TOPIC: INTRODUCTION TO LOGARITHMIC FUNCTIONS

Intro to Logarithms

◆ A **logarithm** is the **exponent** that some **base** must be raised to in order to equal a particular number.

New **Logarithmic Function**

$2^y = 4 \quad \rightarrow y =$ _____

$2^y = 8 \quad \rightarrow y =$ _____

$2^y = 10 \quad \rightarrow y =$ _____

"log base b of x"

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

base *argument*

$x > 0$

$b > 0, b \neq 1$

◆ The **logarithmic function** $f(x) = \log_b x$ is the _____ of the exponential function.

EXAMPLE Find the inverse of the one-to-one function $f(x) = 5^x$.

Replace $f(x)$ with y:

Switch x & y:

Solve for y:

TOPIC: INTRODUCTION TO LOGARITHMIC FUNCTIONS

Converting Between Exponential & Logarithmic Form

Recall

$y = \log_b x \leftrightarrow x = b^y$

◆ Recall: A **log** is the **exponent** that some **base** must be raised to in order to equal a particular number.

Exponential Form	Logarithmic Form
Exponent, Base: $3^4 = 81$	$\log_{\square} \square = \square$ (Exponent, Base)

EXAMPLE Write each log in exponential form & each exponential form in log form.

(A) $\log_2 16 = 4$

(B) $x = \log_5 800$

(C) $10^x = 4500$

TOPIC: INTRODUCTION TO LOGARITHMIC FUNCTIONS

PRACTICE Rewrite the exponential equation as a logarithmic equation.

$(\boldsymbol{A})$

$3^x = 9$

$(\boldsymbol{B})$

$6^{-3} = \frac{1}{216}$

$(\boldsymbol{C})$

$2^y = 3.249$

PRACTICE Rewrite the logarithmic equation as a exponential equation.

$(\boldsymbol{A})$

$\log_5(25) = 2$

$(\boldsymbol{B})$

$\log_3\left(\frac{1}{27}\right) = -3$

$(\boldsymbol{C})$

$\log_4 x = 1.5$

TOPIC: INTRODUCTION TO LOGARITHMIC FUNCTIONS

Basic Properties of Logarithms

◆ You can evaluate many logarithms using properties that come from the log being the _____ of an exponential.

PROPERTIES OF LOGARITHMS			
Name	**EXAMPLE**	**Property**	**Description**
Inverse Property	$\log_2 2^3 =$ _____ $2^{\log_2 3} =$ _____	$\log_b b^x = x$ $b^{\log_b x} = x$	Logs & exponentials w/ the ***same base*** _____
*Log of the **Base***	$\log_2 2 =$ _____	$\log_b b = 1$	Log of its ***base*** equals ___
*Log of **1***	$\log_2 1 =$ _____ _____ *"2 to what power gives 1"*	$\log_b 1 = 0$	*ANY* log of **1** equals ___

EXAMPLE Use the properties above to evaluate the given logarithms.

(A) $\log_{10} 10$

(B) $\log_7 1$

(C) $\log_4 16$

(D) $\log_5 \frac{1}{5}$

Recall

$$\frac{1}{a^n} = a^{-n}$$

TOPIC: INTRODUCTION TO LOGARITHMIC FUNCTIONS

EXAMPLE Evaluate the logarithm.

$\log_4 \sqrt[3]{4}$

Recall
$a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

PRACTICE Evaluate the given expression.

$5^{\log_5 12}$

PRACTICE Evaluate the given logarithms.

(*A*) $\log_y \sqrt{y}$

(*B*) $\log_x 1$