

## The *Ultimate* Formula Sheet for SAT Math

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These formulas are provided in the reference information at the beginning of each SAT math section:

Area of a Circle:  $A = \pi r^2$

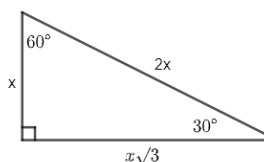
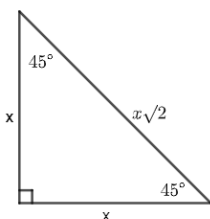
Circumference of a Circle:  $C = 2\pi r$

Area of a Rectangle:  $A = lw$

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

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

Special Right Triangles:



Volume of a Rectangular Prism (Box):  
 $V = lwh$

Volume of a Cylinder:  $V = \pi r^2 h$

Volume of a Sphere:  $V = \frac{4}{3}\pi r^3$

Volume of a Cone:  $V = \frac{1}{3}\pi r^2 h$

Volume of a Pyramid:  $V = \frac{1}{3}lwh$

**Fractions, Decimals, and Percentages: (for this section, r is the percent in decimal form)**

$\text{Fraction} = \frac{\text{part}}{\text{whole}}$

$\text{percent} = \frac{\text{part}}{100}$

Percent Increase or Decrease:

$$\frac{|\text{old} - \text{new}|}{\text{old}} \times 100\%$$

Increase by a percent: multiply by  $(1 + r)$

Decrease by a percent: multiply by  $(1 - r)$

Simple Interest:  $A = P(1 + rt)$

Interest Compounded Annually:  $A = P(1 + r)^t$

Interest Compounded n times per year:

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

**Rates, Ratios, and Proportions:**

General form of a conversion factor:

$$\left( \frac{\text{ending\_units}}{\text{starting\_units}} \right)$$

Example:  $10\text{feet} \left( \frac{12\text{inches}}{1\text{foot}} \right) = 120\text{inches}$

$$\begin{aligned} &\text{Concentration of A} \times \text{Volume of A} \\ &+ \text{Concentration of B} \times \text{Volume of B} \\ &= \text{Final concentration (Vol. of A + Vol. of B)} \end{aligned}$$

Distance = Rate x Time

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## Exponents, Roots, & Polynomials:

Multiplication Rule for Exponents:

$$a^b \cdot a^c = a^{b+c}$$

Negative Exponents:  $a^{-b} = \frac{1}{a^b}$

Division Rule for Exponents:  $\frac{a^b}{a^c} = a^{b-c}$

Fractional Exponents:  $a^{\frac{b}{c}} = \sqrt[c]{a^b}$  or  $(\sqrt[c]{a})^b$

Power Rule for Exponents:  $(a^b)^c = a^{bc}$

$$i^2 = -1; i^3 = -i; i^4 = 1$$

$$i^{4n} = 1; i^{4n+1} = i; i^{4n+2} = -1; i^{4n+3} = -i$$

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## Parabolas:

Standard Form:  $f(x) = ax^2 + bx + c$ ;

Factored Form:  $f(x) = a(x - m)(x - n)$ ;

$$\text{vertex} = \left( -\frac{b}{2a}, f\left(-\frac{b}{2a}\right) \right);$$

x-intercepts are m and n;

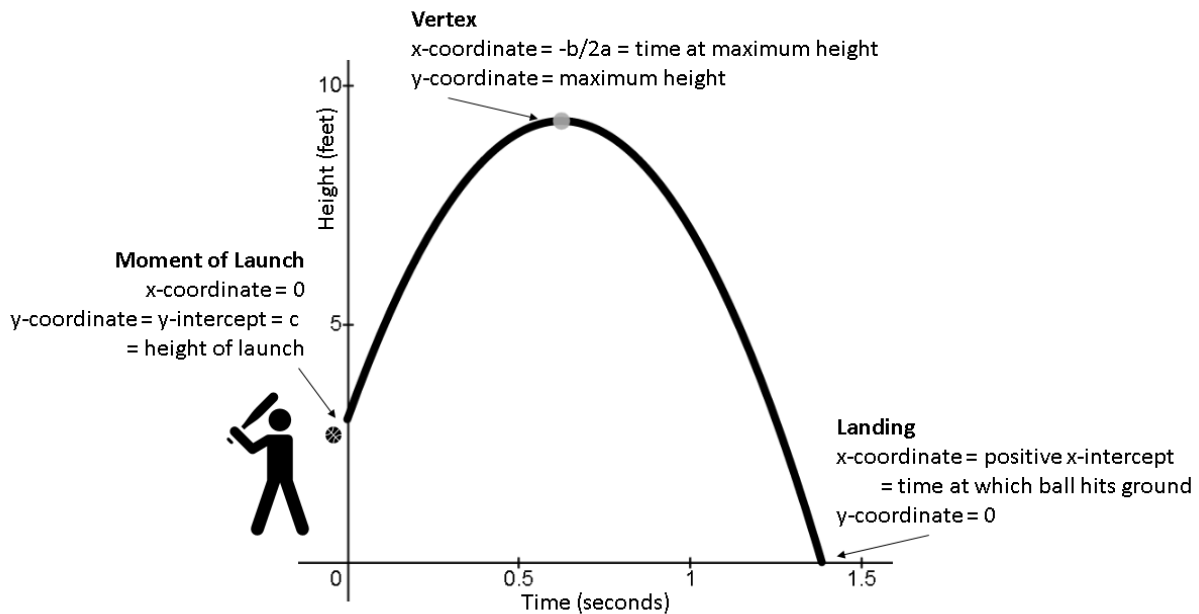
y-intercept = c;

$$\text{x-coordinate of vertex} = \frac{m+n}{2}$$

$$\text{x-intercepts} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Vertex Form:  $f(x) = a(x - h)^2 + k$ ;

vertex = (h, k)



