Name:_____ Class #:_____

Math 48B, Lesson 15: Graphs of Logarithmic Functions

In Math 48B Lessons 14, 15, 16, 17, and 18, we study logarithmic functions:

Logarithmic Form	Exponential Form
$y = \log_b(x)$	$x = b^y$

To begin our exploration, let's recall the rules of powers/exponents.

1. HOW TO EVALUATE LOGARITHMS?

Consider the two equivalent forms for logarithmic functions:

Logarithmic Form	Exponential Form
$y = \log_b(x)$	$x = b^y$

Use these two equivalent forms to evaluate the following logarithm problems.

1A. $4 + \log_{10}(0.001)$ 1B. $\log_4(\frac{1}{32})$ 1C. $\log_e(e^{2/5})$

Name:_____ Class #:_____

2. WHAT DOES THE GRAPH OF A LOGARITHM LOOK LIKE?

2A. Fill out the table for the logarithmic function $y = \log_2(x)$ below. The, use Desmos.com to create a graph and describe the relevant features of that graph including the domain, range, x-intercept, and the end behavior as $x \to +\infty$.

x	y
$\frac{1}{32}$	
$\frac{1}{16}$	
$\frac{1}{8}$	
$\frac{1}{4}$	
$\frac{1}{2}$	
1	
2	
4	
8	
16	
32	
64	

Name:_____ Class #:_____

2B. Fill out the table for the common logarithmic function

$$y = \log_{10}(x) = \log(x)$$

The, use Desmos.com to create a graph and describe the relevant features of that graph including the domain, range, x-intercept, and the end behavior as $x \to +\infty$.

x	y
0.00001	
0.0001	
0.001	
0.01	
0.1	
1	
10	
100	
1000	
10000	
100000	
1000000	

2C. Suppose that $b > 1$ and determine the characteristics of the function

$$y = \log_b(x)$$

Sketch a graph of this curve below and describe the relevant features of that graph including the domain, range, x-intercept, and the end behavior. Using Desmos.com, graph the log functions with $b = 2, e$, and 10 on the same axes. Highlight the various features of each graph.

Name:_____ Class #:_____

3. WHAT DOES THE GRAPH OF A LOGARITHM LOOK LIKE?

3A. Fill out the table for the logarithmic function $y = \log_{0.5}(x)$ below. The, use Desmos.com to create a graph and describe the relevant features of that graph including the domain, range, x-intercept, and the end behavior as $x \to +\infty$.

x	y
$\frac{1}{32}$	
$\frac{1}{16}$	
$\frac{1}{8}$	
$\frac{1}{4}$	
$\frac{1}{2}$	
1	
2	
4	
8	
16	
32	
64	

Name:_____ Class #:_____

3B. Fill out the table for the common logarithmic function

$$y = \log_{0.1}(x) = \log(x)$$

The, use Desmos.com to create a graph and describe the relevant features of that graph including the domain, range, x-intercept, and the end behavior.

x	y
0.00001	
0.0001	
0.001	
0.01	
0.1	
1	
10	
100	
1000	
10000	
100000	
1000000	

Name:_____ Class #:_____

3C. Suppose that $0 < b < 1$ and determine the characteristics of the function

$$y = \log_b(x)$$

Sketch a graph of this curve below and describe the relevant features of that graph including the domain, range, x-intercept, and the end behavior.

Name:_____ Class #:_____

4. TRANSFORMATIONS OF EXPONENTIAL FUNCTIONS?

4A. For logarithmic function $y = a \cdot \log_b(x - h) + k$, what do parameters a ,h, and k do to the graph of $y = \log_b(x)$? Develop graphs on Desmos.com to highlight each parameter and demonstrate the effect on your graph. Capture

Name:_____ Class #:_____

4B. Test your hypothesis from Problem 4A above by graphing the function

$$f(x) = -2\log_3(x-4) + 5$$