

PROPERTIES OF LOGARITHMS

$$y = \log_a(x) \text{ if and only if } x = a^y$$

If a, b, M and N are positive real numbers, $a \neq 1$ and $b \neq 1$, then

$$(1) \log_a(1) = 0$$

$$(2) \log_a(a) = 1$$

$$(3) \log_a(a^x) = x$$

$$(4) a^{\log_a(x)} = x$$

$$(5) \log_a(MN) = \log_a(M) + \log_a(N)$$

$$(6) \log_a\left(\frac{M}{N}\right) = \log_a(M) - \log_a(N)$$

$$(7) \log_a(M^r) = r \log_a(M)$$

$$(8) \log_a(M) = \frac{\log_b(M)}{\log_b(a)}$$

$$\ln(x) = \log_e(x)$$

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