Logarithm laws



The *logarithm laws* are the rules by which logarithms may be combined, and are derived from the definition of the logarithm and the index laws.

The basic rules are:

$$\log_a a = 1$$

$$\log_a(xy) = \log_a x + \log_a y$$

$$\log_a(x^n) = n \log_a x$$

From these we can derive other important rules:

$$\log_a 1 = 0$$

$$\log_a(x/y) = \log_a x - \log_a y$$

$$\log_a(1/x) = -\log_a x$$

$$\log_a \sqrt[n]{x} = \frac{1}{n}\log_a x$$

We can change the base of a logarithm:

$$\log_a x = \frac{\log_b x}{\log_b a}$$

And from the definition of logarithm, it is the inverse of exponentiation:

 $a^{\log_a b} = b$ and $\log_a(a^b) = b$.