1on1 Laws of Exponents & Logarithms

Exp. Law 1: $(b^x)(b^y)= b^{x+y}$, e.g. $(2^3)(2^2) = (2x2x2)(2x2) = 2^{3+2} = 2^5 = 32$

Exp. Law 2: $(b^x)\div(b^y)= b^{x-y}$, e.g. $(2^3) \div (2^2) = 2^{3-2} = 2^1 = 2$

Exp. Law 3: $(b^x)^y= b^{xy}$, e.g. $(2^3)^2 = 2^{3x2} = 2^6 = 64$

Exp. Law 4: $(ab)^x= (a^x)(b^x)$, e.g. $(2 \times 3)^3= (2^3)(3^3) = 8 \times 27$

Exp. Law 5: $b^{-x} = 1/b^x$, e.g. $2^{-3}= 1/2^3 = 1/8$

Exp. Law 6: $(a/b)^x= (a^x)\div(b^x)$, e.g. $(2 / 3)^3= (2^3)\div(3^3) = 8 / 27$

Exp. Law 7: $a^{1/2}=\sqrt{a}$, 'square root' of 'a', e.g. $4^{3/2} = (4^3)^{1/2} = \sqrt{64} = 8$

Just like laws, logarithms are cantankerous, confusing and convoluted. Furthermore, 'logarithm' is just a complicated and inverted term for 'exponent'. So basically, logarithm = exponent.

Mathematically speaking:

$\log_b Y=X$ means that $b^X=Y$ *where b, X and Y are positive real numbers and b≠1*
b is the 'base', X is the 'logarithm' or 'exponent' and Y is the result
For example, $\log_{10}100=2$ means that $10^2=100$

Don't worry, you'll get it with practice. Working with actual numbers will help you see how logarithms work. By the way, if you see* Log Y=X *without any base listed, the base is assumed to be 10. So for example,* Log 100=2 means $10^2=100$*, just like above.

The laws below are used to manipulate (fiddle with) logarithm problems algebraically. Think of this as a logarithm tool box. Chances are that one of these tools will help you solve a logarithm problem.

Log Law 1: $\log_b(MN) = \log_b M + \log_b N$, e.g. $\log_2 32 = \log_2 (4x8) = \log_2 4 + \log_2 8 = 2 + 3 = 5$

Log Law 2: $\log_b(M/N) = \log_b M - \log_b N$, e.g. $\log_3 9 = \log_3 (27/3) = \log_3 27 - \log_3 3 = 3 - 1 = 2$

Log Law 3: $\log_b N^x = x \log_b N$, e.g. $\log_3 9^2 = 2\log_3 9 = 2 \times 2 = 4$

Log Law 4: $\log_b b = 1$, e.g. $\log_3 3 = 1$, because $b^1 = b$ or $3^1 = 3$

Log Law 5: $\log_b 1 = 0$, e.g. $\log_3 1 = 0$, because $b^0 = 1$ or $3^0 = 1$

Log Law 6: $\log_b(1/N) = - \log_b N$, e.g. $\log_3 1/9 = - \log_3 9 = -2$, because $3^{-2} = 1/3^2 = 1/9$

Log Law 7: $\log_b N = (\log_a N)/ (\log_a b)$, e.g. $\log_4 16 = (\log_2 16)/ (\log_2 4) = 4/ 2 = 2$

Are we having fun yet?!!!
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