

Algebra 1

Lesson 10.1

Graph $y = ax^2 + c$

Quadratic Functions

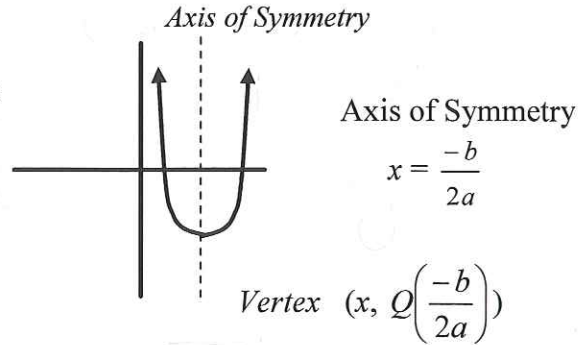
A second degree polynomial function is called **quadratic**

$$Q(x) = ax^2 + bx + c$$

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

If $a > 0$, the parabola is concave up

If $a < 0$, the parabola is concave down



Example 1. Graphing a Quadratic Parent Function

Consider the quadratic equation $y = x^2$.

(a) Does the graph open up or down? Why?

opens up b/c $a > 0$

(b) Find the axis of symmetry.

$$x = \frac{-b}{2a} = \frac{-0}{2(1)} = 0 \quad (x=0)$$

(c) Find the vertex.

$$(0, 0) \quad y = (0)^2 = 0$$

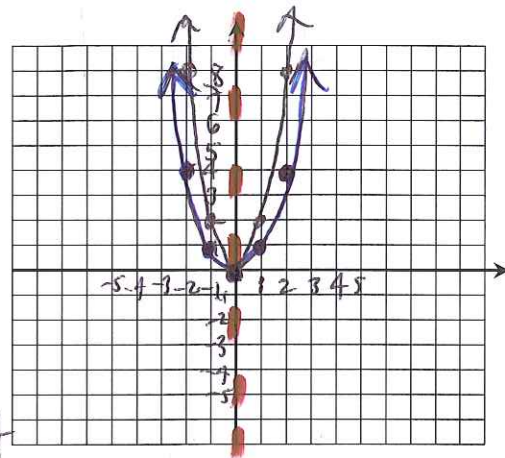
(d) Complete the table of values.

x	-2	-1	0	1	2
y	4	1	0	1	4

$$y = (1)^2 = 1$$

$$y = (2)^2 = 4$$

(e) Plot the points from your table and draw a smooth curve to connect the points.



Example 2. Comparing Two Quadratic Graphs

Consider the quadratic equation $y = 2x^2$.

(a) Does the graph open up or down? Why?

opens up b/c $a > 0$

(b) Find the axis of symmetry.

$$x = 0 \quad \text{b/c } b = 0$$

(c) Find the vertex.

$$(0, 0) \quad y = 2(0)^2 = 0$$

(d) Complete the table of values.

x	-2	-1	0	1	2
y	8	2	0	2	8

$$y = 2(1)^2 = 2$$

$$y = 2(2)^2 = 8$$

(e) Plot the points from your table and draw a smooth curve to connect the points on the same set of axes as **Example 1**.

(f) How are the two graphs similar? How are they different?

same y-intercept : *vertical stretch*
same vertex :
both open up :

Example 3. Comparing Two Quadratic Graphs

(a) Sketch the graph $y = x^2$ (Example 1) on the axes provided.

Graph $y = -\frac{1}{2}x^2$ by following these steps:

(b) Does the graph open up or down? Why?

(c) Find the axis of symmetry. *OPENS DOWN b/c $a < 0$*

$x=0$ b/c $b=0$

(d) Find the vertex.

$(0,0)$ $y = -\frac{1}{2}(0)^2 = 0$

(e) Complete the table of values for the equation $y = -\frac{1}{2}x^2$.

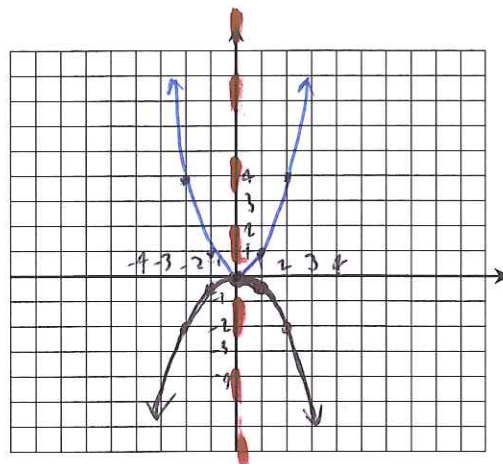
x	-2	-1	0	1	2
y	-2	$-\frac{1}{2}$	0	$-\frac{1}{2}$	-2

$y = -\frac{1}{2}(1)^2 = -\frac{1}{2}$
 $y = -\frac{1}{2}(2)^2 = -2$

(f) Plot the points from your table and draw a smooth curve to connect the points.

(g) How are the two graphs similar? How are they different?

*same y-intercept ; vertical stretch
 same vertex ; reflection over x-axis*



Example 4. Comparing Two Quadratic Graphs

(a) Sketch the graph $y = x^2$ (Example 1) on the axes provided.

Graph $y = 3x^2 - 6$ by following these steps:

(b) Does the graph open up or down? Why?

(c) Find the axis of symmetry. *OPENS UP b/c $a > 0$*

$x=0$ b/c $b=0$

(d) Find the vertex.

$(0,-6)$ $y = 3(0)^2 - 6 = -6$

(e) Complete the table of values for the equation $y = 3x^2 - 6$.

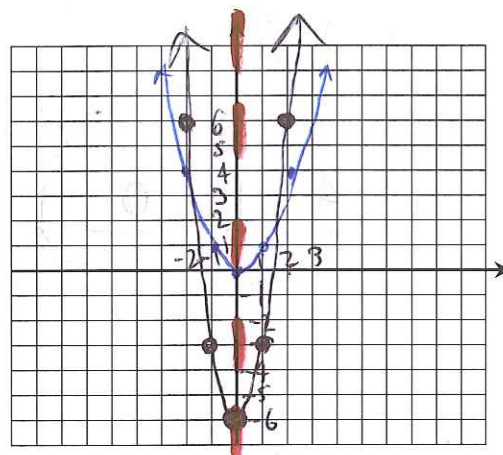
x	-2	-1	0	1	2
y	6	-3	-6	-3	6

$y = 3(1)^2 - 6 = -3$
 $y = 3(2)^2 - 6 = 6$

(f) Plot the points from your table and draw a smooth curve to connect the points.

(g) How are the two graphs similar? How are they different?

*Both open up ; vertical stretch
 ; vertical translation down 6*



Assignment

New: Pgs. 632 - 633 #3-7, 11, 20, 25, 26

Review:

1. $\frac{-8x^4 y^{-2}}{2xy^4}$

2. $(a^6)^3$

3. $\frac{x^{-2}}{x^4}$

4. $\frac{2x^2 z}{-8x^{-2} yz^2}$