Graphing Quadratic Functions

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

Quadratic Functions

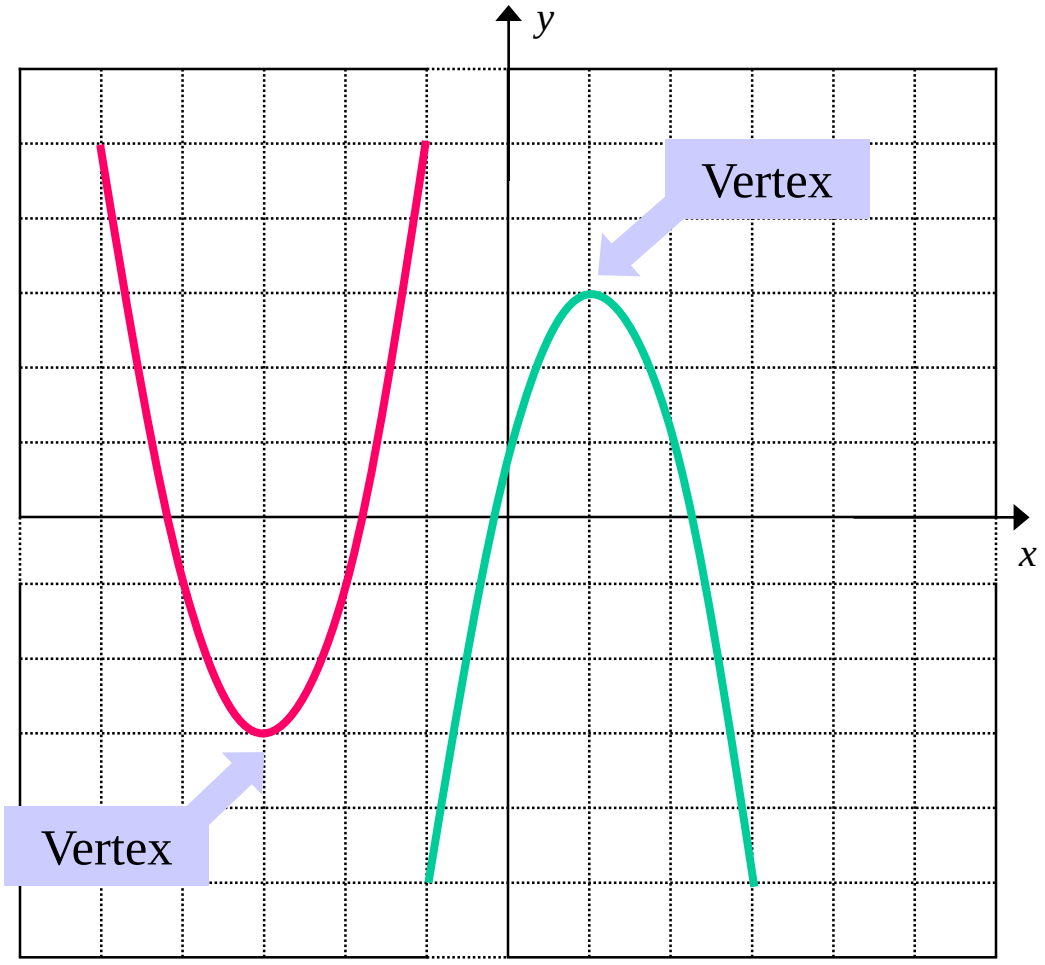
The graph of a quadratic function is a **parabola**.

A parabola can open up or down.

If the parabola opens up, the lowest point is called the vertex.

If the parabola opens down, the vertex is the highest point.

NOTE: if the parabola opened left or right it would not be a function!



