4/1 <u>Graph $y = ax^2 + bx + c$</u> (Ch 10, Sec 2)

Properties of the Graph of a Quadratic Function

The graph of $y = ax^2 + bx + c$ is a parabola that:

- opens up if $a > 0$ (positive)
- opens down if $a < 0$ (negative)

- is narrower than the parent function $y = x^2$ if $|a| > 1$ and wider if $|a| < 1$.

- has an axis of symmetry (vertical line through vertex)
- the equation of the axis of symmetry is $x = \frac{-b}{2a}$.

* the "bx" term shifts the vertex off of the y-axis.

- has a vertex with an x-coordinate of $\frac{-b}{2a}$

- has a y-intercept of $(0, c)$.

<u>Maximum value / Minimum Value</u>:

If the parabola opens up, the vertex is the _____ of the function.

If the parabola opens down, the vertex is the _____ of the function.

Find the axis of symmetry, the vertex, and the y-intercept. Label the vertex as the max/min.

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

$y = x^2 - 6x + 11$

$a = 1$

$b = -6$

$c = 11$

$$x = \frac{-b}{2a} = \frac{-(-6)}{2(1)} = \frac{6}{2} = 3$$

axis of symmetry: $\boxed{x = 3}$

vertex $(3, 2)$

plug in $x = 3$ to $y = x^2 - 6x + 11$

$y = 3^2 - 6(3) + 11$

$y = 2$

y-intercept $(0, 11)$

~~vertex~~ parabola opens up b/c a is positive

Vertex is the <u>minimum</u> value.

$y = -\frac{1}{4}x^2 + 3x - 2$

$a = -\frac{1}{4}$

$b = 3$

$c = -2$

$$x = \frac{-b}{2a} = \frac{-(3)}{2(-\frac{1}{4})} = \frac{-3}{-0.5} = 6$$

axis of symmetry: $x = 6$

vertex $(6, 7)$ <u>max</u>

$y = -\frac{1}{4}(6)^2 + 3(6) - 2$

$y = 7$

y-int $(0, -2)$

Graph $y = 3x^2 + 12x - 8$

$a = 3$
$b = 12$
$c = -8$

Label the axis of symmetry, the vertex (max/min), and the y-intercept.

x	y
-4	-8
-3	-17
vertex ★ -2	-20
-1	-17
0	-8 ← y-intercept

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