TRANSFORMING QUADRATICS... with a little help from desmos

Directions:

- You are going investigate transforming ("changing") quadratic functions. We will use the equation $y = x^2$ as our parent function.

○ Read every line of this investigation carefully. Notice that the open circle symbol is used when there is a question for you to answer or a screenshot for you to add.

- Now, go to **desmos.com** and click the big red box that says **Launch Calculator**.

Part 1: Stretching and Compressing Vertically

Graph the following equations using Desmos:

$y = x^2$
$y = 2x^2$
$y = 5x^2$

○ In your own words, describe how the parabola changes as the "a" gets larger:

Mathematicians describe this change as a "vertical stretch". Try to picture the stretch. The vertex is locked in at (0,0) and the parabola is stretched upward, making it skinnier.

We say the function is "stretched vertically by a factor of 2".

○ Write the equation that represents stretching $y = x^2$ by a factor of 6:

○ Take a screenshot of your Desmos work (THREE equations as well as THREE graphs should be visible). Paste your screenshot below.

Delete all of the graphs in Desmos. Now graph the following equations using Desmos:

$$y = x^2$$

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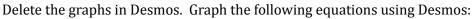
$$y = \frac{1}{5}x^2$$

⬤ In your own words, describe how the parabola changes when "a" is a fraction between 0 and 1:

Mathematicians probably use a different description than we would. When $0 < a < 1$, the function is said to be "**compressed vertically**". Picture this: the vertex is fixed at (0,0) and it is pushed down (compressed), making the parabola wider.

If the equation is $y = \frac{1}{3}x^2$, we say the parabola has been *compressed by a factor of 3*.

⬤ Write the equation that represents *compressing* $y = x^2$ by a factor of 10:

⬤ Take a screenshot of your Desmos work (THREE equations as well as THREE graphs should be visible). Paste your screenshot below.

Delete the graphs in Desmos. Graph the following equations using Desmos:

$y = x^2$
$y = x^2 + 3$
$y = x^2 + 5$
$y = x^2 - 2$

⭕ Describe in your own words how to change an equation to translate the parabola vertically:

⭕ Given the parent function: $y = x^2$, write the equation to translate the parabola vertically up 4 units and compressed by a factor of 3:

Delete what you have in Desmos. Graph the parent function **and** your new function in Desmos.

⭕ Take a screenshot of your Desmos work (TWO equations and TWO graphs should be visible) here:

Look at your two parabolas. Is the new graph shifted vertically up 4 units?
Is it compressed by a factor of 3? (compressed = wider!)
If not - your equation is wrong and needs to be fixed - try again!

Part 3: Reflect Over the x-axis (or Horizontally)

Delete everything from Desmos. Graph the following equations using Desmos:

$y = 2x^2$

$y = -2x^2$

Does the 2nd parabola represent a reflection over the x-axis?

Now try these equations in Desmos:

$y = (1/2)x^2$

$y = (-1/2)x^2$

Does the 2nd parabola represent a reflection over the x-axis?

⭕ Explain what "reflection over the *x*-axis" means in your own words:

Now try this one:

⭕ Given the parent function, $y = x^2$, write the equation to *vertically stretch* the parabola by a factor of 4 **and** *reflect* it over the *x*-axis.

⭕ Clear Desmos and graph the parent function and your new function in Desmos. Take a screenshot and paste your graphs here:

Look at the new parabola. Is it vertically stretched by factor of 4 (this would make it skinnier)?
Is it reflected over the x-axis?

⭕ **Without graphing it**, <u>***describe***</u> how this function: $y = 2x^2 - 1$ is transformed from the parent function $y = x^2$.

Now check your description by graphing these two functions using Desmos.
Was your description correct?

Clear Desmos. Graph the following equations using Desmos:

$y = x^2$

$y = (x - 3)^2$

How is the new function different from the parent function?

⭕ *The new function is shifted horizontally three units to the _____.*

Now try these graphs:

$y = x^2$

$y = (x + 3)^2$

⭕ How is the new function different from the parent function?

This one is tricky.

To shift *right*, change the *x* to (*x* minus a number). To shift *left*, change the *x* to (*x* plus a number).

⭕ Write an equation to shift $y = x^2$ eight units to the left:

⭕ Write an equation to shift $y = x^2$ eight units to the right:

⭕ Clear Desmos and check that your equations are correct by graphing them. Take a screenshot and enter it here:

Now we know to move the parabola to the LEFT 3 units, we use $y = (x + 3)^2$.

If we ALSO want to stretch the parabola vertically by a factor of 2 (to make it skinnier), we write the 2 **in front of the parentheses**: $y = 2(x + 3)^2$

⭕ Clear Desmos. Graph the parent function and the two graphs above in Desmos and copy/paste the screenshot here:

The whole shebang.

⭕ Given the parent function $y = x^2$, write the equation that will shift the parabola to the left 3 units, up 5 units, stretched by a factor of 2, and reflected over the x-axis:

⭕ Now test this beast out on Desmos (clear all old graphs). Were you correct? (If not, fix the equation!) Take a screenshot and enter the graph here:

⭕ Go to the next page to see your NEXT STEPS...

Congratulations! You're a quadratic transformations expert!

There are two tasks left to do to demonstrate your awesomeness.

⭕ Login to ThatQuiz and take the quiz entitled **"Quadratic Transformations"**.

⭕ Go to this URL to access a ThingLink: **http://tinyurl.com/MatchQuad**

⭕ Try the **"Match My Parabola"** graphing activities linked there. If you want bragging rights, you MUST take a screenshot of each successful "match" you make.

Good Luck! (Not that you need it!)