Tips for Using Logarithms

A **logarithm** is used to solve an exponential equation, where the unknown is the exponent. Think of using multiplication to solve a division problem.

$\boldsymbol{y = b^x}$ can be rewritten as $\boldsymbol{\log_b y = x}$

So, when you compute log 3, you are actually solving for x in $10^x = 3$.

For example, to solve for x in $10^x = 25$, rewrite using log.

$10^x = 25$ b is 10, y is 25, and x is our unknown exponent

$\log_{10} 25 = x$ the log button on your calculator is actually $\log_{10}$, so you can just push log 25 and that is your answer

$\log_{10} 25 = 1.398$, so $x = 1.398$

To check your answer, put 1.398 back into the original problem: $10^{1.398} \approx 25$

Sometimes you have a base other than 10. When that is the case, you can use the conversion formula to change bases.

$$\log_b x = \frac{\log x}{\log b} = \frac{\ln x}{\ln b}$$

ln is called the natural log; it is actually $\log_e$. e is like pi, in that it is a name we use to represent a number.

$e \approx 2.718$

Because logs are related to exponents, there are some rules similar to exponent rules that apply to logarithms.

$\log A + \log B = \log (A \times B)$

$\log x^n = n \log x$

$\log_b (\frac{1}{t}) = -\log_b t$

$\log A - \log B = \log (\frac{A}{B})$

$\log_b 1 = 0$

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