

Exponential and Logarithmic Functions Lesson #7: Combining the Laws of Logarithms

Review

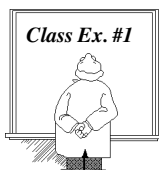
In the previous lesson we learned three laws of logarithms.

The Product Law $\log_a(M \times N) = \log_a M + \log_a N$

The Quotient Law $\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$

The Power Law $\log_a M^n = n \log_a M$

In this lesson we will study examples which combine the Power Law with the Product and Quotient Laws.



Class Ex. #1

Recall Class Ex. #5 from Lesson 6 shown below.

“Determine the value of $3 \log_2 p - 3 \log_2 q$ if $\frac{p}{q} = 8$.”

Show how this problem can be solved using a combination of the Laws of Logarithms without removing a common factor.



Class Ex. #2

a) Use laws of logarithms to write $\frac{1}{2} \log_a 16 - \frac{1}{3} \log_a 8$ as a single logarithm.

$$\begin{aligned}
 &= \log_a 16^{\frac{1}{2}} - \log_a 8^{\frac{1}{3}} \\
 &= \log_a 4 - \log_a 2 \\
 &= \log_a \left(\frac{4}{2}\right) = \boxed{\log_a 2}
 \end{aligned}$$

b) Evaluate a) if $a = 32$.

$$\log_{32} 2 = v$$

$$32^v = 2$$

$$2^{5v} = 2^1$$

$$\begin{aligned}
 5v &= 1 \\
 \frac{5v}{5} &= \frac{1}{5} \\
 \boxed{v} &= \frac{1}{5}
 \end{aligned}$$

Class Ex. #3

Evaluate the following without the use of a calculator.

a) $3 \log x - \log x^3$

$$\log x^3 - \log x^3 = 0$$

b) $2 \log 5 + 2 \log 2$

$$2(\log 5 + \log 2) = 2(\log 10) = 2$$

c) $\log_3 \frac{27^3}{81^4}$

$$\log_3 27^3 - \log_3 81^4 = 3 \log_3 27 - 4 \log_3 81 = 9 - 16 = -7$$

Class Ex. #4

If $\log_2 x = a$, determine an expression for $\log_2 16x^2$.

$$\log_2 16 + \log_2 x^2 = 4 + 2 \log_2 x = 4 + 2a$$

Class Ex. #5

Write the following expression as a single logarithm.

$$\log B + \log D - 5 \log E - \log A^2 + \frac{1}{2} \log A$$

$$\log \left(\frac{A^{\frac{1}{2}} BD}{E^5 A^2} \right) = \log \left(\frac{BD}{E^5 A^{\frac{3}{2}}} \right)$$

* before prod/quot. laws can be used coefficients must become powers *

Complete Assignment Questions #1 - #11

