



Matteman

HIGH SCHOOL MATHEMATICS

LOGARITHMS

Laws of logarithms:

In mathematics, the logarithm is the inverse operation to exponentiation, just as division is the inverse of multiplication.

$$a^x = b \Leftrightarrow \log_a b = x$$

$$\log_a 1 = 0$$

$$\log_a a = 1$$

$$\log_a a^n = n \log a$$

$$\log \left(\frac{1}{a} \right) = -\log a$$

$$\log_{10} x = \log x$$

$$\log(ab) = \log a + \log b$$

$$\log \left(\frac{a}{b} \right) = \log a - \log b$$

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

$$\log_a x - \log_a y = \log_a \left(\frac{x}{y} \right)$$

Changing the base

$$\log_a b = \frac{\log_c b}{\log_c a}$$

Reciprocal

$$\log_a b = \frac{1}{\log_b a}$$

Some important hints:

- *You can solve an equation such as $a^x = b$, by first taking logarithms (to base 10) of each side.*
- *Remember that you can write a^{2x} as $(a^x)^2$ [in general $a^{mx} = (a^x)^m$] this will enable you to turn equations into quadratics where applicable.*
- *Make sure there is no coefficient when you have addition/subtraction, take them as powers [n log a = log aⁿ] before attempting the following rules;*

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

$$\log_a x - \log_a y = \log_a \left(\frac{x}{y} \right)$$

Example:

$$2\log_5(x) - \log_5(x+2) = 1$$

$$\log_5(x^2) - \log_5(x+2) = 1$$

$$\log_5 \left(\frac{x^2}{x+2} \right) = 1$$