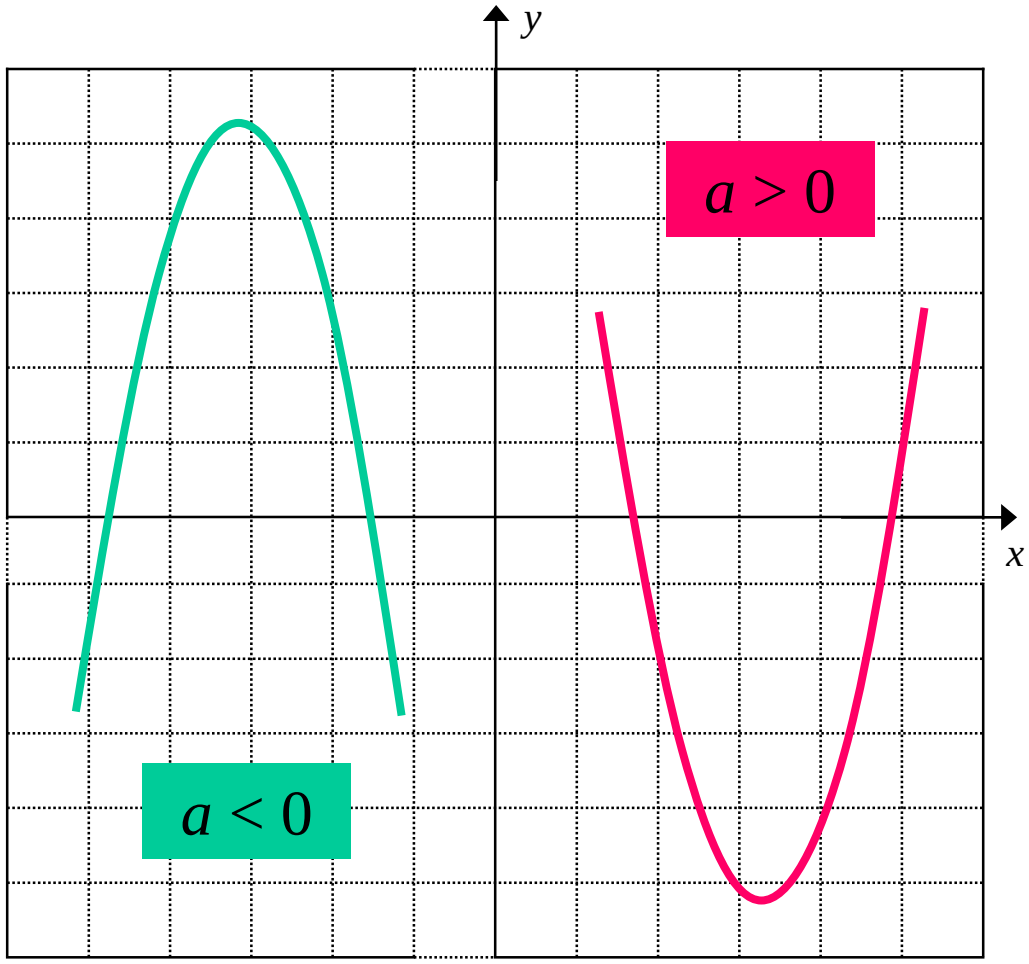
Standard Form

The standard form of a quadratic function is

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

The parabola will open up when the *a* value is positive.

The parabola will open down when the *a* value is negative.



