

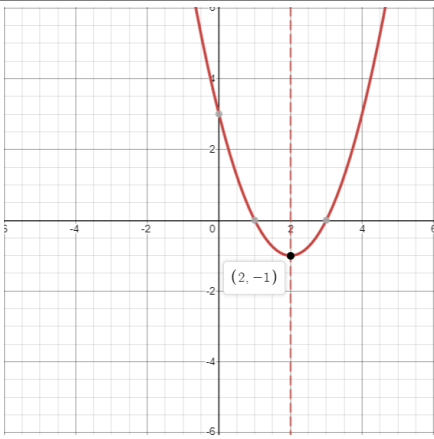
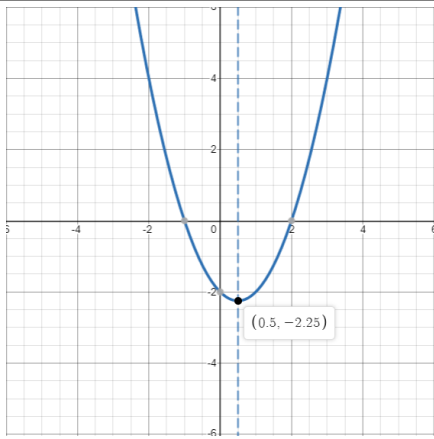
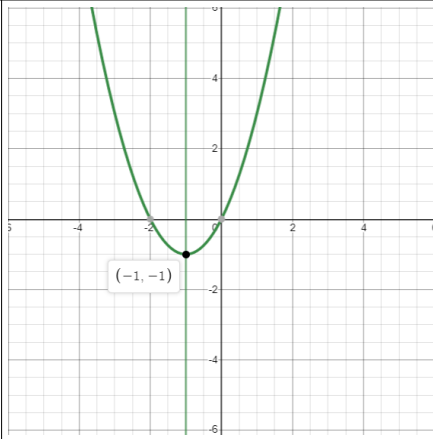
Finding the Vertex

Recall:

The **axis of symmetry** is the line that divides a parabola in half.

The **vertex** is the highest (or lowest) point on a parabola.

Here are the same equations from yesterday, but now with the axis and vertex also shown:

$y = (x - 1)(x - 3)$	$y = (x + 1)(x - 2)$	$y = x(x + 2)$
		
Intercepts are $x = 1$ and $x = 3$	Intercepts are $x = -1$ and $x = 2$	Intercepts are $x = -2$ and $x = 0$
Axis is $x = 2$	Axis is $x = 0.5$	Axis is $x = -1$
Vertex is $(2, -1)$	Vertex is $(0.5, -2.25)$	Vertex is $(-1, -1)$

Notice that the **axis of symmetry** is located **halfway between** the x -intercepts.

To find the halfway point between the intercepts, either you must “visualize” where the halfway point is on a number line, or you can take the **average** of the intercepts.

For example, with $y = (x + 1)(x - 2)$:

The x -intercepts are **-1** and **2**.

The average of these numbers is $\frac{(-1)+(2)}{2} = \frac{1}{2} = 0.5$. So the axis is $x = 0.5$.

Example 1: Find the axis of symmetry of each relation.

$y = (x - 2)(x + 4)$ x-intercepts are 2 and -4. Halfway: $\frac{(2) + (-4)}{2} = \frac{-2}{2} = -1$ The axis is $x = -1$.	$y = (x + 5)(x + 6)$ x-intercepts are -5 and -6. Halfway: $\frac{(-5) + (-6)}{2} = \frac{-11}{2} = -5.5$ The axis is $x = -5.5$.	$y = (x - 3)(x - 3)$ x-intercepts are 3 and... 3. Halfway: $\frac{(3) + (3)}{2} = \frac{6}{2} = 3$ The axis is $x = 3$.
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To find the **vertex**, we take the value of our axis and plug it into our equation.

For example, with $y = (x + 1)(x - 2)$:

We found the axis is $x = 0.5$.

$$y = (0.5 + 1)(0.5 - 2)$$

$$y = (1.5)(-1.5)$$

$$y = -2.25$$

So the vertex is **(0.5, -2.25)**. (Note the vertex is a **point**. You need both x and y.)

Example 2: Find the vertex of each relation in Example 1.

$y = (x - 2)(x + 4)$ The axis is $x = -1$. $y = (-1 - 2)(-1 + 4)$ $y = (-3)(3)$ $y = 9$ The vertex is (-1, 9) .	$y = (x + 5)(x + 6)$ The axis is $x = -5.5$. $y = (-5.5 + 5)(-5.5 + 6)$ $y = (-0.5)(0.5)$ $y = 0.25$ The vertex is (-5.5, 0.25) .	$y = (x - 3)(x - 3)$ The axis is $x = 3$. $y = (3 - 3)(3 - 3)$ $y = (0)(0)$ $y = 0$ The vertex is (3, 0) .
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