

Algebra Formulas

Geometry

Equation of a circle: $(x - h)^2 + (y - k)^2 = r^2$,
Center = (h, k) , Radius = r

Quadratic Function: $y = ax^2 + bx + c$,

$$\text{Vertex} = \left(-\frac{b}{2a}, c - \frac{b^2}{4a} \right)$$

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

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$, Parallel lines: $m_1 = m_2$, Perpendicular lines: $m_1 = -\frac{1}{m_2}$

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

Slope-Intercept Form: $y = mx + b$, Horizontal Line: $y = b$, Vertical Line: $x = a$
($m = 0$) (m undefined)

Standard Form: $Ax + By = C$

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

Factoring

Difference of Squares:

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

Perfect Square Binomials:

$$(1) (a + b)^2 = a^2 + 2ab + b^2$$

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

Difference of Cubes

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

Perfect Cube Binomials

$$(1) (a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(2) (a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

Sum of Cubes

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

Exponents/Radicals

$$b^m \cdot b^n = b^{m+n} \quad b^0 = 1, (b \neq 0)$$

$$(b^m)^n = b^{mn} \quad (ab)^n = a^n b^n$$

$$\frac{b^m}{b^n} = b^{m-n} \quad \left(\frac{a}{b} \right)^n = \frac{a^n}{b^n}$$

$$b^{-n} = \frac{1}{b^n} \quad \left(\frac{a}{b} \right)^{-n} = \left(\frac{b}{a} \right)^n$$

$$\frac{1}{b^{-n}} = b^n$$

$$\sqrt[n]{b} = b^{\frac{1}{n}}$$

$$b^{\frac{m}{n}} = \sqrt[n]{b^m} \quad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}, (b \neq 0)$$

Imaginary Number

$$i = \sqrt{-1}$$

$$i^2 = -1$$

$$i^3 = -i$$

$$i^4 = 1$$

Quadratic Equation

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

Quadratic Formula

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

Absolute Value

$$|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$$

$$|a| = \sqrt{a^2}$$

For $a > 0$,

$$|x| = a \Leftrightarrow x = -a \text{ or } x = a$$

$$|x| < a \Leftrightarrow (x > -a \text{ and } x < a) \\ \Leftrightarrow (-a < x < a)$$

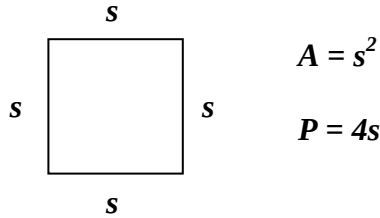
$$|x| > a \Leftrightarrow x < -a \text{ or } x > a$$

Area & Perimeter Formulas

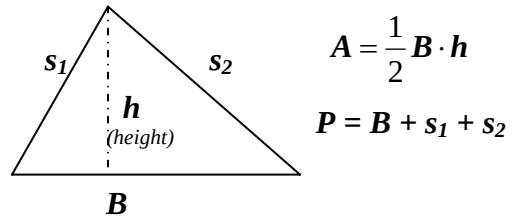
Area (A) is the amount of *square units* of space an object occupies.

Perimeter (P) is the distance *around* a figure.

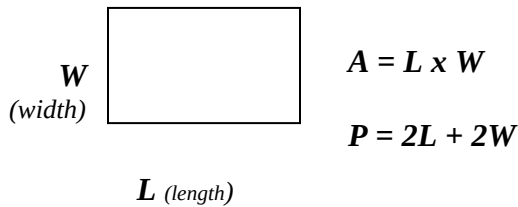
1. **Square:** A quadrilateral (4-sided figure) with four 90° (right) angles and four equal sides.



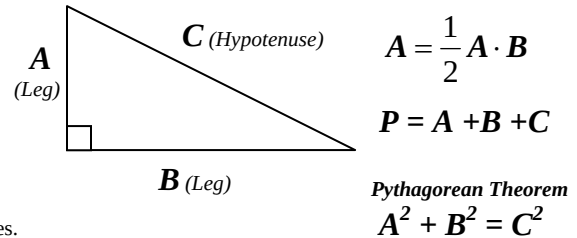
2. **Triangle:** A 3-sided figure



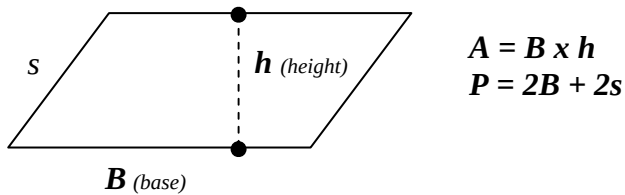
3. **Rectangle:** A quadrilateral with four 90° (right) angles.



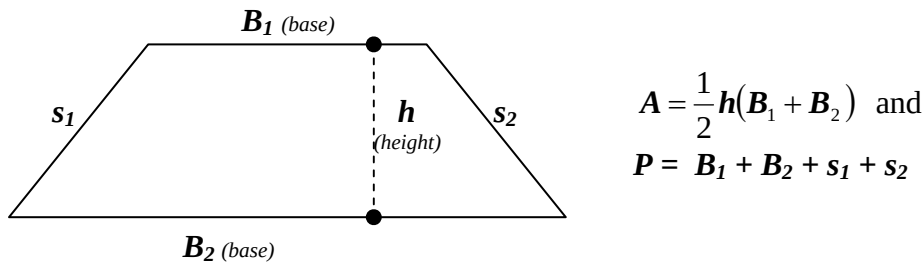
4. **Right Triangle:** triangle with a 90° (right) angle



5. **Parallelogram:** A quadrilateral with equal opposite sides.



6. **Trapezoid:** A quadrilateral with exactly one pair of parallel sides.



7. **Circle:** A set of points a constant distance (radius) from a given point (center).

$$A = \pi r^2$$

$$C = 2\pi r$$

$$d = 2r \text{ or } r = \frac{d}{2}$$

