

Standard Form

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

NOTE: Both **Standard Form** and **Vertex Form** can open either UP or DOWN.

Vertex Form

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

Leading Coefficient (a)

$a < 0$
(negative)

$a > 0$
(positive)

Vertex is: (h, k)
be sure to switch sign for h

Vertex Formula:

$$\left(-\frac{b}{2a}, f\left(-\frac{b}{2a} \right) \right)$$

plug in x to get y

Maximum value
is (y -vertex)

opens
DOWN

opens
UP

Decreasing
 $x < (x\text{-vertex})$
 $(-\infty, x\text{-vertex})$

Increasing
 $x > (x\text{-vertex})$
 $(x\text{-vertex}, \infty)$

Domain: all real numbers
 $(-\infty, \infty)$

Range: $y \leq y\text{-vertex}$
 $(-\infty, y\text{-vertex}]$
(use bracket for range)

Domain: all real numbers
 $(-\infty, \infty)$

Range: $y \geq (y\text{-vertex})$
 $[y\text{-vertex}, \infty)$
(use bracket for range)

Increasing
 $x < (x\text{-vertex})$
 $(-\infty, x\text{-vertex})$

Decreasing
 $x > (x\text{-vertex})$
 $(x\text{-vertex}, \infty)$

Minimum value
is (y -vertex)

Axis of Symmetry

Equation is: $x = (x\text{-vertex})$

Section 3.1 Quadratic Functions