

3.3 Product and Quotient Laws of Logarithms Lesson

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Part 1: Proof of Product Law of Logarithms

Let $x = \log_b m$ and $y = \log_b n$
Written in exponential form:
_____ and _____

Part 2: Summary of Log Rules

Rule	Formula
Power Law of Logarithms	_____ for $b > 0, b \neq 1, x > 0$
Product Law of Logarithms	_____ for $b > 0, b \neq 1, m > 0, n > 0$
Quotient Law of Logarithms	_____ for $b > 0, b \neq 1, m > 0, n > 0$
Change of Base Formula	_____ for $m > 0, b > 0, b \neq 1$
Exponential to Logarithmic	_____
Logarithmic to Exponential	_____
Other useful tips	_____ _____ _____

Part 3: Practice Using Log Rules

Example 1: Write as a single logarithm
a) $\log_5 6 + \log_5 8 - \log_5 16$

b) $\log x + \log y + \log(3x) - \log y$

Note: Started by collecting like terms. Must have the same base and argument.

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Note: Can't use the power law because the exponent 2 applies only to x , not $3x$.

c) $\frac{\log_2 7}{\log_2 5}$

Note: Used the change of base formula.

d) $\log 12 - 3\log 2 + 2\log 3$

Example 2: Write as a single logarithm and then evaluate

a) $\log_8 4 + \log_8 16$

b) $\log_3 405 - \log_3 5$

c) $2\log 5 + \frac{1}{2}\log 16$

Example 3: Write the Logarithm as a Sum or Difference of Logarithms

a) $\log_3(xy)$

b) $\log 20$

c) $\log(ab^2c)$

Example 4: Simplify the Following Algebraic Expressions

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

b) $\log(\sqrt{x})^3 + \log x^2 - \log \sqrt{x}$

c) $\log(2x - 2) - \log(x^2 - 1)$