Definition of a Logarithm

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If $b^x = N$

$b \neq 1$

$b > 0$

$N > 0$

Then we can write

$b^x = N \longleftrightarrow \log_b N = x$ (the same)

Argument

reads "log to the base 'b' of N = exponent"

ex. $5^3 = 125 \longrightarrow \log_5 125 = 3$ (becomes)

$10^2 = 100 \longrightarrow \log_{10} 100 = 2$

ex. $2^x = 16 \longrightarrow \log_2 16 = x \longrightarrow x = 4$

ex. $3^4 = 81 \longrightarrow \log_3 (81) = 4$

Note: $5^1 = 5$ $\quad \log_5 5 = 1$

$6^1 = 6$ $\quad \log_6 6 = 1$

$\log_m m = 1$

Summary: $b^x = N$ and $\log_b N = x$ are the same thing just saying it a different way

Log Form $\longrightarrow$ Exponential Form

$2 = \log_4 16 \longrightarrow 4^2 = 16$

$\log_3 \left(\frac{1}{9}\right) = -2 \longrightarrow 3^{-2} = \frac{1}{9}$

Note: Can't write log of zero or negative

$\log_4 0 = x \longrightarrow 4^x = 0$

$\log_4(-2) = x \longrightarrow 4^x = -2$

x does not exist
UND
DNE

ex. Solve for x must rewrite in exp. form

a) $\log_2 32 = x$

$2^x = 32 \longrightarrow 2^x = 2^5$

$x = 5$

b) $\log_x 125 = 3$

$\sqrt[3]{x^3} = \sqrt[3]{125}$

$x = 5$

c) $\log_4 x = -3$

$4^{-3} = x$

$\frac{1}{64} = x$

d) $\log_4(2^6) = x$

$4^x = 2^6 \longrightarrow 2^{2x} = 2^6$

$2x = 6$

$x = 3$

e) $3^{\log_3 2} = x$

x

b N

$\log_b N = x$

$\log_3 x = \log_3 2$

$x = 2$

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