MATH 156: Precalculus
Fall 2015
Worksheet §4.3: Logarithmic Functions

This is the most important section we will cover this year. Make sure to mastered the techniques here.

The following is your life-raft for understanding and manipulating logarithmic functions. If you know this, you can reason your way out of most anything related to logarithms.

$$\boxed{y = \log_a x \iff}$$

Are there any restrictions on a?

What is the number a called?

There is a word describing the relationship between logarithms and exponents that is illustrated by the box. What is is?

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1. Use the box above to fill in the blanks:
   (a) The domain of $\boxed{y = \log_a x}$ is
   (b) The range of $\boxed{y = \log_a x}$ is
   (c) $\log_a 1 =$
   (d) $\log_a a =$
   (e) $\log_a a^x =$
   (f) $a^{\log_a x} =$
2. How do your answers above change is a is replaced by the number e?

3. Without the aid of a calculator, graph $y = \log_3 x$ by plotting at least 5 different points. Use this graph to describe the end behavior of the function and determine if the graph has any asymptotes.

4. Use your answer to #3 to graph each of the functions below. Include asymptotes, domain and range.

   (a) $y = 1 + \log_3(-x)$

   (b) $y = -\log_3(x - 2)$

5. Express in exponential form:

   (a) $\log_7 x = 31$

   (b) $\log_7 3 = 4y$

6. Express in logarithmic form:

   (a) $10^{-4x} = 1000$

   (b) $e^{2t} = 3s$

7. Evaluate the expressions without the use of a calculator:

(a) $\log_2 32$ (b) $\log_8 8^{17}$ (c) $\log_7 1$

(a) $\log_{27} \frac{1}{9}$ (b) $\ln \sqrt{e}$ (c) $\log 0.0001$

8. Solve for x in the equations below. Get an exact answer without the use of a calculator.

(a) $\ln x = 3$ (b) $\ln e^2 = x$ (c) $\log_4 2 = x$

(a) $\log_4 x = 2$ (b) $\log_x 1000 = 3$ (c) $\log_x 12 = \frac{2}{5}$

9. Find the domain of the functions below

(a) $f(x) = \log_5(x + 4)$

(b) $f(x) = \log_9(x - x^2)$

(c) $f(x) = \ln x + \ln(1 - x)$

(d) $f(x) = \ln(x^2)$