Desmos Activity #3 - 5.3 Graphing Quadratics in Vertex Form

Instructions:

Today we are just putting together our lessons from the last two sections. We will apply stretches/reflections as well as translations of the graph of $y = x^2$.

- Use Desmos to graph the following relations, in the order they are listed:
  - > $y = x^2$
  - > $y = 2x^2$
  - > $y = 2(x - 3)^2$
  - > $y = 2(x - 3)^2 + 4$
- State the vertex for the last graph that you drew.

- Note that we applied the transformations in the order of BEDMAS - we must MULTIPLY (stretch/reflect) before we ADD/SUBTRACT (shift horizontally and vertically)

- Complete the table below. State the transformations applied to the graph of $y = x^2$ by filling in the rows. The first one is done for you. Use Desmos to support your thinking.

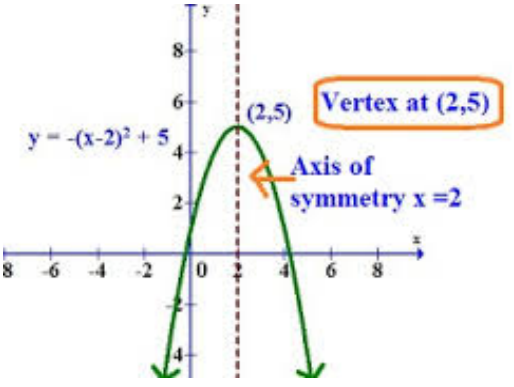
Equation	Stretch/ Compress by a factor of....	Reflect over x-axis?	Horizontal translation (h)	Vertical translation (k)	Vertex	Equation of the axis of symmetry
$y= -2(x - 1)^2 + 3$	2	Yes	Right 1 unit	Up 3 units	(1, 3)	x = 1
$y= 2(x + 3)^2 - 4$						
$y= - (x - 2)^2 + 5$						
$y= -0.25(x - 3)^2 + 1$						
$y= 5(x + 6)^2 + 8$						
$y= -10(x - 20)^2 + 40$						

Date: _____

5.3 Graphing Quadratics in Vertex Form

Vertex Form: $y = a(x - h)^2 + k$

We are combining the things that we have discovered in the last two lessons today. Remember, 'a' is responsible for vertical stretches/compressions, so this is the part that changes the shape of your graph. The 'h' and 'k' values just move the new graph around!



Sketching Graphs Given a Relation in Vertex Form

*** The graph of $y = x^2$ is called your base (or parent) function. You are ALWAYS going to start with this graph and perform transformations on it to produce your new graph. ***

To sketch:

1) Write down a table of values for $y = x^2$ (see table 1).

Table 1:

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

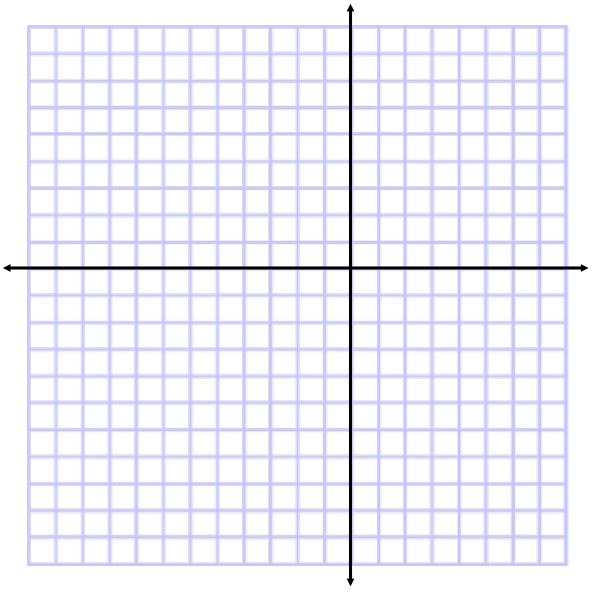
Table 2:

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

2) Multiply the y - coordinates by 'a' to perform any stretch or compression (Refer to table 2), or adjust your step pattern to include your new 'a' value. Remember that your x's don't change! Draw this new graph ($y = ax^2$) (Eventually you can skip this step)
3) Perform the horizontal and/or vertical shifts indicated by h and k on all points.
4) Label your final graph with the complete equation.

Example:

Graph $y = -2(x + 3)^2 + 1$ by transforming the graph of $y = x^2$



*** You can graph more than one parabola on the same set of axes to save time and paper! Just use colours or labels so that you know what's what.

More Practice:

1) State the transformations, in the correct order, that you would apply to the graph of $y = x^2$ to sketch the graph of $y = 3(x - 5)^2 + 3$. How many zeros will this parabola have?

2) The graph of $y = x^2$ is reflected about the x - axis, vertically compressed by a factor of 0.2 and translated three units down. Write its equation.