan +$	$\cos +$
	$\sin -$	$\sin -$
	$\cos -$	$\tan -$
270°, $\frac{3\pi}{2}$		

FUNCTIONS & GRAPHS

Given the graph of

$$y = x^2$$



Outside parenthesis ()

$$y = x^2 + 3$$

Move graph UP 3 spaces.

$$y = x^2 - 3$$

Move graph DOWN 3 spaces.

Inside parenthesis ()

$$y = (x+5)^2$$

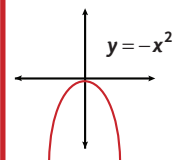
Move graph LEFT 5 spaces.

$$y = (x-5)^2$$

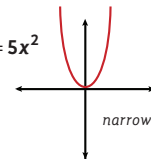
Move graph RIGHT 5 spaces.

Also remember...

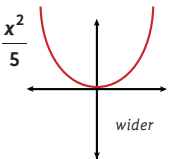
The graph of $y = -x^2$ reflects about the x-axis.



$$y = 5x^2$$



$$y = \frac{x^2}{5}$$



STATISTICS & PROBABILITY

Arithmetic Mean (Average)

$$\text{Average} = \frac{\text{Sum}}{\text{Number}}$$

Mode

The most occurring value

1, 3, 3, 4, 5, 3, 7 mode = 3

Median

The middle value in increasing or decreasing order

Formula	2, 3, 4, 5, 7	median = 4
$\frac{n+1}{2}$	2, 3, 4, 5	median = $\frac{3+4}{2} = 3.5$

Fractions and Probability

$$\text{Fraction} = \text{Probability} = \frac{\text{Focus}}{\text{Total}}$$

Fraction or probability of selecting an odd number from the example set below is:

2, 3, 5, 7, 10, 13
 $\frac{4}{6}$ (# of odd values / total of values)

Percentage

$$\text{What \%} = \frac{x}{100} \quad \text{What \% of} = \frac{\text{Focus}}{\text{Total}} \times \frac{100\%}{1}$$

$$\text{Percentage Increase} = \frac{\text{Increase}}{\text{Original}} \times 100$$

$$\text{Percentage Decrease} = \frac{\text{Decrease}}{\text{Original}} \times 100$$

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