Quadratic Equation

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

Quadratic Formula

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

Factoring

Difference of Squares:

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

Difference of Cubes

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

Sum of Cubes

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

Perfect Square Binomials:

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

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

Perfect Cube Binomials

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

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

Exponents/Radicals

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

$$\left(b^m\right)^n = b^{mn} \qquad (ab)^n = a^n b^n$$

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

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

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

$$\sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$$

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

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

Absolute Value

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

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

For $a > 0$,

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

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

$$\Leftrightarrow (-a < x < a)$$

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

Geometry

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

$$\text{Center} = (h,k), \text{Radius} = r$$

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

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

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

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

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

Slope-Intercept Form: $y = mx + b$, $\quad$ *Horizontal Line: $y = b$, Vertical Line: $x = a$*

$$\qquad\qquad\qquad\qquad\qquad (m = 0) \qquad\qquad (m \text{ undefined})$$

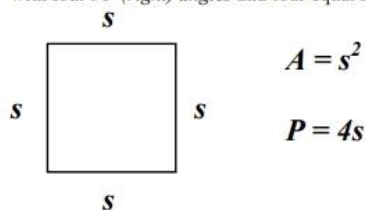*Standard Form:* $\qquad Ax + By = C$

Midpoint Formula: $\quad \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$
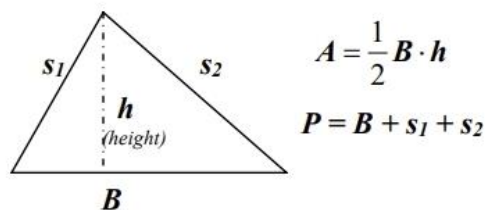
Area & Perimeter Formulas

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

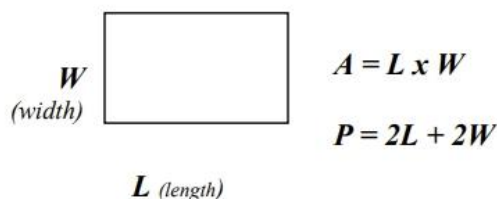**Perimeter (P)** is the distance *around* a figure.

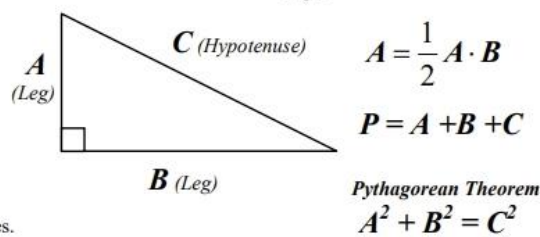1. **Square**: A *quadrilateral* (4-sided figure) with four *90° (right) angles* and four equal sides.

$A = s^2$

$P = 4s$

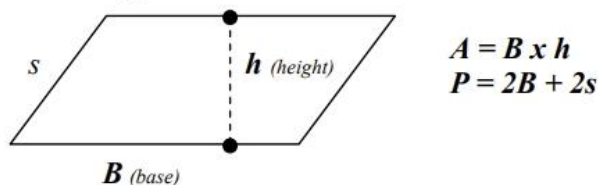2. **Triangle**: A *3-sided figure*

$A = \frac{1}{2}B \cdot h$

$P = B + s_1 + s_2$

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

$A = L \times W$

$P = 2L + 2W$

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

$A = \frac{1}{2}A \cdot B$

$P = A + B + C$

Pythagorean Theorem

$A^2 + B^2 = C^2$

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

$A = B \times h$

$P = 2B + 2s$

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

$A = \frac{1}{2}h(B_1 + B_2)$ and

$P = B_1 + B_2 + s_1 + s_2$

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

$A = \pi r^2$

$C = 2\pi r$

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

Diameter (d) (*distance across the circle*)

Radius (r) (*distance from center to circle*)

Circumference (C) (*distance around the circle*)

center