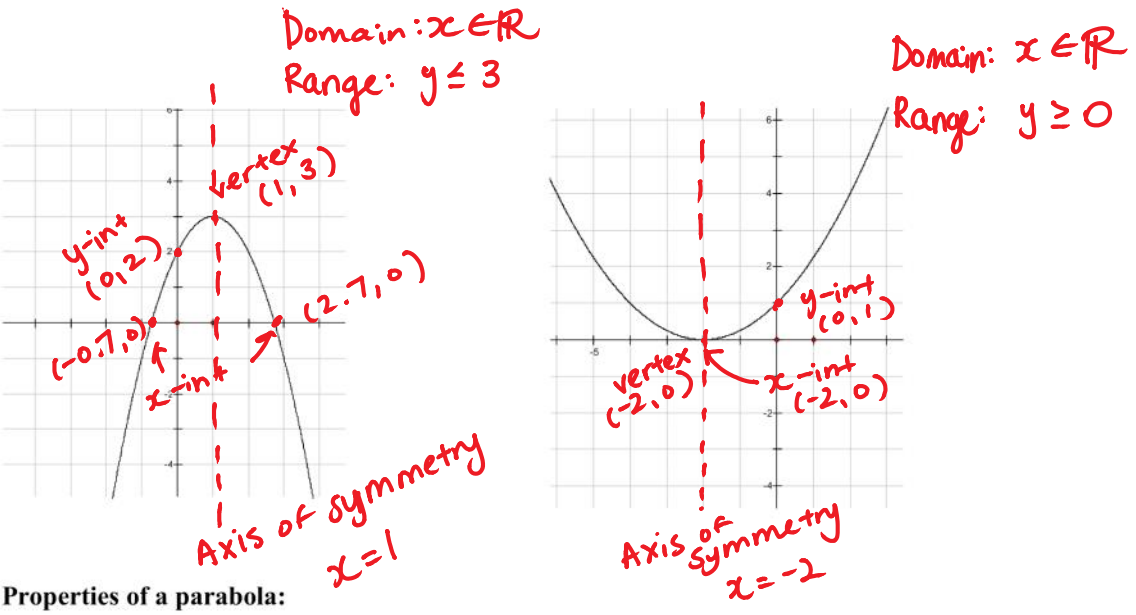
7.1 Exploring Quadratic Relations

A ***quadratic function*** is a function of degree 2 (ie. The highest exponent on the variable is 2). The equation of a quadratic function can be written in the form $y = ax^2 + bx + c$, where a, b, and c are constants, and $a \neq 0$. Some examples are:

$$y = x^2 \qquad f(n) = n^2 - 4 \qquad y = 3x^2 - 4x - 7$$

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

Examples:



Properties of a parabola:

- **Vertex**: the maximum or minimum point on the graph
- **Y-intercept:** where the graph crosses the y-axis (ie. Where x = 0)
- **X-intercept(s)**: where the graph crosses the x-axis (ie. Where y = 0)
- **Axis of symmetry**: the line about which the parabola is reflected. It goes through the vertex. If the vertex is located at point (m, n), the equation of the axis of symmetry is $x = m$.
- **Domain:** the set of valid x-values for the graph.
- **Range:** the set of valid y-values for the graph.

a)

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

vertex $(-1,-4)$

x-int $(1,0)$ + $(-3,0)$

y-int $(0,-3)$

Axis of sym $x=-1$

Domain: $x \in \mathbb{R}$

Range: $y \geq -4$

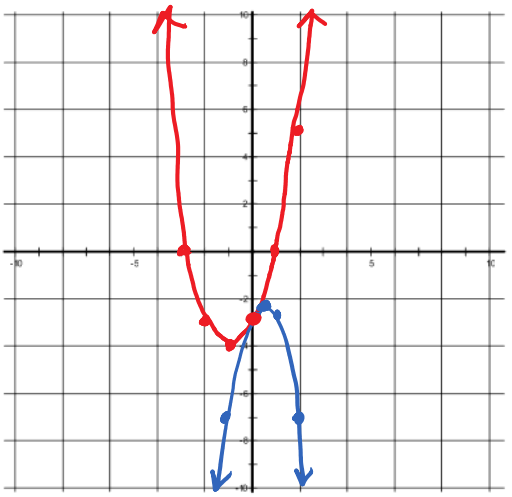
Example 1: Graph the following quadratic functions on the same grid:

a. $y = x^2 + 2x - 3$

b. $y = -2x^2 + 2x - 3$

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

d. $y = 3x^2 + 2x - 3$



The value of a is changed, but b and c are left constant. What effect does this have on the graph?

