Lesson 21: The Graph of the Natural Logarithm Function

Classwork

Exploratory Challenge

Your task is to compare graphs of base logarithm functions to the graph of the common logarithm function  
 and summarize your results with your group. Recall that the base of the common logarithm function is . A graph of is provided below.

* 1. Select at least one base value from this list: , , , , , . Write a function in the form   
      for your selected base value,
  2. Graph the functions and in the same viewing window using a graphing calculator or other graphing application, and then add a sketch of the graph of to the graph of shown below.



* 1. Describe how the graph of for the base you selected compares to the graph of .
  2. Share your results with your group and record observations on the graphic organizer below. Prepare a group presentation that summarizes the group’s findings.

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| --- | --- |
| **How does the graph of compare to the graph of for various values of ?** | |
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Exercise 1

Use the change of base property to rewrite each function as a common logarithm.

Base Base (Common Logarithm)

**Example 1: The Graph of the Natural Logarithm Function**

Graph the natural logarithm function below to demonstrate where it sits in relation to the base and base logarithm functions.



Example 2

Graph each function by applying transformations of the graphs of the natural logarithm function.

* 1. 
  2. 

Problem Set

1. Rewrite each logarithm function as a natural logarithm function.
2. Describe each function as a transformation of the natural logarithm function .
3. Sketch the graphs of each function in Problem 2 and identify the key features including intercepts, decreasing or increasing intervals, and the vertical asymptote.
4. Solve the equation graphically.
5. Use a graphical approach to explain why the equation has only one solution.
6. Juliet tried to solve this equation as shown below using the change of base property and concluded there is no solution because . Construct an argument to support or refute her reasoning.
7. Consider the function given by for and .
   1. What are the values of ,, and ?
   2. Why is the value excluded from the domain of this function?
   3. Find a value so that .
   4. Find a value so that .
   5. Sketch a graph of for and .