Laws of Logarithms

Product Law

$$\log_a(xy) = \log_a x + \log_a y \qquad a > 0,\ a \neq 1,\ x > 0,\ y > 0$$

Example 1

a. $\log_5 9 + \log_5 3$

b. $\log_3 4x$

Quotient Law

$$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y \qquad a > 0, a \neq 1, x > 0, y > 0$$

Example 2

a. $\log 9 - \log 6$

b. $\log_4\left(\frac{x}{x+1}\right)$

Power Law

$$\log_a x^n = n \log_a x \qquad a > 0, a \neq 1, x > 0, n \in R$$

Example 3

a. $\log_4 3^2$

b. $4 \log_5 2$

Change of Base Formula

$$\log_b m = \frac{\log m}{\log b} \qquad b > 0,\ m > 0,\ b \neq 1$$

Example 4 Evaluate using the change of base formula.

a) $\log_5 10$ b) $\log_3 1.08$ c) $\log_{\frac{1}{2}} 125$

Example 5 Solve for x: $4\log_2 x = \log_2 3 + \log_2 27$