Algebra 1: 11.1 Guided Notes - Part 2 **Name** _____ **Period** _____
Exploring Quadratic Functions

Learning Goals:
Graph a quadratic function of the form $y = ax^2 + bx + c$.
Analyze the standard form of a quadratic function and use it to sketch its graph.

Let's Review

What do we know about the graphs of $y = ax^2$ and $y = ax^2 + c$?

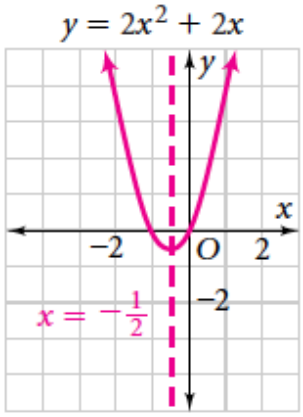
If $a > 0$, the parabola opens UP.	If $\|a\| > 1$, the parabola gets narrower/skinner.
If $a < 0$, the parabola opens DOWN.	If $\|a\| < 1$, the parabola gets wider.

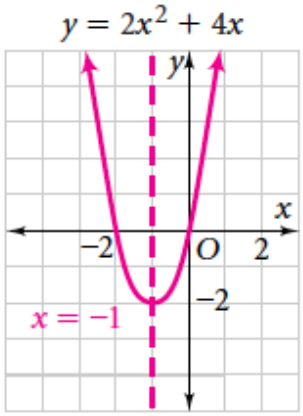
If $c > 0$, the parabola moves UP c units.	If $c < 0$, the parabola moves DOWN c units.

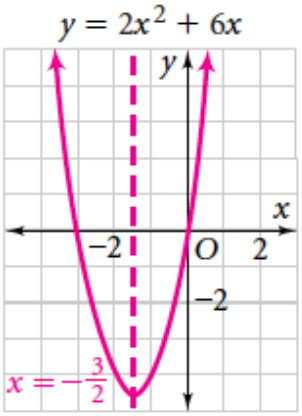
Essential Question

How does the value of b affect the graph? More importantly, how does it change the axis of symmetry?

Consider the graphs of 3 different quadratic functions.







All 3 graphs have the same value for a, a = 2, and the same value for c, c = 0. These graphs also have the same y-intercept, $y = c = 0$.

Only the value of b is different for each quadratic function.

The value of b changes the **axis of symmetry.**

Equation for the axis of symmetry is $x = -\frac{b}{2a}$. This is also the x-coordinate for the vertex.

Let's calculate the axis of symmetry for each of the quadratic functions listed above.

1) $2x^2 + 2x$

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

2) $2x^2 + 4x$

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

3) $2x^2 + 6x$

$$x = -\frac{6}{2(2)} = -\frac{6}{4} = -\frac{3}{2}$$

Once you know the axis of symmetry, how do you find the vertex?

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

Plug the value of x into the quadratic function to find the y-coordinate of the vertex.

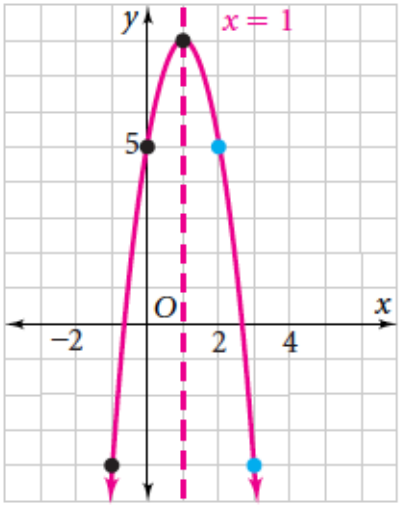
How do you find the y-intercept?

Let $x = 0$ in the quadratic function and solve for y. The y-intercept will be $y =$ c.

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

Graph the function $y = -3x^2 + 6x + 5$.

Steps:	
▪ Find the axis of symmetry.	Axis of symmetry: $x = -\frac{6}{2(-3)} = -\frac{6}{-6} = 1$
▪ Find the y-coordinate of the vertex by substituting the axis of symmetry for x in the quadratic function.	$y = -3(1)^2 + 6(1) + 5 = -3 + 6 + 5 = 8$ The vertex is (1, 8).
▪ Find the y-intercept by letting $x = 0$ in the quadratic function.	$y = -3(0)^2 + 6(0) + 5 = 5$ The y-intercept is (0, 5)
▪ Choose another value for x on the same side of the vertex as the y-intercept.	Let x = -1. $y = -3(-1)^2 + 6(-1) + 5 = -3 - 6 + 5 = -4$ Another point is (-1, -4).
▪ Reflect the y-intercept and another point across the axis of symmetry.	The point (2, 5) is a reflection of (0, 5) and (3, -4) is a reflection of (-1, -4). Each set of points has an x-coordinate that is the same distance (or # of units) from the axis of symmetry.
▪ Sketch the parabola.	



x	y
-1	-4
0	5
1	8
2	5
3	-4

Put the vertex in the middle of the table!