Lesson 19: Four Interesting Transformations of Functions

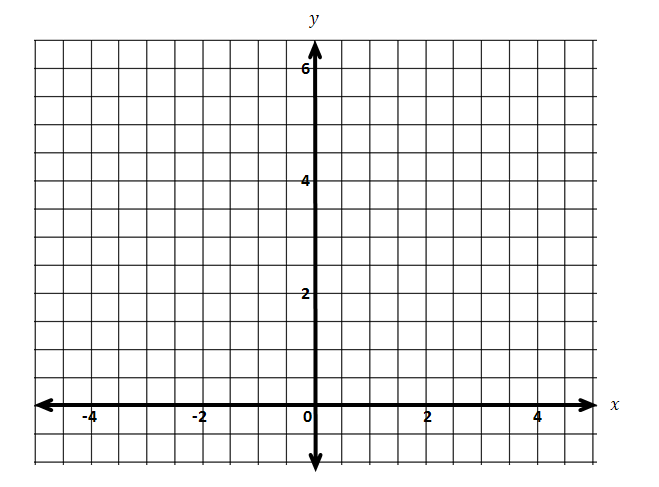
Classwork

**Exploratory Challenge 1**

Let and , where can be any real number.

1. Write the formula for in terms of (i.e., without using notation).
2. Complete the table of values for these functions.

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1. Graph both equations: and .

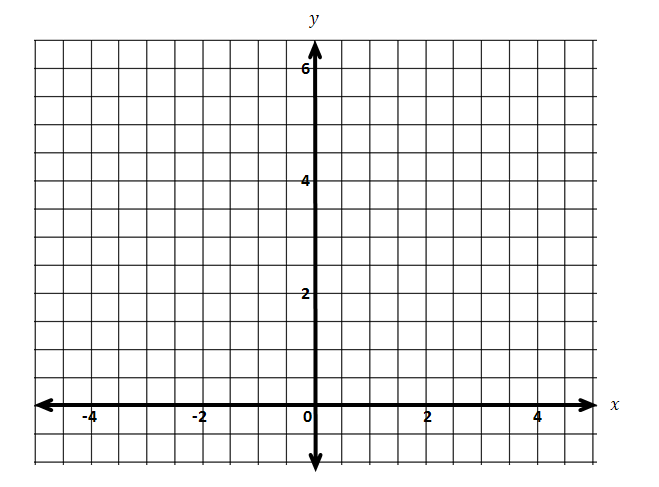
1. How does the graph of relate to the graph of ?
2. How are the values of related to the values of ?

**Exploratory Challenge 2**

Let and , where can be any real number.

* 1. Rewrite the formula for in terms of (i.e., without using notation).
  2. Complete the table of values for these functions.

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* 1. Graph both equations: and .
  2. How does the graph of relate to the graph of ?
  3. How are the values of related to the values of ?

Exercise

Complete the table of values for the given functions.

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* 1. Label each of the graphs with the appropriate functions from the table.

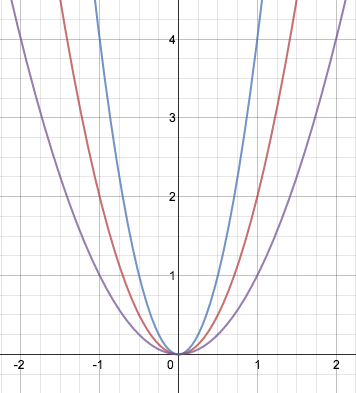


* 1. Describe the transformation that takes the graph of to the graph of .
  2. Consider and. What does negating the input do to the graph of ?
  3. Write the formula of an exponential function whose graph would be a horizontal stretch relative to the   
     graph of .

**Exploratory Challenge 3**

* 1. Look at the graph of for the function in Exploratory Challenge 1 again. Would we see a difference in the graph of if were used as the scale factor instead of ? If so, describe the difference. If not, explain why not.
  2. A reflection across the -axis takes the graph of for the function back to itself. Such a transformation is called a *reflection symmetry*. What is the equation for the graph of the reflection symmetry of the graph of ?
  3. Deriving the answer to the following question is fairly sophisticated; do this only if you have time. In Lessons 17 and 18, we used the function to examine the graphical effects of transformations of a function. In this lesson, we use the function to examine the graphical effects of transformations of a function. Based on the observations you made while graphing, why would using be a better option than using the function ?

Problem Set



Let ,, and , where can be any real number. The graphs above are of the functions ,, and .

1. Label each graph with the appropriate equation.
2. Describe the transformation that takes the graph of to the graph of . Use coordinates to illustrate an example of the correspondence.
3. Describe the transformation that takes the graph of to the graph of . Use coordinates to illustrate an example of the correspondence.