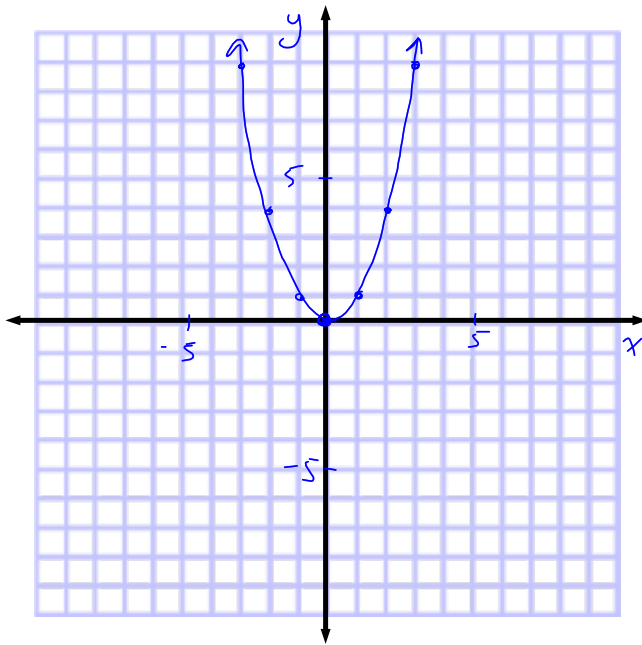


Warm Up 1. Sketch the base graph of all parabolas: $y = x^2$. Remember the pattern?



Pattern: x | y
 from the vertex
 over 1, up 1
 over 2, up 4
 over 3, up 9
 ...etc. 1 1
 2 4

Faster...
 from vertex
 over 1, up 1^2
 over 2, up 2^2
 over 3, up 3^2

2. Recall $y = x^2 + k$.

- Vertical translation by k units.

Ex. $y = x^2 + 3$

x	$y = x^2 + 3$
0	

$\therefore (0, 0) \Rightarrow (0, 3)$

3. Recall $y = (x - h)^2$.

- Horizontal translation by h units.

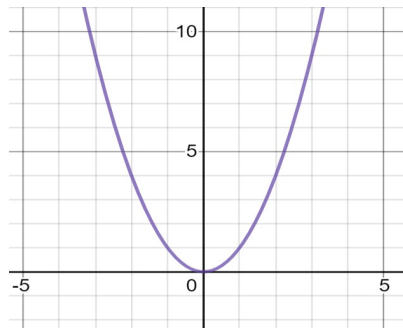
Ex. $y = (x - 4)^2$

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

$\therefore (0, 0) \Rightarrow (4, 0)$

3.3B Investigate Transformations - Day 2

Recall: The base graph of all parabolas is $y = x^2$.

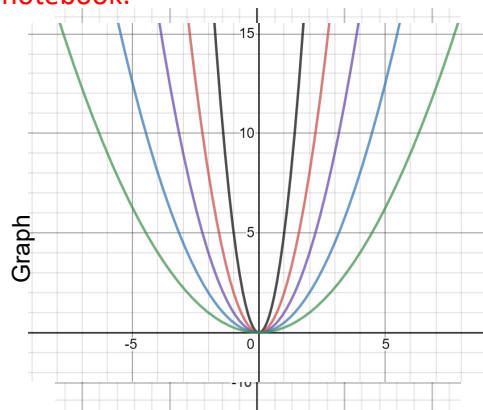


Pattern:
from the vertex
 over 1, up 1
 over 2, up 4
 over 3, up 9
 ...

C. Investigate $y = ax^2$, $a > 0$

Using Desmos, compare the following graphs to $y = x^2$.
 Sketch the graphs in your notebook.

- 1 $y = x^2$
- 2 $y = 5x^2$
- 3 $y = 2x^2$
- 4 $y = \frac{1}{2}x^2$
- 5 $y = \frac{1}{4}x^2$



What do you notice about the how the "a" value affects the graph?

Pattern:
from the vertex
 over 1, up 1 $\times a$
 over 2, up 4 $\times a$
 over 3, up 9 $\times a$
 ...

