7-1 Defining and evaluating logarithms

- I can convert between exponential and logarithmic form

Good I can evaluate logarithms
$$5000 = 1000 (1+.05)^{t}$$

$$1000 = (XPONENTS)$$

In general, the exponential function $f(x) = b^x$, where b > 0 and $b \ne 1$, has the logarithmic function $f^{-1}(x) = \log_b x$ as its inverse. For instance, if $f(x) = 3^x$, then $f^{-1}(x) = \log_3 x$, and if $f(x) = \left(\frac{1}{4}\right)^x$, then $f^{-1}(x) = \log_1 x$. The inverse relationship between exponential functions and logarithmic functions also means that you can write any exponential equation as a logarithmic equation and any logarithmic equation as an exponential equation.

> **Logarithmic Equation** Exponential Equation

 loy_b .

Ner

> 0, b \neq 1 base

\[
\lambda \log base \quad \text{of } \alpha \\

\log base \quad \text{of } \alpha \\

equals \times ''

Module 15 Lesson 1

Examples

Exponential Equation	Logarithmic Equation
$\frac{4^3}{1} = 64$	$\log_4 64 = 3$
5(2)= 1/25	$\log_5 \frac{1}{25} = -2$
$\left(\frac{2}{3}\right)^p = q$	$\log_{\frac{2}{3}}q = p$
$\left(\frac{1}{2}\right)^n = m$	$\log_{\frac{1}{2}} m = n$

Switch between Log and exponential forms

Exponential Equation	Logarithmic Equation
3 ⁵ = 243	1093243=5
4= 4	$\log_4 \frac{1}{64} = -3$
$\left(\frac{3}{4}\right) = s$	10935=r
5 = V	$\log_{\frac{1}{5}} v = W$

$$y = \ln x$$
 is equivalent to $x = e^y$

Base C

The common logarithm:

$$= \log_{10} x \quad \text{is equivalent to } x = 10^y$$

Base ()

Exponential Equation	Logarithmic Equation
$e^5 \approx 148.4$	In 148.4=5
e1.8 ~ 6	$ln6 \approx 1.8$
$10^5 = 100,000$	109/100,000 = 5
103 = 1,000	$\log 1,000 = 3$

Evaluating logarithms

$$f(x) = \log x$$

Find f(10), f(0.1), f(100)

$$f(10) = 109.10 = ?$$

$$\frac{10^{2}}{10^{2}} = \frac{10^{2}}{10^{2}} = \frac{10$$

Evaluate f(x)

$$f(x) = \log_2 x$$
 Find f(4), f(16), f(64)
 $\log_2 4 = 7.2$ $2^? = 4$ $?=2$
 $\log_2 10 = 7.4$ $2^? = 10$ $?=4$
 $\log_2 64 = 8$ $2^? = 64$

Evaluate f(x)

$$f(x) = \log_7 x$$

Find f(49), f(343)

7?=49

 $7^{13} = 343$

Find the exact value

Find the exact value
$$\log_2 32 = X \qquad \log_4 \frac{1}{16} = X$$

$$2 = 32 \qquad 4 = \frac{1}{16}$$

$$x = 5$$

$$\log 100000000 = X \qquad \log .00001 = X$$

$$10^X = 10,000,000 \qquad 10^X = .000$$

$$x = -5$$

$$10^1 = 10$$

Find the exact value

$$\log_5 25$$

$$\log_2 \frac{1}{8} = -3$$

$$2^{-3} = \frac{1}{8}$$

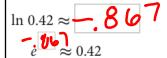
$$10^{-3} = .001$$

Use a calculator to

First, find the common logarithm of 0.42. Round the result to the thousandths place and raise 10 to that number to confirm that the power is close to 0.42.

$$\log 0.42 \approx -.376$$
 ≈ 0.42

Next, find the natural logarithm of 0.42. Round the result to the thousandths place and raise e to that number to confirm that the power is close to 0.42.



Your Turn

Use a scientific calculator to find the common logarithm and the natural logarithm of the given number. Verify each result by evaluating the appropriate exponential expression.

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