

Unit 8: Logarithmic Functions**8.3 Laws of Logarithms**

Since logarithms are exponents, the laws of logarithms are related to the laws of powers.

Let $M = c^x$ and $N = c^y$:

$$MN =$$

$$\frac{M}{N} =$$

$$M^P =$$

Product Law of Logarithms

$$\log_c MN =$$

Quotient Law of Logarithms

$$\log_c \frac{M}{N} =$$

Power Law of Logarithms

$$\log_c M^P =$$

Ex. Write each expression in terms of individual logarithms of x , y , and z .

a) $\log_5 \frac{xy}{z}$

b) $\log_7 \sqrt[3]{x}$

c) $\log_6 \frac{1}{x^2}$

d) $\log \frac{x^3}{y\sqrt{z}}$

Ex. Use the laws of logarithms to simplify and evaluate each expression.

a) $\log_6 8 + \log_6 9 - \log_6 2$

b) $\log_7 7\sqrt{7}$

c) $2\log_2 12 - \log_2 6 - \frac{1}{3}\log_2 27$

d) $\log_9 36 + \log_{27} 8 - \log_3 4$

Ex. If $\log_2 5 = x$ & $\log_2 3 = y$ express each statement in terms of x and/or y :

a) $\log_2 125$

b) $\log_2 75$

c) $\log_2 36$

Ex. Write each expression as a single logarithm in simplest form. State the restrictions on the variable.

a) $\log_7 x^2 + \log_7 x - 5 \frac{\log_7 x}{2}$

b) $\log_5(2x - 2) - \log_5(x^2 + 2x - 3)$

Ex. The pH (acidity) of a solution is defined by:

$\text{pH} = -\log[\text{H}^+]$ where $[\text{H}^+]$ is the hydrogen ion concentration in moles per litre.

a) Determine the pH of potato soil, to the nearest tenth, if the soil has a hydrogen ion concentration of $5 \times 10^{-8} \text{ mol/L}$.

b) What is the hydrogen ion concentration of a solution with $\text{pH} = 3.1$?