Difference of Squares:  $a^2 - b^2 = (a + b)(a - b)$

Perfect Square Trinomial:  $a^2 + 2ab + b^2 = (a + b)^2$

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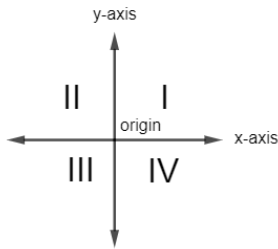
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## Graphing Lines:

Slope Formula:  $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope of horizontal line = 0

Slope of vertical line = undefined



Standard Form:  $Ax + By = C$

Slope-Intercept Form:  $y = mx + b$

Point-Slope Form:  $y - y_1 = m(x - x_1)$

Distance Formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

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

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## Angles:

Vertical  $\angle$ 's are  $\cong$

$\angle$ 's that form a linear pair are supplementary

$\angle$ 's that form a circle add up to  $360^\circ$

When  $\parallel$  lines are cut by a transversal, all acute  $\angle$ 's are  $\cong$  and all obtuse  $\angle$ 's are  $\cong$

## Triangles:

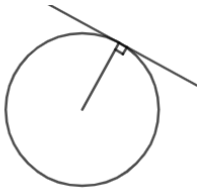
The three  $\angle$ 's of a  $\Delta$  add up to  $180^\circ$

An exterior  $\angle$  is equal to the sum of the two remote interior  $\angle$ 's

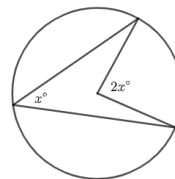
Pythagorean Triples: 3-4-5 and 5-12-13

## Circles:

A radius and tangent make a right  $\angle$



A central  $\angle$  is double the inscribed  $\angle$



Formula for a Circle:  $(x - h)^2 + (y - k)^2 = r^2$ , where (h,k) is the center and r is the radius

**Polygons: (for this section, n is the number of sides)**

Area of a trapezoid:  $\frac{1}{2}bh$

Sum of the interior angles:  $180(n - 2)$

Sum of the exterior angles:  $360^\circ$

One interior angle of a regular polygon:  
$$\frac{180(n - 2)}{n}$$

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### Properties of Parallelograms:

1. Opp sides are  $\parallel$  and  $\cong$
  2. Opp  $\angle$ 's are  $\cong$
  3. Consec  $\angle$ 's are supplementary
  4. Each diagonal forms a pair of  $\cong\Delta$ 's
  5. Diagonals bisect each other
- If they are  $\cong$  it is a rectangle  
→ If they are  $\perp$  it is a rhombus
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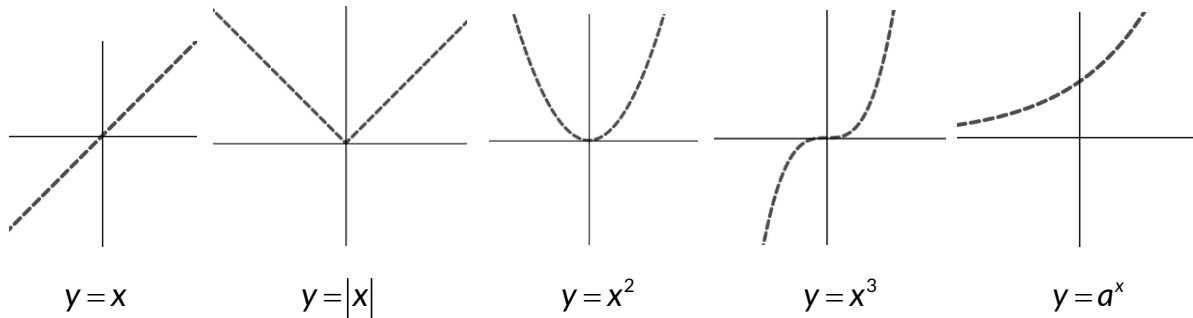
### Trigonometry:

$$\sin = \frac{\text{opp}}{\text{hyp}} \quad \cos = \frac{\text{adj}}{\text{hyp}} \quad \tan = \frac{\text{opp}}{\text{adj}}$$

The sine of an  $\angle$  is equal to the cosine of its complement.

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### Parent Graphs & Transformations:



#### Transformation

$$f(x) + k$$

$$f(x) - k$$

$$f(x + h)$$

$$f(x - h)$$

$$-f(x)$$

$$cf(x)$$

$$\frac{1}{c}f(x)$$

#### Visual effect

Shift up by  $k$  units

Shift down by  $k$  units

Shift left by  $h$  units

Shift right by  $h$  units

Reflect over the  $x$  axis (flip upside down)

Stretch vertically by a factor of  $c$  (becomes skinnier)

Shrink vertically by a factor of  $c$  (becomes fatter)