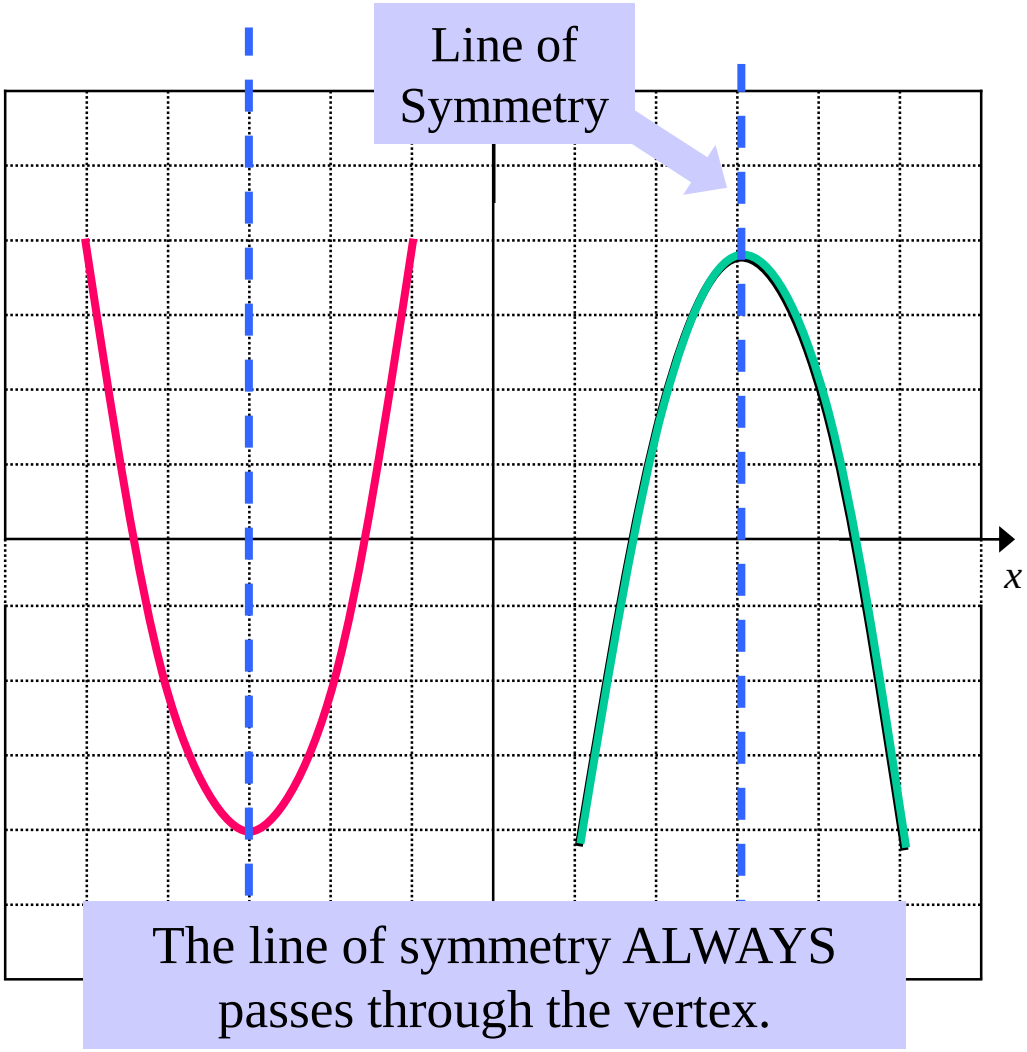
Line of Symmetry

Parabolas have a symmetric property to them.

If we drew a line down the middle of the parabola, we could fold the parabola in half.

We call this line the **line of symmetry**.

Or, if we graphed one side of the parabola, we could "fold" (or REFLECT) it over, the line of symmetry to graph the other side.



Finding the Line of Symmetry

When a quadratic function is in standard form

$$y = ax^2 + bx + c,$$

The equation of the line of symmetry is

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

This is best read as …

the opposite of b divided by the quantity of 2 times a.

For example…

Find the line of symmetry of

$$y = 3x^2 - 18x + 7$$

Using the formula…

$$x = \frac{18}{2(3)} = \frac{18}{6} = 3$$

Thus, the line of symmetry is $x = 3$.

Finding the Vertex

We know the line of symmetry always goes through the vertex.

Thus, the line of symmetry gives us the x – coordinate of the vertex.

To find the y – coordinate of the vertex, we need to plug the x – value into the original equation.

$$y = -2x^2 + 8x - 3$$

STEP 1: Find the line of symmetry

$$x = \frac{-b}{2a} = \frac{-8}{2(-2)} = \frac{-8}{-4} = 2$$

STEP 2: Plug the x – value into the original equation to find the y value.

$$y = -2(2)^2 + 8(2) - 3$$

$$y = -2(4) + 8(2) - 3$$

$$y = -8 + 16 - 3$$

$$y = 5$$

Therefore, the vertex is (2 , 5)

A Quadratic Function in Standard Form

The standard form of a quadratic function is given by

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

There are 3 steps to graphing a parabola in standard form.

