

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

$$2^y = 4 \quad \rightarrow y = \underline{\hspace{1cm}}$$
$$2^y = 8 \quad \rightarrow y = \underline{\hspace{1cm}}$$
$$2^y = 10 \quad \rightarrow y = \underline{\hspace{1cm}}$$

"log base b of x"

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

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 :

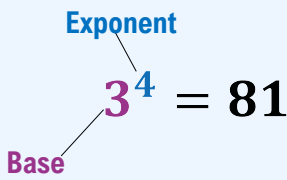
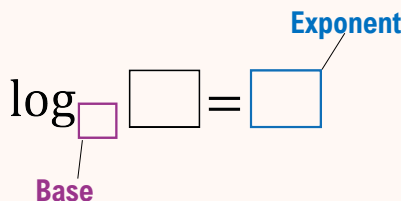
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Converting Between Exponential & Logarithmic Form

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
 $3^4 = 81$	 $\log \boxed{} \boxed{} = \boxed{}$

EXAMPLE

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

(A) $\log_2 16 = 4$

(B) $x = \log_5 800$

(C) $10^x = 4500$

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PRACTICE

Rewrite the exponential equation as a logarithmic equation.

(A)

$$3^x = 9$$

(B)

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

(C)

$$2^y = 3.249$$

PRACTICE

Rewrite the logarithmic equation as an exponential equation.

(A)

$$\log_5(25) = 2$$

(B)

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

(C)

$$\log_4 x = 1.5$$

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Evaluating Logarithms

◆ To evaluate a logarithm, think: "What **exponent** can I raise the **base** to in order to get the **argument** of the log?"

EXAMPLE

Find the value of each logarithmic expression.

(A) $\log_2 16$

(B) $\log_{49} 7$

(C) $\log_4 \frac{1}{64}$

Recall

$$\log_b x = y$$

base *argument* *exponent*

(Log Def'n)

$$\sqrt{a} = a^{1/2} \quad \frac{1}{a^n} = a^{-n}$$

(Exp. Rules)

PRACTICE

Evaluate the given logarithmic expression.

(A) $\log_2 128$

(B) $\log_5 \frac{1}{125}$

(C) $\log_{10} 0.1$

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

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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) $\log_x 1$