Note: Inverses Come Later. We don't need to do the last three pages

Warm-up!

Rewrite each as a single logarithm base 5. Your answers should be in the form $\log_5(\text{expression})$.

$1 + \log_5(3x) - 3\log_5(x)$

$2\log_5(2x^5) - 5\log_5(x)$

Log Functions Day 2:

- (2.10) Exponents vs Logs Inverse Relationship
- (2.12) More Log Properties
- (2.10/2.11) Recognizing Log Functions From Tables

Homework: Inverse of Exponentials and More Log Properties

Some anticlimactic math problems

A) Use a calculator/Desmos to find $\log_4 17$.

B) Use a calculator/Desmos to find 3^{11}.

C) Let A be your answer to question A. Find 4^A.

D) Let B be your answer to question B. Find $\log_3 B$.

Logs are the inverse functions to exponents

$f(x) = \log_b x$ and $g(x) = b^x$ are inverse functions
(where $b > 0$ and $b \neq 1$)

$(f \circ g)(x) =$

$(g \circ f)(x) =$

Consequences of the previous page

A) If the point $(2,10)$ is on the graph of $y = a^x$, what point is on the graph of $y = \log_a x$?

B) Simplify $\log_4(4^5)$

C) Simplify $3^{\log_3 6}$

D) Simplify $e^{2 \ln 8}$

E) We know what the graph of $y = 2^x$ looks like. What does the graph of $y = \log_2 x$ look like?

More consequences

F) If the points $(2,6)$ and $(4,36)$ are on the graph of $y = a^x$, find the average rate of change of $y = \log_a x$ over the interval $[6,36]$.

G) Simplify $\ln(e^3)$

H) Simplify $2^{\log_2 5 + \log_2 3}$

I) We know what the graph of $y = \left(\frac{1}{2}\right)^x$ looks like. What does the graph of $y = \log_{\frac{1}{2}}(x)$ look like?

Two More

J) Simplify $8^{\log_2 x}$

K) $3^{\log_9 x}$

Log Properties: Horizontal Dilations = Vertical Translations

$$f(x) = \log_5 x$$

$$g(x) = \log_5 \left(\frac{x}{5}\right)$$

Describe the transformation that maps the graph of f to the graph of g.

Log Properties: Raising the Argument to a Power = Vertical Dilation

$$f(x) = \log_5 x$$

$$g(x) = \log_5\left(x^8\right)$$

Describe the transformation that maps the graph of f to the graph of g.

Log Properties: All Log Functions are Vertical Dilations of Each Other

Rewrite the following with a base of 4

$$f(x) = \log_2 x \qquad g(x) = \log_4 x \qquad h(x) = \log_8 x \qquad k(x) = \log_{16} x$$

Log Properties and Transformations Practice

Let $f(x) = \log x$

Match each of the numbered statements with the letter of the corresponding function.

#1) The graph of this function is the image of the graph of $f(x)$ after a vertical dilation by a factor of 10.

A) $g(x) = \log(10x)$

#2) The graph of this function is the image of the graph of $f(x)$ after a vertical dilation by a factor of $\frac{1}{2}$.

B) $g(x) = \log(10^x)$

#3) The graph of this function is the image of the graph of $f(x)$ after a vertical translation by 1 unit.

C) $g(x) = \log(x^{10})$

#4) This function is the identity function.

D) $g(x) = \log_{100} x$

Recognizing Log Functions From Tables

The following is a table of values of $f(x) = a(b)^x$

x	$f(x)$
-3	3
0	6
3	12
6	24
9	48

Let's make a table of values for $f^{-1}(x)$

x	$f^{-1}(x)$

Exponential functions: input has constant difference ⇔ output has constant ratio/proportion

Log functions: input has constant ratio/proportion ⇔ output has constant difference

One of these tables is from an exponential function, one of these tables is from a logarithmic function, and one of these tables is a distractor. Which is which?

x	$f(x)$
2	48
4	72
6	108
8	162
10	243

x	$g(x)$
1	120
4	60
16	30
64	15
256	7.5

x	$h(x)$
2	25
10	20
50	15
250	10
1250	5

Let $f(x) = 2^x - 5$

Find an expression for $f^{-1}(x)$

Let $g(x) = \log_3(x - 8)$

Find an expression for $g^{-1}(x)$

Find the inverse of each of the following functions

$f(x) = 2(3)^{x-4}$

$g(x) = \ln(x) + 8$