b)

x	y
-2	-15
-1	-7
0	-3
1	-3
2	-7

vertex $(0.5, -2.5)$

y-int $(0,-3)$

x-int None

Axis of sym $x = 0.5$

Domain: $x \in \mathbb{R}$ Range: $y \leq -2.5$

What does the value of a tell you about the parabola?

Example 2: Graph the following quadratic functions on the same grid:

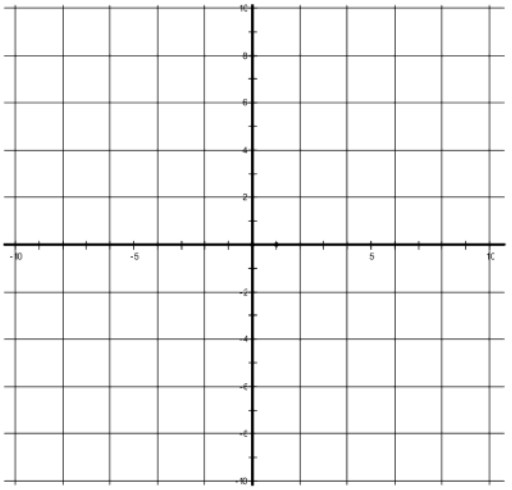
HW

a. $y = x^2 + 3x + 1$

b. $y = x^2 + 2x + 1$

c. $y = x^2 - 5x + 1$

d. $y = x^2 - 4x + 1$



The value of b is changed, but a and c are left constant. What effect does this have on the graph?

What does the value of b tell you about the parabola?

Example 3: Graph the following quadratic functions on the same grid:

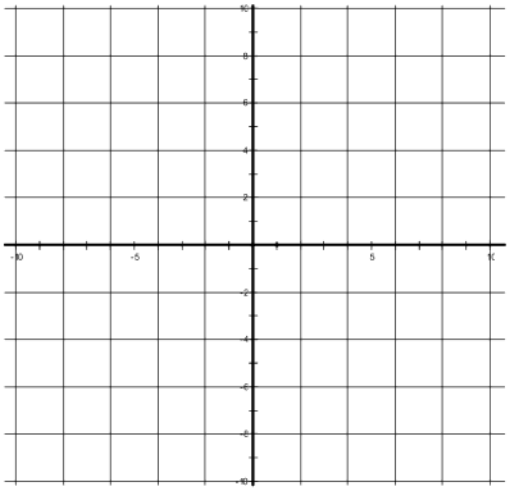
HW

a. $y = 2x^2 - 4x + 1$

b. $y = 2x^2 - 4x + 3$

c. $y = 2x^2 - 4x - 2$

d. $y = 2x^2 - 4x$

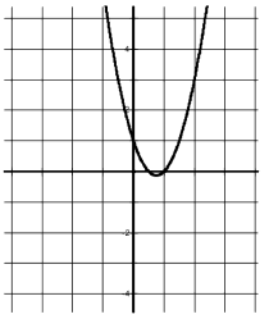


The value of c is changed, but a and b are left constant. What effect does this have on the graph?

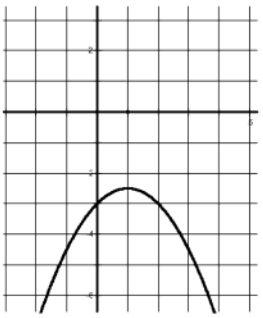
What does the value of c tell you about the parabola?

Example 4: The graphs of three quadratic relations are shown. Predict possible values of a, b, and c in the equation for each graph.

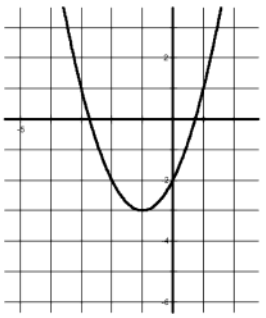
a.



b.



c.



Assignment: pg. 360 #1-6