# Quadratic Equations

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

Vertex (*h*,*k*)
Equation of the Axis of symmetry: *x* = *h*

***Vertex Form Example:***

$\boldsymbol{y = 1(x-1)^2 - 4}$

**Vertex (1, -4)**
*x* = 1 is the Axis of Symmetry

## Intercept Form $y = a(x-p)(x-q)$

Set the equation equal to zero to find the x-intercepts. Why? Because *y* is equal to zero when a coordinate pair is located on the x-axis.

$$0 = a(x-p)(x-q)$$

Set $x - p = 0$ and $x - q = 0$
*x*-intercept coordinate pairs: (p,0) and (q,0)

Equations of the Axis of Symmetry and x-coordinate of the vertex are: $x = \frac{p+q}{2}$.

To calculate the y-coordinate of the vertex, plug the value of the x-coordinate $x = \frac{p+q}{2}$ into the original equation.

***Intercept Form Example:***

*y* = (*x* + 1)(*x* – 3)

(-1,0) and (3,0) are the x-intercepts

Vertex $x = \frac{-1+3}{2} = 1$
*f*(1) = (1+1)(1-3) = -4
Vertex (1, -4)

## For all 3 forms:

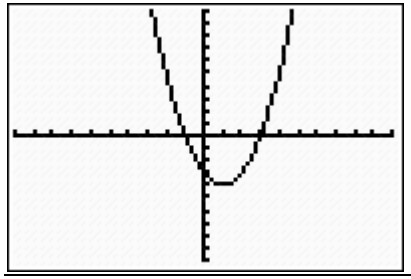
Follow the initial steps in the "standard", "vertex" or "intercept" box, then plot points near the vertex such as:

| *x* | *y* |
|---|---|
| **0** | **-3** |
| **3** | **0** |

**The x-coordinate of the vertex is the axis of symmetry.**

**- When a > 0 (a is positive), the parabola opens up (like a cup).**
**- When a < 0 (a is negative), the parabola opens down (like a frown).**

***The graph for all 3 functions is the same.***



## Standard Form $y = ax^2 + bx + c$

Axis of Symmetry $x = \frac{-b}{2a}$
X-coordinate of the vertex: $x = \frac{-b}{2a}$

To calculate the y-coordinate of the vertex, plug the value of the x-coordinate $x = \frac{-b}{2a}$ into the original equation.

When $x = 0, y = c$, which is the y-intercept, (0,c).

***Standard Form Example:***

$y = x^2 - 2x - 3$

Axis of Symmetry $x = \frac{-(-2)}{2(1)} = 1$

$f(1) = 1^2 - 2(1) - 3 = -4$

Vertex (1, -4)

$f(0) = 0^2 - 2(0) - 3 = -3$
Therefore, the y-intercept is (0, -3)