
Directly Proportional

$$y = kx \quad k = \frac{y}{x}$$

k : Constant of Proportionality

Inversely Proportional

$$y = \frac{k}{x} \quad k = yx$$

Quadratic formula

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

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

Concavity

Concave up: $a > 0$

Concave down: $a < 0$

Discriminant

$$\Delta = b^2 - 4ac$$

Vertex of the parabola

$$V\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$$

$$y = a(x - h)^2 + k$$

Concavity

Concave up: $a > 0$

Concave down: $a < 0$

Vertex of the parabola

$$V(h, k)$$

Zero-product property

$$A \times B = 0 \Leftrightarrow A = 0 \vee B = 0$$

$$\text{ex: } (x + 2) \times (x - 1) = 0 \Leftrightarrow \\ x + 2 = 0 \vee x - 1 = 0 \Leftrightarrow x = -2 \vee x = 1$$

Difference of two squares

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

$$\text{ex: } (x - 2)(x + 2) = x^2 - 2^2 = x^2 - 4$$

Perfect square trinomial

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

$$\text{ex: } (2x + 3)^2 = (2x)^2 + 2 \cdot 2x \cdot 3 + 3^2 = \\ 4x^2 + 12x + 9$$

Binomial theorem

$$(x + y)^n = \sum_{k=0}^n {}^n C_k x^{n-k} y^k$$
