**Activity 1.4.3 Move It! Part One**

Unit 1 lays the foundation for many topics that you will study not only in Algebra II, but Pre-Calculus, Calculus and Statistics. In this investigation, we should begin by looking back into Geometry to tie things together. You should remember the concept of an **isometry**. In an **isometry**, all original aspects (segments and angles) of the shape are preserved. In computer-speak, we are talking about clicking and dragging without changing shape. In this investigation, it would be helpful to keep that concept in mind. The other key concept we want to hold on to is the idea of **parent functions**. In simple terms, the **parent function** is the most basic version of that function. It would be helpful if you have your function *reference* sheet out for that very reason, to use as a *reference*.

If you look at the reference sheet in terms of columns, you can see the three main components of the sheet. Column 1 represents the parent function; column 2 contains some basic (dare I say critical) sets of coordinate pairs (solutions); and column 3 is the graph (picture) of that parent function. For example, find the **absolute value function**. This will be the most referenced function in this investigation. Copy the information from the reference sheet onto this investigation.

**Absolute Value:**

Parent function: Basic set of solutions: Graph:



|  |  |
| --- | --- |
| -2 |  |
| -1 |  |
| 0 |  |
| 1 |  |
| 2 |  |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_

As stated above, transformations will continue to come up time and time again in your mathematics career, so let’s give it our full attention and do the best we can at understanding, not memorizing the relationships we observe. Understanding, not memorizing, what graphical changes are imposed on the **absolute value function** as we **“move”** the function will be a key to understanding transformations on **all families of functions**.

Our *goal* will be to understand the changes that take place with respect to absolute value, square root, cubic, quadratic and exponential functions. After that, you’ll be able to apply the concepts learned here to any parent function you bump into along your mathematical travels. ☺

1. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function. (What happened to the parent to make it move to the new location?)



Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| -2 |  | -5 |  |
| -1 |  | -4 |  |
| 0 |  | -3 |  |
| 1 |  | -2 |  |
| 2 |  | -1 |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

It’s at this point that we should point out how useful it is to have the parent solutions in a “handy-to-reference” location. Instead of relying on substitution, take a look at what happened to the x-values you were given. In f(x) we started with -2 and g(x) we started with -5. How do you go from -2 to -5 mathematically?

Does the same idea hold true for all of the other x values as you look from f(x) to g(x)?

Are you ready to apply a rule at this point?

Let’s try this again and see *what we see*…….

2. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function. (What happened to the parent to make it move to the new location?)



Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| -2 |  | 0 |  |
| -1 |  | 1 |  |
| 0 |  | 2 |  |
| 1 |  | 3 |  |
| 2 |  | 4 |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Again, it is useful have the parent solutions in a “handy-to-reference” location. Instead of relying on substitution, take a look at what happened to the x-values you were given. In f(x) we started with -2 and g(x) we started with 0. How do you go from -2 to 0 mathematically?

Does the same idea hold true for all of the other x values as you look from f(x) to g(x)?

Are you ready to apply a rule at this point? The rule we’d like to write should include some formal discussion of notation such as  and ; where f(x) is our original function and

 is our transformed function and *k* is an ***inside*** value. Write your rule.

Using your family of function reference sheet, try to see how this horizontal transformation applies to other families.

3. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function. You’ll have to complete the x-values in the g(x) table as well, similar to what we did in #1 and 2 above. You can do it!!



Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| -2 |  | -4 |  |
| -1 |  |  |  |
| 0 |  |  |  |
| 1 |  |  |  |
| 2 |  |  |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function.



Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| -2 |  | 2 |  |
| -1 |  |  |  |
| 0 |  |  |  |
| 1 |  |  |  |
| 2 |  |  |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Parent Function: Transformed Function:

Notice the slight location change for the value of *k* in this example! It is now an ***outside*** value. Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function.



Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| -2 |  | -2 |  |
| -1 |  | -1 |  |
| 0 |  | 0 |  |
| 1 |  | 1 |  |
| 2 |  | 2 |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function.



Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| -2 |  | -2 |  |
| -1 |  | -1 |  |
| 0 |  | 0 |  |
| 1 |  | 1 |  |
| 2 |  | 2 |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function.

Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| 0 |  | 0 |  |
| 4 |  | 4 |  |
| 9 |  | 9 |  |
| 16 |  | 16 |  |
| 25 |  | 25 |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Parent Function: Transformed Function:

Evaluate the functions using the given x-values. Then, graph the functions and label them f(x) and g(x) accordingly. Using the line below, describe the transformation that was applied to the parent function.

Parent Transformed

|  |  |  |  |
| --- | --- | --- | --- |
| x | f(x) | x | g(x) |
| 0 |  | 0 |  |
| 4 |  | 4 |  |
| 9 |  | 9 |  |
| 16 |  | 16 |  |
| 25 |  | 25 |  |

Describe the transformation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Are you ready to apply a rule at this point? Again, the rule we’d like to write should include some formal discussion of notation such as  and ; where f(x) is our original function and is our transformed function and *k* is an ***outside*** value. Write your rule.