

Date: _____

5.1 Stretching/Reflecting Quadratic Relations

Activity #1: Graphing Quadratic Relations of the Form $y = ax^2$

(Video tutorial for how to use Desmos is posted!)

Use the Desmos app on your phone or the Desmos graphing calculator on their website (link here!) to graph the parabolas $y = x^2$, $y = 2x^2$, $y = 5x^2$, $y = 0.5x^2$, $y = -x^2$, and $y = -2x^2$. For each relation, open the table of values in Desmos (refer to my video to find it) and copy it below.

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

x	$y = 2x^2$

x	$y = 5x^2$

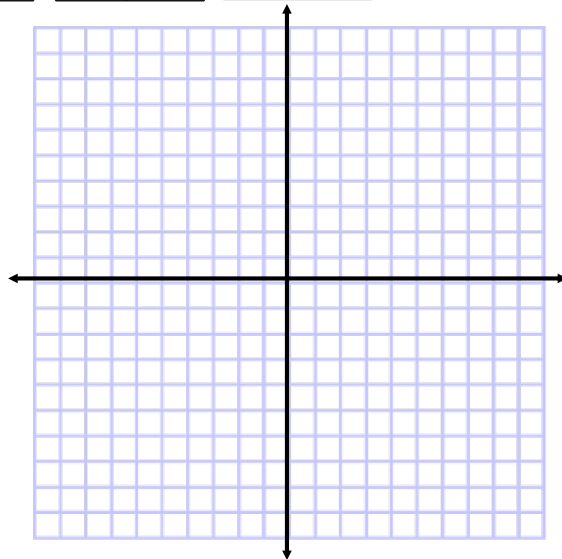
x	$y = 0.5x^2$

x	$y = -x^2$

x	$y = -2x^2$

Graph each parabola on the axes provided (or print/screen capture from Desmos if you would rather). The only change that we made to the equation of $y = x^2$ was placing a different 'a' value in front.

- 1) What happened when 'a' was negative?
- 2) What happened when 'a' was greater than one?
- 3) What happened when 'a' was between 0 and 1?
- 4) Now look at the tables. Compare each new table to the red and blue table (parent function). What would you have to do to the y-coordinates of $y = x^2$ to get the y-coordinates for each new graph?



Transformations of the Graph of $y = x^2$

Part 1: Stretching and Reflecting

The relation $y = x^2$ is the base function, or parent function, for the family of quadratic relations. The 'a' value is 1. Changing the 'a' value will:

- **reflect** the graph over the x - axis (when 'a' is negative);
- **stretch** the graph by a factor of 'a' (when 'a' is > 1 or < -1)
- **compress** the graph by a factor of 'a' (when $0 < a < 1$, or when $-1 < a < 0$).

To apply a stretch/reflection to the graph of $y = x^2$:



Option 1: Do some math.

- Write the table of values for your parent function, $y =$
- Multiply all of your y - coordinates by 'a'.
- Use these points (with your original x - coordinate) to create the graph of your transformed function.

Option 2: Use a pattern.

- Examine the graph of $y = x^2$. Start from the vertex, and notice that you move over 1 unit, then up 1 unit to plot the next point.
- What do you do next?

- What would the 'a' value do to change this **step pattern**?

A stretch/reflection will only impact your y - coordinates! The x - coordinates should stay the same!! The graph just gets wider or narrower, it does not move!

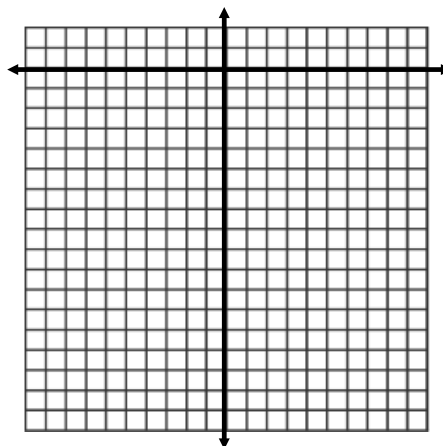
Practice Problems:

1. A quadratic relation is represented by $y = -6x^2$.

a) Describe the transformations that must be applied to the graph.

b) Create a table of values for the graph.

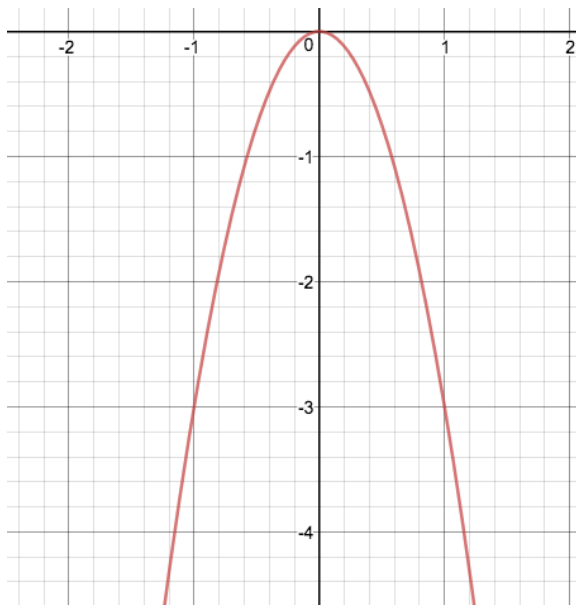
x	$y=x^2$	$y=-6x^2$
-2	4	
-1	1	
0	0	
1	1	
2	4	



c) Accurately sketch the graph.

d) The point $(-7, 49)$ was on the original graph. What are the coordinates of this point on the transformed graph?

2) Determine an equation for the parabola shown. Explain your thinking.



Hint: You can use the step pattern to figure out your 'a' value.