Compared to $y = x^2$, the graph of $y = ax^2$:
 if $a > 1$, there is a vertical stretch of a factor of "a"
 if $0 < a < 1$, - stretching by a






or compressing by $\frac{1}{a}$

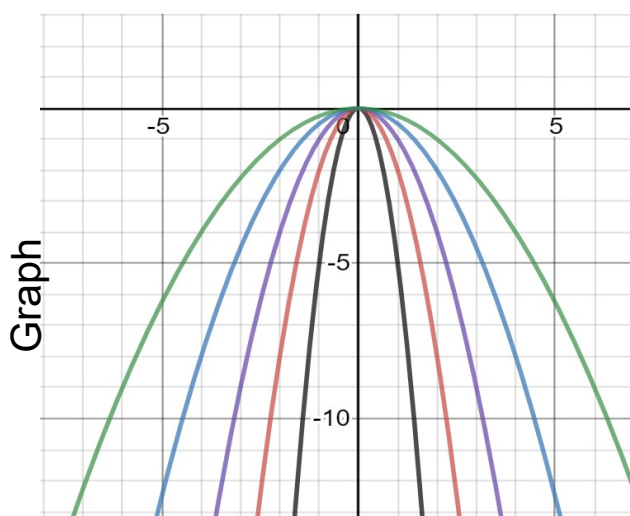
ex: $y = 3x^2$ "Vertical stretch by 3"

$y = \frac{1}{4}x^2$ "Vertical stretch by $\frac{1}{4}$ "
 OR
 "Vertical compression by 4"

D. Investigate $y = ax^2$, $a < 0$

Using Desmos, compare the following graphs to $y = x^2$.
Sketch the graphs in your notebook.

1		$y = -x^2$
2		$y = -5x^2$
3		$y = -2x^2$
4		$y = -\frac{1}{2}x^2$
5		$y = -\frac{1}{4}x^2$



What do you notice about the how the sign of "a" affects the graph?

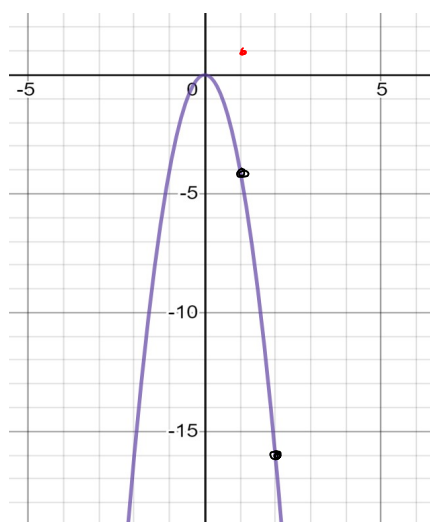
Pattern:
from the vertex
over 1, up 1 $\times a$
over 2, up 4 $\times a$
over 3, up 9 $\times a$
...

Compared to $y = x^2$, the graph of $y = ax^2$:
if $a < 0$, there is a reflection over the x-axis

Ex. 1 List the transformations on $y = x^2$ and sketch the graph.

a) $y = -4x^2$

- Vertical stretch by 4
- Vertical reflection

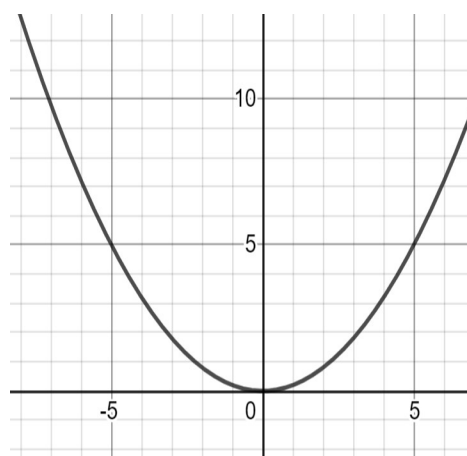


b) $y = 0.2x^2$

$y = \frac{1}{5}x^2$

- Vertical compression by 5
(OR - Vertical stretch by $\frac{1}{5}$)

X	Y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9
4	16
5	25



Ex. 2 Write an equation of a quadratic relation under the following transformations on $y = x^2$:

a) vertically stretched by a factor of 7

$$y = 7x^2$$

b) vertically compressed by a factor of 2 and reflected in the x-axis

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

c) vertically stretched by a factor of 4 and translated 5 units left

$$y = 4(x+5)^2$$

$$\left\{ \begin{array}{l} 4x^2 \\ \text{AND} \\ (x+5)^2 \end{array} \right.$$

d) vertically compressed by a factor of 3 and translated up 1 unit

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

$$\left\{ \begin{array}{l} \frac{1}{3}x^2 \\ \text{AND} \\ x^2 + 1 \end{array} \right.$$

e) reflected in the x-axis, vertically stretched by a factor of 3, translated 4 units left, translated 5 units down and

$$y = -3(x+4)^2 - 5$$

Homework
Pages 178-179
#C2, 4, 8, 13, 14

Text solutions are incorrect for 4be & 8b.

