Sec 10-2: Logarithms

Logarithms (Logs) are exponents.

Logarithms were <u>most</u> useful before computers, to simplify calculations using a base raised to an exponent.

The system works like this:

Exponential Equation	Logarithmic Equation
$\underset{\text{base}}{b}^{\overset{\text{exponent}}{p}} = \underset{\text{the number (answer)}}{n}$	$\log_{\underset{\text{base}}{b}} \underset{\#}{n} = \underset{\text{exponent}}{p}$

Ex.) $2^5 = 32$ * $\log_2 32 = 5$

* This is read as "the log base 2 of 32 is equal to 5."

log ← refers to the exponent.

More examples

Exponential Equation	Log Equation
$5^2 = 25$	$\log_5 25 = 2$
$10^5 = 100{,}000$	$\log_{10} 100{,}000 = 5$
$8^0 = 1$	$\log_8 1 = 0$
$2^{-4} = \frac{1}{16}$	$\log_2 \frac{1}{16} = -4$
$9^{1/2} = 3$	$\log_9 3 = \frac{1}{2}$

Complete

* log base must be > 0 and $\neq 1$. "The number", n, must also be > 0.

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ex.) Write $2^5 = 32$ in log form: $\log_2 32 = 5$

ex.) write $\log_5 125 = 3$ in exponential: $5^3 = 125$

Solve

$\log_9 x = \frac{3}{2}$

$9^{3/2} = x$

$\sqrt[2]{9^3} = x$

$27 = x$

Solve

$\log_4 256 = y$

$4^y = 256$

$y = 4$

Evaluate

$\log_3 \frac{1}{27}$

$\log_3 \frac{1}{27} = x$

$3^x = \frac{1}{27}$

$3^{-3} = \frac{1}{27}$

$x = -3$

Evaluate

$\log_{16} 4 = x$

$16^x = 4$

$\downarrow$

$(4^2)^x = 4^1$

$\frac{2x}{2} = \frac{1}{2}$

$x = \frac{1}{2}$