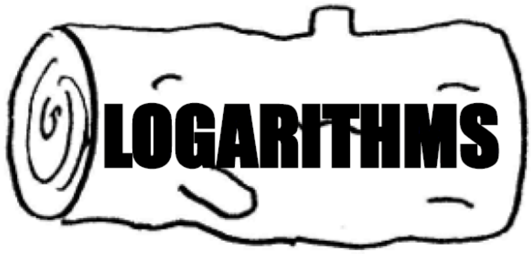
Lesson 8.4: Part 1



A logarithm is just a special way to ask a specific question.

The Question:

Exponential Form	Logarithmic Form

Oh no!
My logarithm has no base!

$log10$

$log\frac{1}{100}$

$log1000$

The Logarithm Loop Trick

Always draw your loop counter-clockwise from the base!

$log_b a = x \qquad b^x = a$

Example 1:

Convert to exponential form.	Convert to logarithmic form.
$log_4 16 = 2$	$3^2 = 9$
$log_5 125 = x$	$2^x = 18$

Example 2: Evaluate

$log_3 81$

Lesson 8.4: Part 2

Special Values:

Log of 1 – $log_b 1 = 0 \quad \rightarrow \quad b^0 = 1$

Log of base b – $log_b b = 1 \quad \rightarrow \quad b^1 = 1$

Common Logarithm: $log_{10} x = log x$ ** log key on calculator
(base 10)

Natural Logarithm: $log_e x = ln x$ ** ln key on calculator
(base e)

Inverse Logs: If $g(x) = log_b x$ what is the inverse?

$g\left(g^{-1}(x)\right) =$

$g^{-1}\left(g(x)\right) =$

Example 3: Find the inverse of the function.

a. $y = log_8 x$

b. $y = \ln(x - 3)$

Inverse Properties:

$$b^{log_b x} = x \qquad\qquad log_b b^x = x$$

Example 4: Use inverse properties to simplify.

a. 10^{logx}

b. $log_5 125^x$

Lesson 8.5: Properties of Logarithms

Recall:

Exponent rules

a. *Multiplication Property*

$b^m \cdot b^n = b^{m+n}$

b. *Division Exponents*

$\frac{b^m}{b^n} = b^{m-n}$

$\boldsymbol{log_b u}$	$\boldsymbol{log_b v}$	$\boldsymbol{log_b uv}$
$log10 =$	$log100 =$	$log1000 =$
$log.1 =$	$log.01 =$	$log.001 =$
$log_2 4 =$	$log_2 8 =$	$log_2 32 =$

Conjecture? $log_b uv =$

Product Property: $log_b uv =$

Quotient Property: $log_b \frac{u}{v} =$

Power Property: $log_b u^n =$

Example 1: Evaluate

$3^x = 12$

Example 2: Expand

a. $log_{10}100x^6$

b. $log_2 9x^2$

Example 3: Condense

a. $2log_3 7 - 5log_3 x$

b. $log_4 5 + 2log_4 x$

Example 4: Given $log_b a = c$ and $log_b d = e$
Evaluate the following

a. $log_b \frac{a}{d}$

b. $log_b a^2$

c. $log_b a^2 d^3$

Change of Base Formula

Let x, y, and b be positive numbers with $b \neq 0$ and $c \neq 1$

$$log_x y = \frac{log_b y}{log_b x} \quad \text{OR} \quad log_x y = \frac{lny}{lnx}$$

*** Use $b = 10$ so we can use calculator!

Example 5: Use change of base formula to evaluate.

a. $log_6 9$

b. $log_4 8$

Lesson 8.6: Solving Exponential and Logarithmic Equations

Properties:

If two powers with the same base are equal, then their exponents must be equal. If $b^x = b^y$, then $x = y$ for $b > 0$ & $b \neq 1$

$log_b x = log_b y$ then $x = y$

Example 1: $2^{4x} = 32^{x-1}$

Example 4: $log_4(x+3) = log_4(8x+17)$

Example 2: $4^x = 15$

Example 5: $log_4(x+3) = 2$

Example 3: $5^{x+2} + 3 = 28$

Recall:

The domain of logarithmic functions does not typically include all real numbers. Be sure to check your solutions for extraneous solutions.

Example 6: $log_2 x + log_2(x-7) = 3$

Example 7: $log_2(2x+2) = log_2(x-7)$