

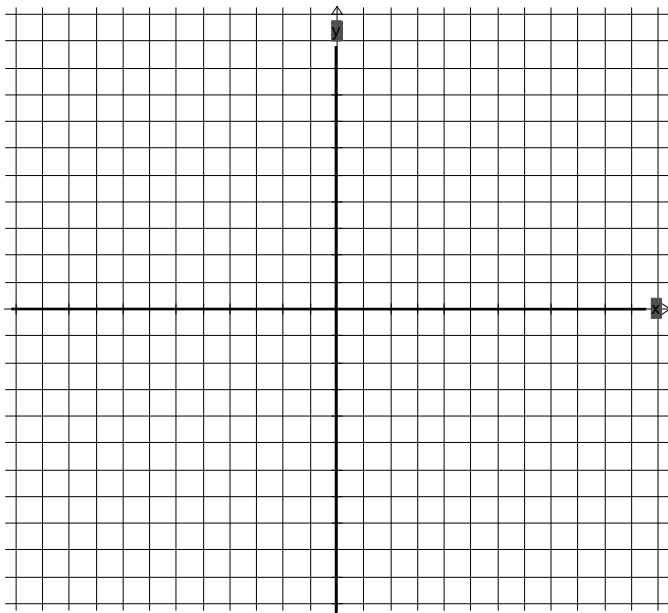
Worksheet 4-3: Quadratic Relations $y = ax^2$

Investigation 1: $y = ax^2$, “positive a ” vs. “negative a ”

On the same axes, graph $y = x^2$ and $y = -x^2$.

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

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



Compare to the basic parabola $y = x^2$,

(a) how is $y = -x^2$ similar to $y = x^2$?

(b) how is $y = -x^2$ different from $y = x^2$?

$y = x^2$ and $y = -x^2$ are vertical reflections of each other along the x -axis.

Conclusion:

When a is positive,
the parabola opens upward, and
the vertex is at $(0, 0)$.

When a is negative,
the parabola opens downward, and
the vertex is at $(0, 0)$.

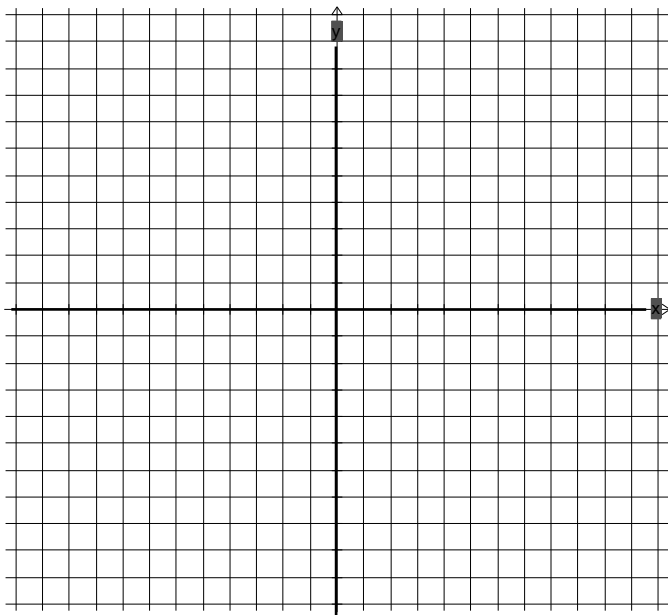
Assigned Work: WS 2-3; p. 190 #1, #4 (a, c), #9, #11

Investigation 2: $y = ax^2$, when a is positive and greater than 1

On the same axes, graph $y = x^2$, $y = 2x^2$ and $y = 3x^2$.

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

x	$3x^2 = y$	(x, y)
2		
1		
0		
-1		
-2		



Compare the three parabolas,

(a) how are they similar?

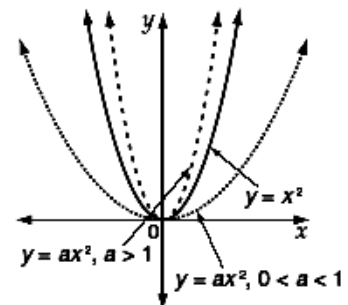
(b) how are they different?

$y = 2x^2$ and $y = 3x^2$ are vertical stretches of $y = x^2$.