STEP 1: Find the line of symmetry

USE the equation $x = \frac{-b}{2a}$ using the close to the mmetry.

STEP 2: Find the vertex

STEP 3: Find two other points and reflect them across the line of symmetry. Then connect the five points with a smooth curve.

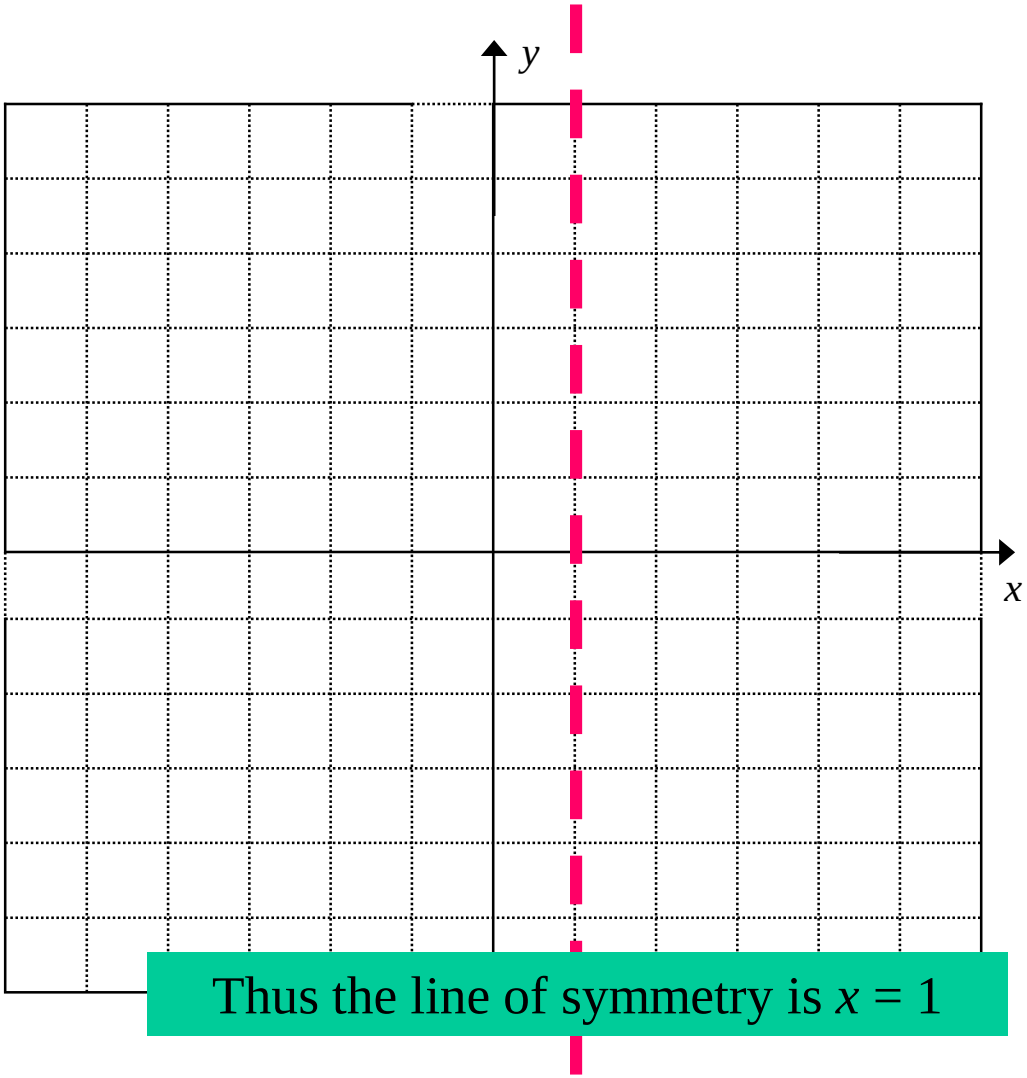
A Quadratic Function in Standard Form

Let's Graph ONE! Try …

$$y = 2x^2 - 4x - 1$$

