

Lesson 5 Laws of Logarithms

Let “ x ” be any real number, and M , N and “ a ” are positive real numbers with $a \neq 1$

Name of Law	Law	Example
Product Law	$\log_a MN = \log_a M + \log_a N$	$\log 6 = \log 2 + \log 3$
Quotient Law	$\log_a \left(\frac{M}{N}\right) = \log_a M - \log_a N$	$\log \frac{3}{4} = \log 3 - \log 4$
Power Law	$\log_a M^x = x \log_a M$	$\log 5^2 = 2 \log 5$

Ex. 1) Write each as a single logarithm

a) $\log x + 3 \log y$

b) $\log \sqrt{x} + 2 \log y - 4 \log(z - 2)$

c) $\log_2 6 - 3$

Ex. 3) Expand, using the laws of logarithms.

a) $\log\left(\frac{2x}{y^2z}\right)$

b) $\log\left(\frac{x^2\sqrt[3]{y}}{z+3}\right)$

Ex. 4) Evaluate.

a) $3\log_9 6 - \log_9 72$

b) $2\log_4 6 - 3\log_4 3 + \log_4 12$

Ex. 5) Given $\log_a 9 = 1.129$, $\log_a 4 = 0.712$, use the laws of logarithms to evaluate.

a.) $\log_a 36$

b.) $\log_a 12$