

QF in Vertex Form II

Sunday, February 28, 2016 12:20 PM

3.1 Quadratic Functions in Vertex Form: Part II

Investigating $y = ax^2$

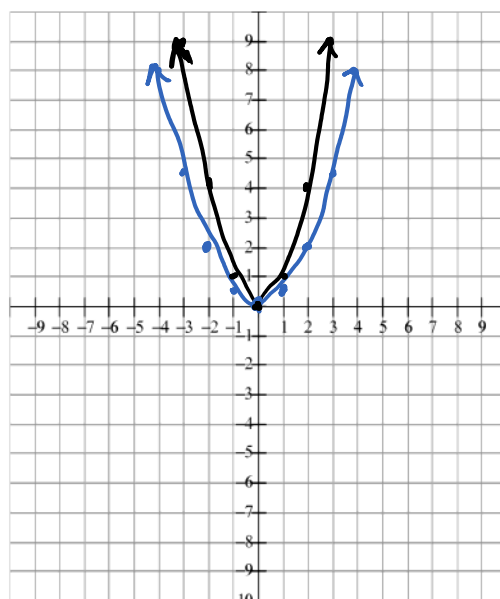
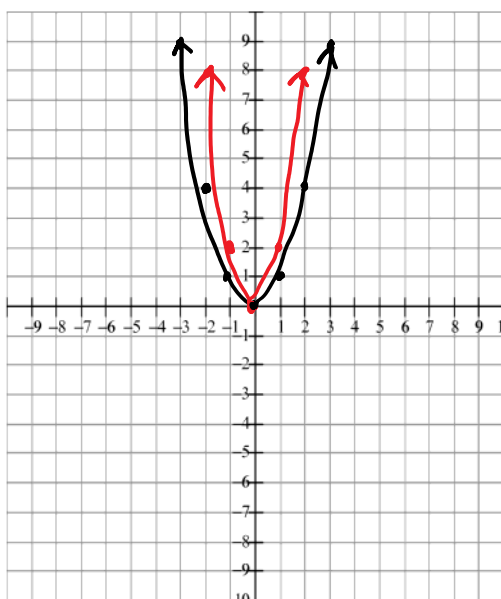
Graph the following equations on the axes provided.

$y = x^2$
 $y = 2x^2$ $y = 2(0)^2$

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

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

x	y
0	0
1	1
2	2
3	4.5
4	8



In general if $a > 1$ the parabola is thinner.

In general if $-1 < a < 1$ the parabola is fatter.

In general, for the function $y = x^2$ the graph of $y = ax^2$, where a is any real number,

is obtained by multiplying the original y-value by a.

↓
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 Joe Average.

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Ex. #1: Sketch the graph of $y = 3x^2$ on the grid provided and answer the following questions.

$$\begin{array}{c|c} x & y \\ \hline 2 & y = 3(2)^2 \\ & = 12 \end{array}$$

Vertex: $(0, 0)$

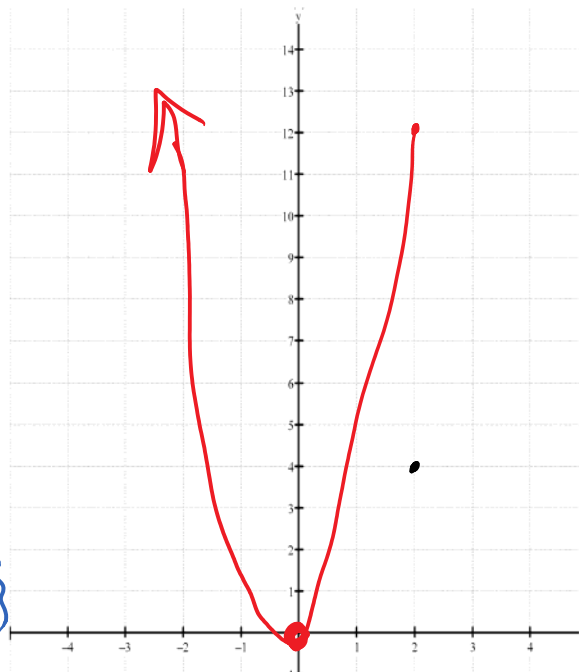
Max or Min: $y = 0$

Axis of Symmetry:

$x = 0$

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

Range: $\{y \mid y \geq 0, y \in \mathbb{R}\}$

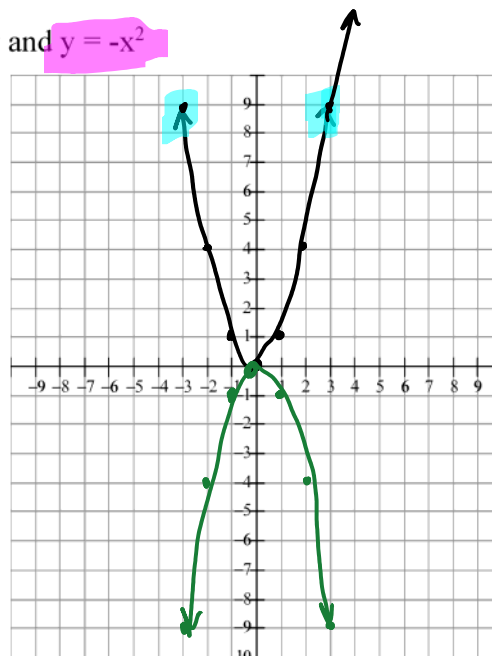


Investigating $y = -x^2$

On the grid provided sketch the graph of $y = x^2$ and $y = -x^2$

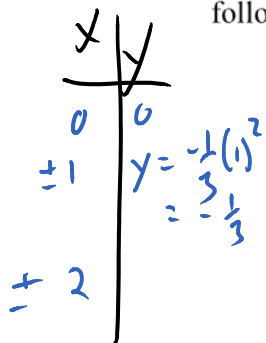
x	y

x	y
0	0
1	$y = -(1)^2 = -1$
-2	$y = -(-2)^2 = -4$
2	$y = -(2)^2 = -4$



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Ex. #2: Sketch the graph of $y = -\frac{1}{3}x^2$ on the grid provided and answer the following questions.



Vertex: $(0, 0)$

Max or Min: $y = 0$

Axis of Symmetry:
 $x = 0$

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

Range: $\{y \mid y \leq 0, y \in \mathbb{R}\}$

Steps:
 → shift left/right
 → up/down
 → multiply by a

Summary

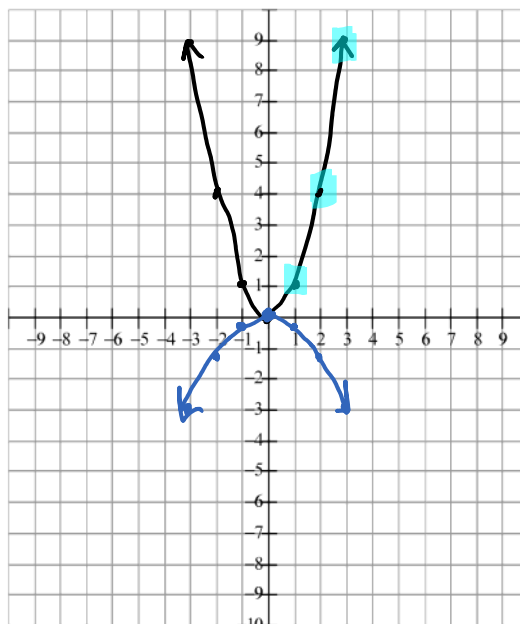
A quadratic function can be expressed in vertex form as follows:

$$y = a(x - p)^2 + q$$

$$y = (x + 3)^2$$

$$p = -3$$

The coordinates of the vertex of the parabola are (p, q)



$$y = 7(x - 3)^2 + 2$$

Ex. #3: Determine a quadratic function in vertex form that has the given characteristics.

(a) Vertex at $(-1, -3)$, passing through the point $(1, 5)$.

$$\begin{aligned}
 y &= a(x-p)^2 + q \\
 y &= a(x - (-1)) + (-3) \\
 y &= a(x+1)^2 - 3 \\
 5 &= a(1+1)^2 - 3 \\
 5+3 &= a(2)^2 \\
 \frac{8}{4} &= a = 2 \\
 y &= \underline{2}(x+1)^2 - \underline{3}
 \end{aligned}$$

(b) Vertex at $(4, 1)$, passing through the point $(8, -3)$.

$$\begin{array}{r}
 p \ q \quad 15 \ 7 \\
 \quad \quad 1, \ 9
 \end{array}$$