STEP 1: Find the line of symmetry

$$x = \frac{-b}{2a} = \frac{4}{2(2)} = 1$$



A Quadratic Function in Standard Form

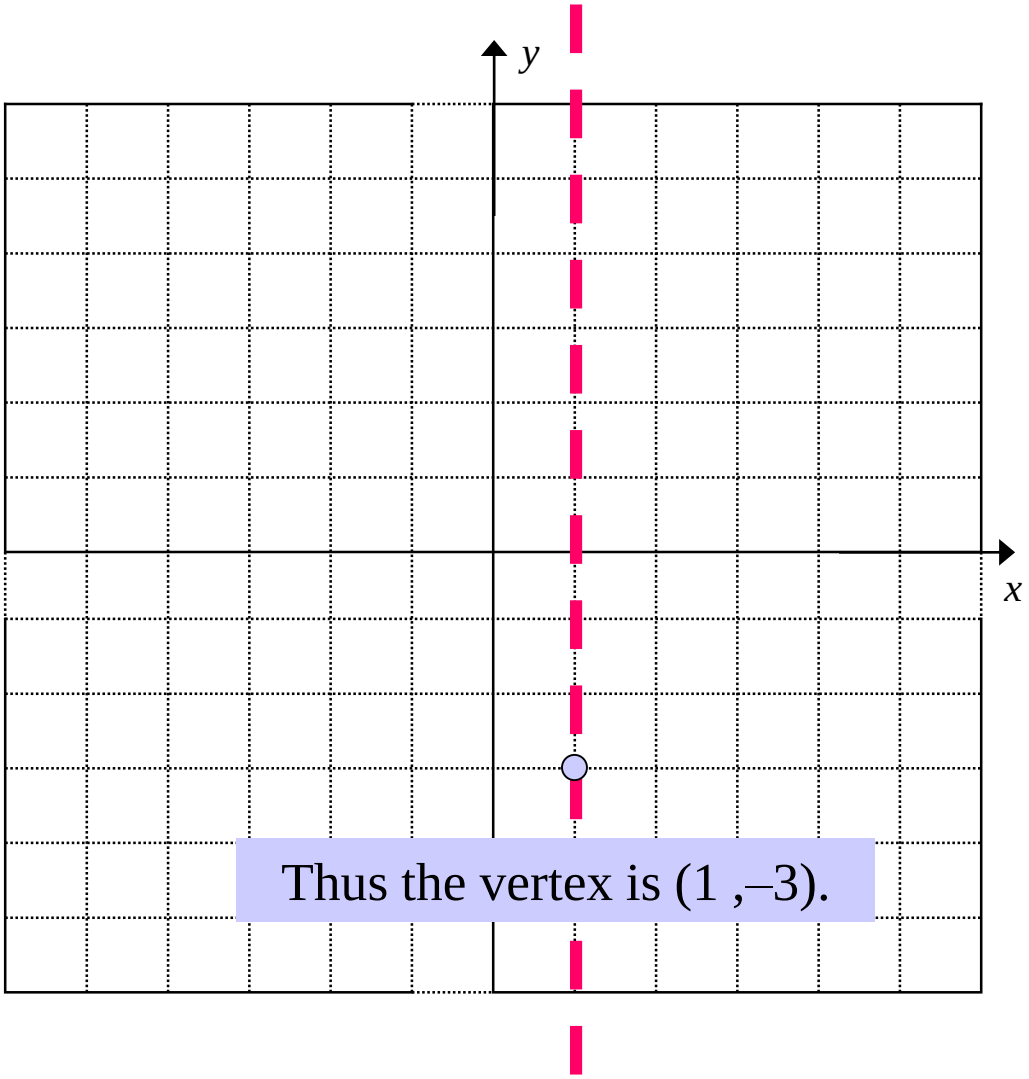
Let's Graph ONE! Try …

$$y = 2x^2 - 4x - 1$$

STEP 2: Find the vertex

Since the x – value of the vertex is given by the line of symmetry, we need to plug in $x = 1$ to find the y – value of the vertex.

