TOPIC: INTRODUCTION TO LOGARITHMS

Logarithms Introduction

- The ______________ (inverse) operation of an exponential is taking the ***logarithm*** (log).
  - Logs and exponentials with the same **base** ________ each other.
  - A **log** gives us the **power** that some **base** must be raised to in order to equal a particular number.

Solving Polynomials

$$x^3 = 216$$
$$\sqrt[3]{x^3} = \sqrt[3]{216}$$
$$x = \sqrt[3]{216}$$

Solving Exponentials

(***A***)

$$2^x = 8$$
$$2 \times 2 \times 2 = 8$$
$$x = 3$$

(***B***)

$$2^x = 216$$ *(Exponential Form)*

$$x = \log$$ *(Logarithmic Form)*

"log base 2 of 216"

- You will need to convert expressions between **exponential form** and **logarithmic form**.

Recall: Exponential Form	New: Logarithmic Form	Exponential Form	Logarithmic Form
Equals $3^x = 81$ *Log base of*	$\log_{\square} \square = \square$	$\square^{\square} = \square$	*Equals* $x = \log_4 64$ *To the power of*

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

(***A***) $x = \log_5 800$

(***B***) $\log_2 16 = 4$

(***C***) $10^x = 4500$

- $\log_{10}$, known as the __________ log, can be written as just _____ and has its own calculator button: LOG

TOPIC: INTRODUCTION TO LOGARITHMS

The Natural Log

◆ Besides the common log, ($\log_{10}$), another frequently occurring log is $\log$___, called the ________________ log.

- The natural log is written as _______, and also has its own calculator button: LN

Equals

$$b^x = M \quad \Rightarrow \quad \log_b M = x$$

Log base of

$$e^x = M \quad \Rightarrow \quad \log_{\square} M = x$$

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

(***A***) $x = \ln 17$

(***B***) $e^x = 4$

TOPIC: INTRODUCTION TO LOGARITHMS

PRACTICE Convert the following logarithmic statement to its equivalent exponential form.

(***A***)

$$\log_4 x = 5$$

(***B***)

$$x = \log 9$$

PRACTICE Convert the following exponential statements to their equivalent logarithmic form.

(***A***)

$$3^x = 7$$

(***B***)

$$e^9 = x + 3$$

TOPIC: INTRODUCTION TO LOGARITHMS

Evaluate Logarithms

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

New **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 Using known properties, evaluate the given logarithms.

(***A***) $\log_2 \sqrt[3]{2}$

(***B***) $\ln 1$

(***C***) $\log 10$

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

TOPIC: INTRODUCTION TO LOGARITHMS

PRACTICE Evaluate the given logarithm.

(***A***)

$$\log_7 7^{0.3}$$

(***B***)

$$\frac{3}{2}\log 1$$

(***C***)

$$\log_9 \frac{1}{81}$$