

Section 7.3 - Laws of Logarithms

$$1. \text{ Product law: } \log_b(m \times n) = \log_b m + \log_b n$$

example, $\log_3(9 \times 27) = \log_3 9 + \log_3 27$

Remember
to evaluate:

$$\log_3 9 = y$$

$$3^y = 9$$

$$3^y = 3^2$$

$$y = 2$$



$$2. \text{ Quotient Law: } \log_b(m \div n) = \log_b m - \log_b n$$

example, $\log_2(256 \div 32) = \log_2 256 - \log_2 32$



Note the similarities between
the **laws of logarithms** and
the **laws of exponents**.

$$a^n \times a^m = a^{n+m}$$

$$a^n \div a^m = a^{n-m}$$

$$(a^n)^m = a^{nm}$$

$$3. \text{ Power Law: } \log_b(m^n) = n \log_b m$$

example, $\log_2 4^3 = 3 \log_2 4$



Example 1:

Write as a single logarithm, then evaluate.

a) $\log_2 5 + \log_2 6.4$

b) $\log 12 - \log 6$

c) $\log_3 27^5$

d) $2\log_3 6 + \log_3 0.75$

e) $\log_2 \sqrt{80} - \log_2 \sqrt{5}$

f) $2\log_3 6 - \frac{1}{2}\log_3 64 + \log_3 2$

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Your Turn:

Write as a single logarithm, then evaluate.

a) $\log 12 + \log 2$

b) $\log_5 100 - \log_5 4$

c) $\log_3 18 + \log_3 \left(\frac{3}{2} \right)$

d) $\log_5 40 - 3\log_5 2$

e) $3\log_6(2) + \log_6(27)$

f) $\log_5(2.5) + 2\log_5(10) - \log_5(2)$

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Example 4: Error Analysis

Simplify: $\log_5 36 + 2\log_5 3$

Student 1: $\log_5 36 + 2\log_5 3$
 $\log_5 36 + \log_5 3^2$
 $\log_5 36 + \log_5 6$
 $\log_5(36 \times 6)$
 $\log_5 324$

Student 2: $\log_5 36 + 2\log_5 3$
 $\log_5 36 + \log_5 3^2$
 $\log_5 36 + \log_5 9$
 $\log_5(36 \div 9)$
 $\log_5 4$

Example 5:

Express $\log 6$ as a:

a) sum of two logs.

b) difference of two logs.



Example 6:

What is $4\log A + \log B - 2\log C$ expressed as a single log?

Example 7:

Write an equivalent expression for $\log\left(\frac{A^2B}{C^3}\right)$.

Practice:
p. 446-447, #1 - 7, 10 - 16 + Worksheet