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



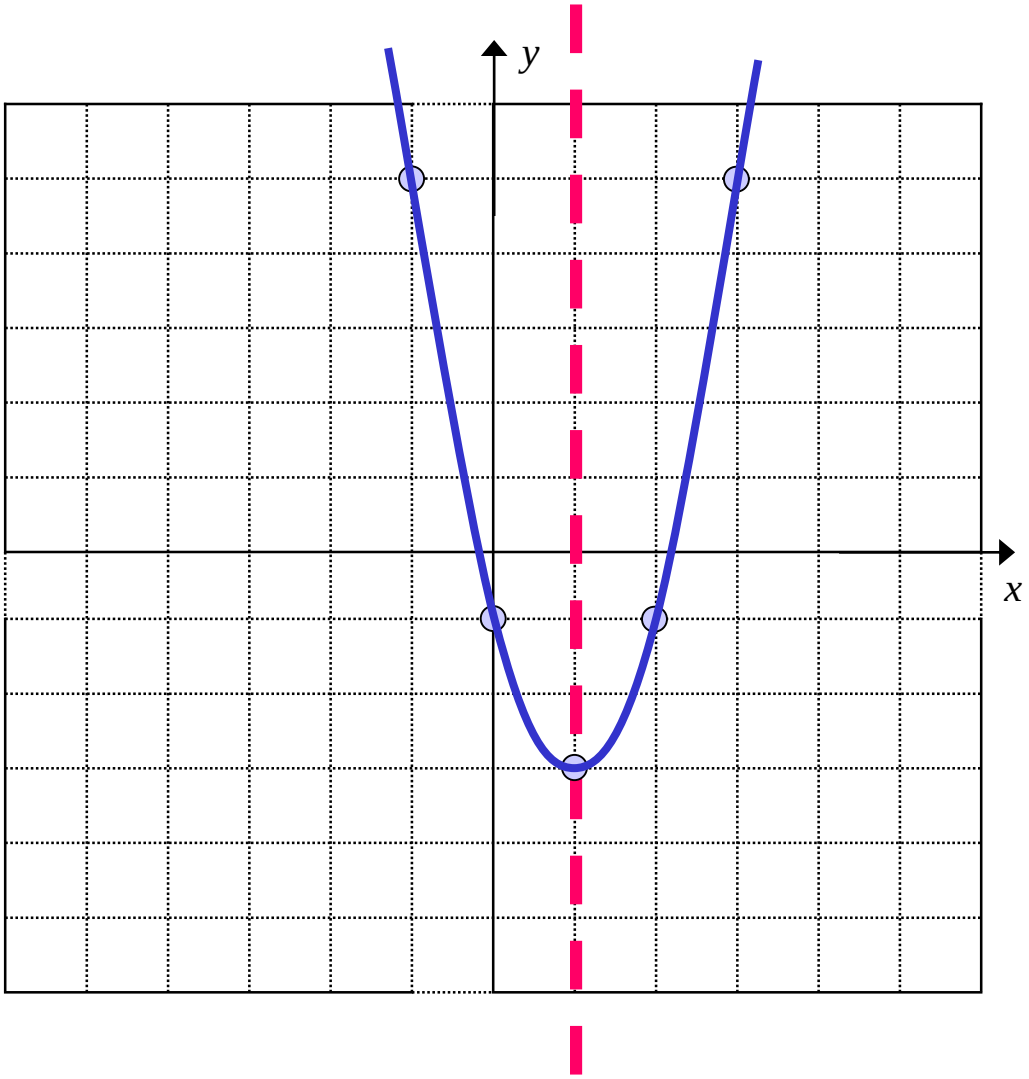
A Quadratic Function in Standard Form

Let's Graph ONE! Try …

$$y = 2x^2 - 4x - 1$$

STEP 3: Find two other points and reflect them across the line of symmetry. Then connect the five points with a smooth curve.

x	y
2	–1
3	5



$y = 2(2)^2 - 4(2) - 1 = -1$

$y = 2(3)^2 - 4(3) - 1 = 5$