

Quadratic Function

Vertex Form

Standard Form

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

$$f(x) = ax^2 + bx + c$$

$$f(x) = ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 + \frac{4ac - b^2}{4a}$$

Axis of Symmetry line

$$x = h$$

$$x = -\frac{b}{2a}$$

$$\text{Vertex} = (h, k) = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right) = \left(-\frac{b}{2a}, \frac{-\Delta}{4a}\right)$$

Case

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

$$\Delta > 0$$

- If $\Delta > 0$, the graph of $f(x) = ax^2 + bx + c$ has two distinct x intercepts so it crosses the x – axis in two places.

$$\Delta = 0$$

- If $\Delta = 0$, the graph of $f(x) = ax^2 + bx + c$ has one distinct x – intercept so it touches the x – axis at its vertex.

$$\Delta < 0$$

- If $\Delta < 0$, the graph of $f(x) = ax^2 + bx + c$ has no x intercepts so it does not cross or touch the x – axis .

$$\Delta \geq 0$$

$$x - \text{intercepts} = \left(\frac{-b \pm \sqrt{\Delta}}{2a}, 0\right)$$