

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

$$\begin{aligned}
 x^3 &= 216 \\
 \sqrt[3]{x^3} &= \sqrt[3]{216} \\
 x &= \sqrt[3]{216}
 \end{aligned}$$

(A)

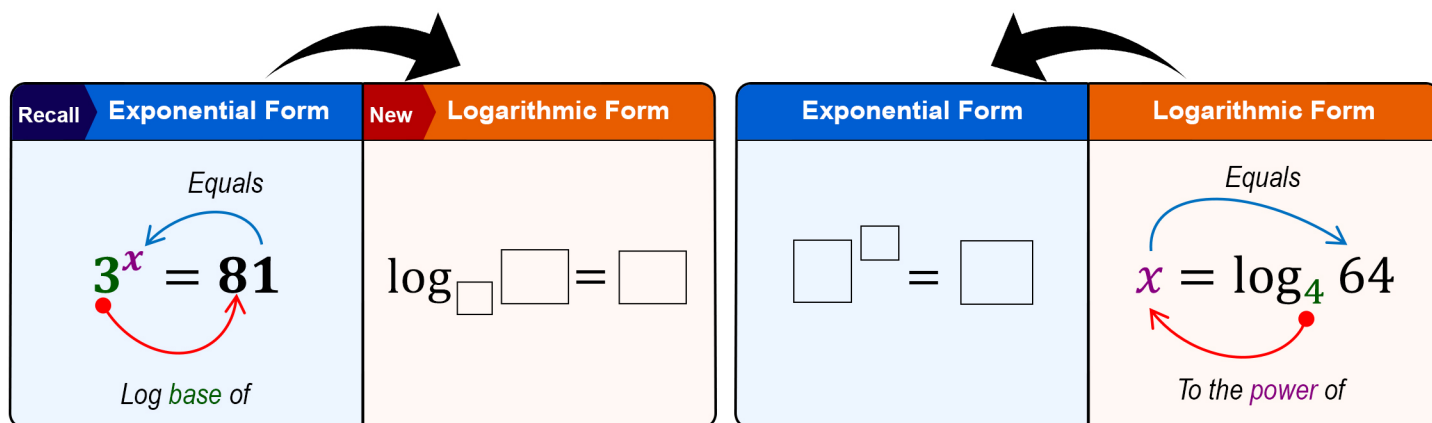
$$\begin{aligned}
 2^x &= 8 \\
 2 \times 2 \times 2 &= 8 \\
 x &= 3
 \end{aligned}$$

Solving Exponentials

(B)

$$\begin{aligned}
 2^x &= 216 && \text{(Exponential Form)} \\
 x &= \log && \text{(Logarithmic Form)} \\
 &&& \text{"log base 2 of 216"}
 \end{aligned}$$

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



EXAMPLE

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

(A)

$$x = \log_5 800$$

(B)

$$\log_2 16 = 4$$

(C)


$$10^x = 4500$$

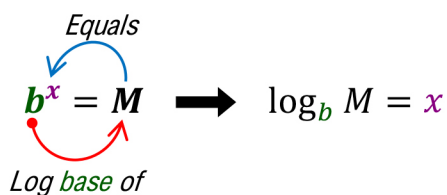
- ◆ \log_{10} , known as the _____ log, can be written as just _____ and has its own calculator button: **LOG**

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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: 


$$b^x = M \longrightarrow \log_b M = x$$

$$e^x = M \longrightarrow \log_{\boxed{}} M = x$$

EXAMPLE

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

(A) $x = \ln 17$

(B) $e^x = 4$

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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)

$$e^9 = x + 3$$

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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	$\log_2 2^3 = \underline{\hspace{1cm}}$ $2^{\log_2 3} = \underline{\hspace{1cm}}$	$\log_b b^x = x$ $b^{\log_b x} = x$	Logs & exponentials w/ the <i>same base</i> _____
Log of the Base	$\log_2 2 = \underline{\hspace{1cm}}$	$\log_b b = 1$	Log of its <i>base</i> equals ____
Log of 1	$\log_2 1 = \underline{\hspace{1cm}}$ _____ "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) $\log_5 \frac{1}{5}$

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PRACTICE

Evaluate the given logarithm.

(A)

$$\log_7 7^{0.3}$$

(B)

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

(C)

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