L3 – 7.3 – Product and Quotient Laws of Logarithms
MHF4U

Part 1: Proof of Product Law of Logarithms

Let $x = \log_b m$ and $y = \log_b n$

Written in exponential form:

Part 2: Summary of Log Rules

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

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

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

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

Used 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)** $\log\left(\sqrt{x}\right)^3 + \log x^2 - \log\sqrt{x}$ **c)** $\log(2x-2) - \log(x^2-1)$