Conclusion:

Compared to $y = x^2$, the graph of $y = ax^2$ is

- stretched vertically, and thus narrower, if $a > 1$
- the parabola opens upward and the vertex is at $(0, 0)$

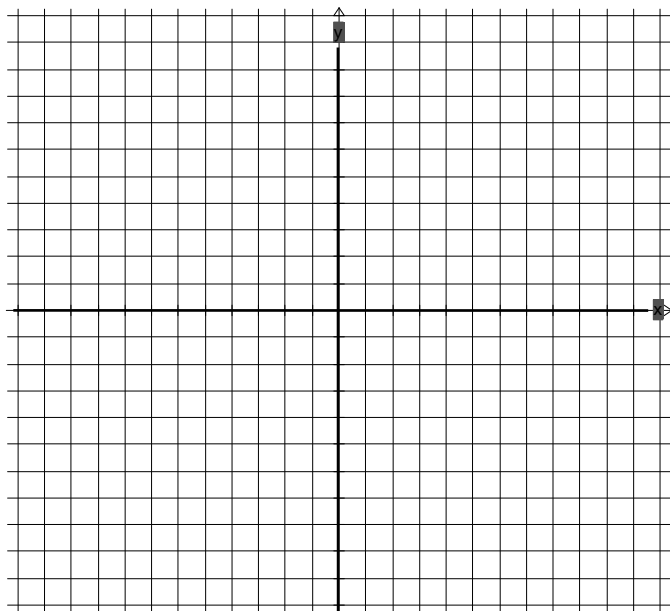


Investigation 3: $y = ax^2$, when a is positive and less than 1

On the same axes, graph $y = x^2$, $y = \frac{1}{2}x^2$ and $y = \frac{1}{4}x^2$. ****Hint: Use 2 units as 1 for the y-axis**

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

x	$\frac{1}{4}x^2 = y$	(x, y)
2		
1		
0		
-1		
-2		



Compare the three parabolas,

(a) how are they similar?

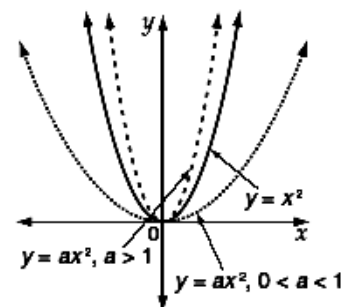
(b) how are they different?

$y = \frac{1}{2}x^2$ and $y = \frac{1}{4}x^2$ are vertical compressions of $y = x^2$.

Conclusion:

Compared to $y = x^2$, the graph of $y = ax^2$ is

- compressed vertically, and thus wider, if $0 < a < 1$
- the parabola opens upward and the vertex is at $(0, 0)$



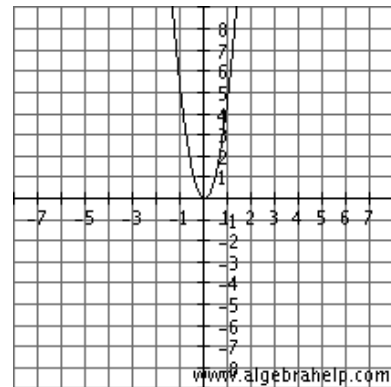
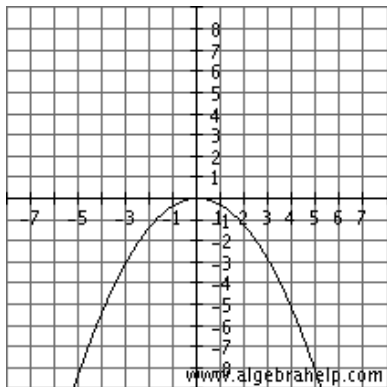
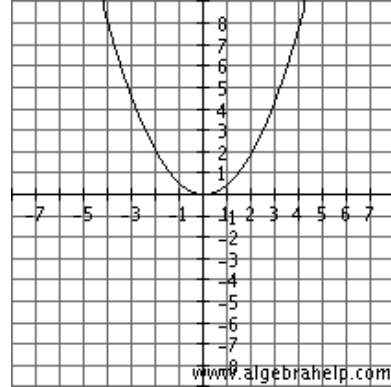
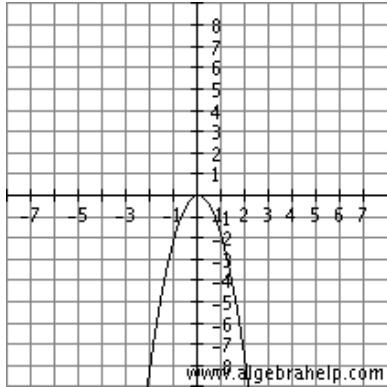
1. Match the following graphs to their corresponding equations.

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

$$y = -2x^2$$

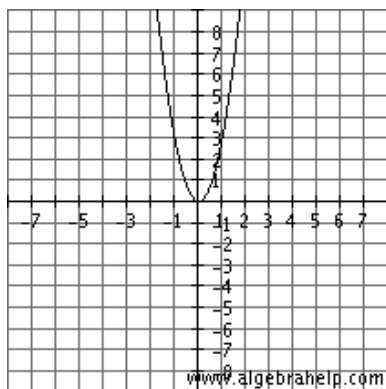
$$y = 4x^2$$

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



2. State the vertex and the equation for each of the following graphs.

(a)



(b)

