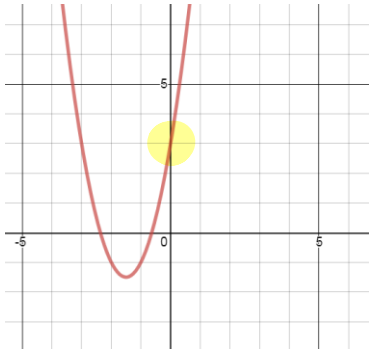
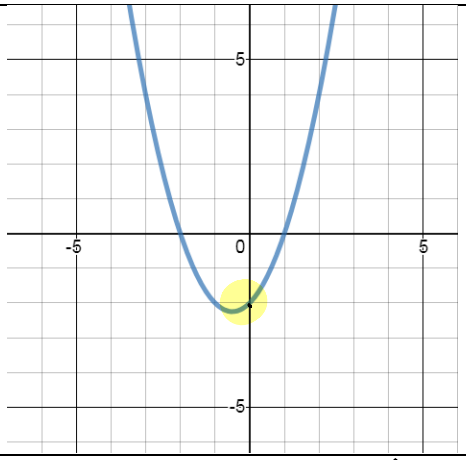
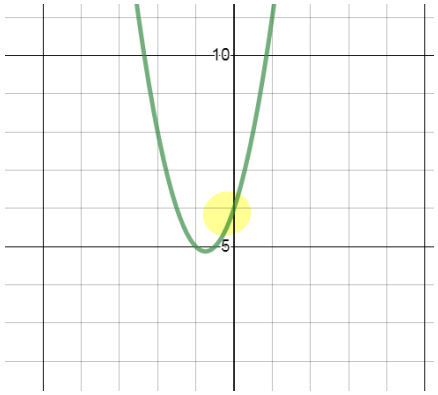
Topic 8.3 – Quadratic Functions in Standard Form

EXAMPLE 1 - Relate c to the Graph of $f(x) = ax^2 + bx + c$

What information does c provide about the graph of $f(x) = ax^2 + bx + c$?

$f(x) = 2x^2 + 6x + 3$	$f(x) = x^2 + x - 2$	$f(x) = 2x^2 + 3x + 6$
		
y-int: (0,3)	y-int: (0,-2)	y-int: (0,6)

Finding the vertex from Standard Form:

The **standard form of a quadratic function** is $f(x) = ax^2 + bx + c$, where $a \neq 0$. The value c is the y-intercept of the graph.

Axis of symmetry/x-value of vertex: $x = \frac{-b}{2a}$

Y-value of the vertex: plug in the x-value to get the y-value

EXAMPLE 2 – Find the vertex of the quadratic in standard form.

Graph $f(x) = -0.75x^2 + 3x - 4$.

$a = -0.75$ $b = 3$ $c = -4$

Step 1.

Find x-value of vertex: $x = \frac{-b}{2a}$ $x = \frac{-3}{2(-0.75)} = \frac{-3}{-1.5} = 2$ $x = 2$

Step 2. $y = -0.75(2)^2 + 3(2) - 4$

$y = -0.75(4) + 6 - 4$

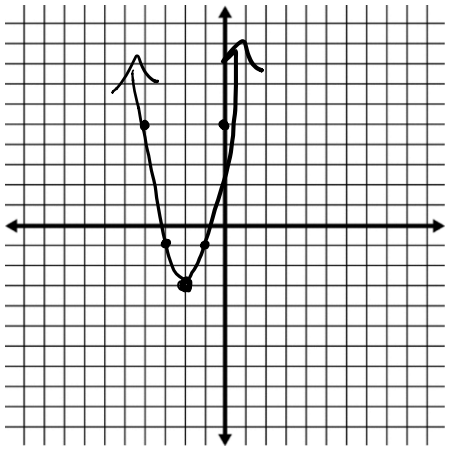
$y = -3 + 6 - 4 = -1$

Plug x-value in to get the y-value of vertex.

Step 3. vertex: (2,-1)

Write as a coordinate pair

Example 3 - Find the vertex and graph $f(x) = 2x^2 + 8x + 5$



x-value: $x = \frac{-8}{2(2)} = \frac{-8}{4} = -2$

y-value: $y = 2(-2)^2 + 8(-2) + 5$

$y = 2(4) - 16 + 5$

$y = 8 - 16 + 5$

$y = -3$

vertex: $(-2, -3)$

over x	up y
1	$1 \cdot 2 = 2$
2	$4 \cdot 2 = 8$

$a = 2 \rightarrow$ vertical dilation is 2

Example 4 – Convert a Quadratic from Vertex to Standard Form:

$f(x) = 2(x+3)^2 - 4$

$f(x) = 2(x+3)(x+3) - 4$

$f(x) = 2(x^2 + 3x + 3x + 9) - 4$

$f(x) = 2x^2 + 6x + 6x + 18 - 4$

$f(x) = 2x^2 + 12x + 14$

1) Expand the binomial.
2) FOIL the binomials.
3) Distribute into the parenthesis.
4) Simplify.

Example 5– Cyndie is standing a platform 24 feet above the pool. She jumps off the platform and her height above the pool can be measured with the function $h(t) = -16t^2 + 8t + 24$, where *t* is the seconds after she jumped and *h* is her height over time.

a) What is her maximum height above the water? (y-value of vertex)

$h(t) = -16(0.25)^2 + 8(0.25) + 24$

$h(t) = -1 + 2 + 24$

$h(t) = 25$

She is 25 ft above the water

b) How long does it take her to reach the maximum height? (x-value of the vertex)

$x = \frac{-b}{2a} = \frac{-8}{2(-16)} = \frac{-8}{-32} = \frac{1}{4}$

$\frac{1}{4}$ sec or 0.25 sec

Example 6- A ball is thrown into the air. The height of the ball, *h,* over *t* seconds can be modeled with the equation: $h(t) = -t^2 + 8t$.

a) How long does it take the ball to reach it's maximum height? (x-value of vertex)

$x = \frac{-b}{2a} = \frac{-8}{2(-1)} = \frac{-8}{-2} = 4$ sec

b) How high does it get? (y-value of the vertex

$h(t) = -(4)^2 + 8(4)$

$h(t) = -16 + 32$

$h(t) = 16$ units

You Try!

1) Find the vertex for the equation: $f(x) = x^2 - 4x + 8$

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

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

$y = 4 - 8 + 8$

$y = 4$

vertex (2, 4)

2) Find the vertex for the equation: $f(x) = -3x^2 - 12x + 1$

$x = \frac{12}{-3(2)} = \frac{12}{-6} = -2$

$y = -3(-2)^2 - 12(-2) + 1$

$y = -3(4) + 24 + 1$

$y = -12 + 24 + 1$

$y = 13$

(-2, 13)