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	$y = 2x^2$
-2	8
-1	2
0	0
1	2
2	8

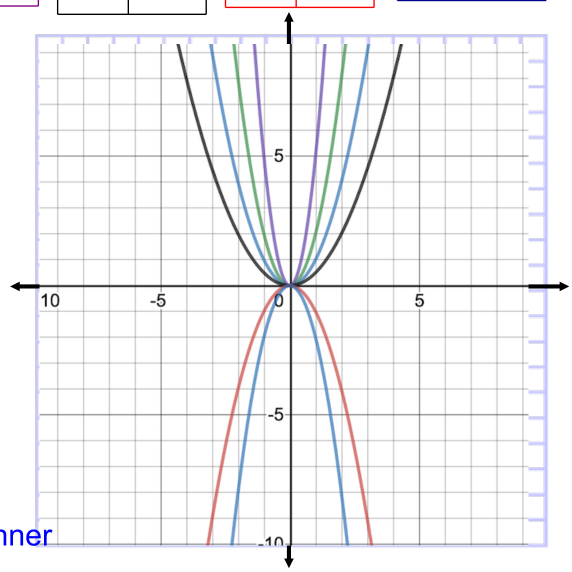
x	$y = 5x^2$
-2	20
-1	5
0	0
1	5
2	20

x	$y = 0.5x^2$
-2	2
-1	0.5
0	0
1	0.5
2	2

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

x	$y = -2x^2$
-2	-8
-1	-2
0	0
1	-2
2	-8

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?

   The graph opened down.

2) What happened when 'a' was greater than one?

   The graph got taller and thinner

3) What happened when 'a' was between 0 and 1?

   The graph got shorter and wider

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?

   If you multiply the y - coordinates of $y = x^2$ by the 'a' value, you will get the y-coordinates of the new graph.

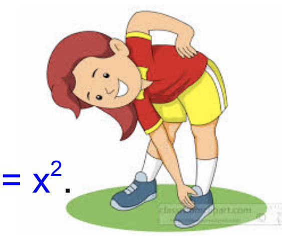
Transformations of the Graph of $y = x^2$

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, $y = x^2$.
- 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?

  over 1, up 3

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

  'a' multiplies with the "up" unit

  'over 1, up a'

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.

· reflect over the x-axis

· stretch by a factor of 6

b) Create a table of values for the graph.

x	$y=x^2$	$y=-6x^2$
-2	4 ×-6	-24
-1	1 ×-6	-6
0	0 ×-6	0
1	1 ×-6	-6
2	4 ×-6	-24

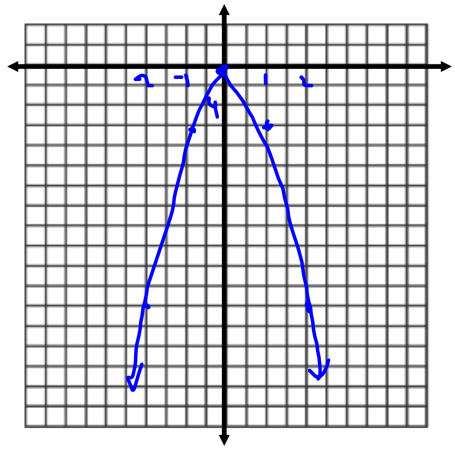
(-2, -24)

(-1, -6)

(0, 0)

(1, -6)

(2, -24)

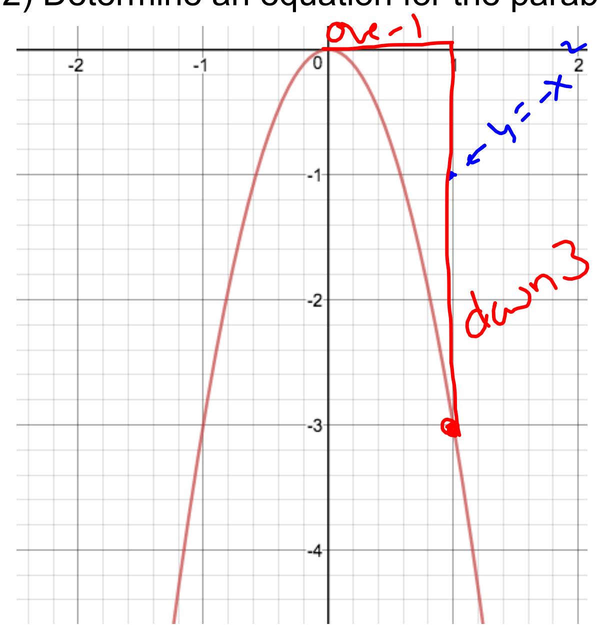


c) Accurately sketch the graph.

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

Multiply 49 by -6. → (-7, -294)

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



a is negative.

a = -3

$y = -3x^2$

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