Unit 1 Day 2: Transformational Graphing Investigation

We will complete the following using the Desmos app on your IPad. All examples will use the square root function, $y = \sqrt{x}$ so you will want to keep that equation entered in the first line of Desmos for all examples. Delete all other equations you have entered as you move to the next number. Stay with me as we do this so that you can participate fully in the discussions.

1. Graph the absolute value parent function y = $\sqrt{x}$.

   In the next line graph the child, y =$\sqrt{x-4}$. Which way did the shift move the parent function? RIGHT 4

   In the next line graph the child, y =$\sqrt{x+4}$. Which way did the shift move the parent function? LEFT 4

   In the next line, graph the child, y= $\sqrt{x}+3$. Which way did the shift move the parent function? UP 3

   In the next line graph the child, y =$\sqrt{x}-3$. Which way did the shift move the parent function? DOWN 3

Look at the examples below and determine what it meant to be "in" as opposed to "out" of an argument.

RIGHT

$y = \sqrt{x-6}$ This 6 is "in the argument"

DOWN

$y = \sqrt{x}-6$. This 6 is "out of the argument"

$y = \sqrt{x-3}$ This 3 is "in the argument"

$y = \sqrt{x}-3$ This 3 is "out of the argument"

If you want to translate a parent function to the right, you subtract **inside the argument.**

If you want to translate a parent function to the left, you add **inside the argument.**

If you want to translate a parent function up, you add **outside the argument.**

If you want to translate a parent function down, you subtract **outside the argument.**

2. Using Desmos, compare the following two equations to the square root parent function, $y = \sqrt{x}$.

   $y = -\sqrt{x}$ $y = \sqrt{-x}$ (Graph all three functions in Desmos)

   Which equation above reflects the square root parent function over the x axis? $y = -\sqrt{x}$

   Which equation above reflects the square root parent function over the y axis? $y = \sqrt{-x}$

If you want to reflect a parent function over the y axis, you multiply by a negative inside **the argument.**

If you want to reflect a parent function over the x axis, you multiply by a negative outside **the argument.**

3. Using Desmos, compare the following two equations to the square root parent function, $y = \sqrt{x}$.

$y = 2\sqrt{x}$ vertical stretch by 2 $y = \frac{1}{2}\sqrt{x}$ vertical comp. $\frac{1}{2}$ (Graph all three functions in Desmos)

Notice that in $y = 2\sqrt{x}$ each y value is twice the distance from the x axis as the parent.

But in $y = \frac{1}{2}\sqrt{x}$ each y value is half the distance from the x axis as compared to the parent.

If you want to stretch a function vertically, you multiply outside **of the argument by a constant c where c > 1.**

If you want to shrink (or compress) a function vertically, you multiply outside **of the argument by a constant c where 0 < c < 1.**

4. Using Desmos, compare the following two equations to the square root parent function, $y = \sqrt{x}$.

$y = \sqrt{2x}$ $\frac{1}{2}$ as wide $y = \sqrt{\frac{1}{2}x}$ twice as wide (Graph all three functions in Desmos)

Notice here that the values 2 and ½ have a very different impact on the parent function than the previous example. This time look at a y value on the parent function. Can you tell that in $y = \sqrt{2x}$ the y value is half the distance to the y axis but in $y = \sqrt{\frac{1}{2}x}$ the y value is twice the distance from the y axis.

If you want to stretch a function horizontally, you multiply inside **of the argument by a constant c where 0 < c < 1.**

If you want to shrink (or compress) a function horizontally, you multiply inside **of the argument by a constant c where c > 1.**

This table summarizes what we have just stated in a generic form. It is important to see that when we perform an operation out of the argument, the movement of the transformation is always a vertical movement. But when perform an operation in the argument the movement of the transformation is always a horizontal movement.

Transformations of the graphs of functions	
$f(x)+c$	shift $f(x)$ up c units
$f(x)-c$	shift $f(x)$ down c units
$f(x+c)$	shift $f(x)$ left c units
$f(x-c)$	shift $f(x)$ right c units
$f(-x)$	reflect $f(x)$ about the y-axis
$-f(x)$	reflect $f(x)$ about the x-axis
$cf(x)$	When $0 < c < 1$ – vertical shrinking of $f(x)$ When $c > 1$ – vertical stretching of $f(x)$ Multiply the y values by c
$f(cx)$	When $0 < c < 1$ – horizontal stretching of $f(x)$ When $c > 1$ – horizontal shrinking of $f(x)$ Divide the x values by c

We will continue now working examples using graph paper. Clear all of your equations and close all apps on your IPad. One person will return the IPads for your table when called.