Questions from Homework

Ex: 4.5

④ b) $\log_{12} 3 + \log_{12} 8 + \log_{12} 6$

$\log_{12}(144)$

2

Ex: 4.6

④ A: $\log_3 72 - \log_3 8$

$\log_3 9$

2

B: $\log_{10} 500 + \log_{10} 2$

$\log_{10} 1000$

$\boxed{3}$

⑧ c) $\log_3(x+y) + \log_3(x-y) - (\log_3 x + \log_3 y)$

$\log_3(x+y) + \log_3(x-y) - \log_3 xy$

$\log_3 (x+y)(x-y) - \log_3 xy$

$\log_3 \frac{(x+y)(x-y)}{xy}$

$\log_3\left(\frac{x^2-y^2}{xy}\right)$

Logarithms

exponential form

$$x = b^y$$

Say "the base ***b*** to the exponent ***y*** is ***x***."

logarithmic form

$$y = \log_b x$$

Say "***y*** is the exponent to which you raise base ***b*** to get the answer ***x***."

$$x = b^y \longleftrightarrow y = \log_b x$$

Logarithm of a Product

$$\log_b M + \log_b N = \log_b (MN)$$

Logarithm of a Quotient

$$\log_b M - \log_b N = \log_b \left(\frac{M}{N} \right)$$

Law of Logarithms for Powers

$$\log_b(N^p) = p\log_b(N) \qquad N \in R, b > 0, b \neq 1$$

Since *p* can be expressed as a whole number or a fraction, this law can be expressed as follows.

Law of Logarithms for Roots

$$\log_b(N^{\frac{p}{q}}) = \frac{p}{q}\log_b(N) \qquad N \in R, b > 0, b \neq 1$$

When you work with equations involving logarithms you need to use the laws of logarithms, which are summarized below:

$$\log_b M + \log_b N = \log_b (MN)$$ Product

$$\log_b M - \log_b N = \log_b \left(\frac{M}{N} \right)$$ Quotient

$$\log_b (N^p) = p \log_b (N)$$

$$\log_b (N^{\frac{p}{q}}) = \frac{p}{q} \log_b (N)$$ } Power

Example 1

a) $\log_{10} \sqrt[4]{1000}$

$\log_{10} (1000)^{1/4}$

$\frac{1}{4} \log_{10} 1000$

$\frac{1}{4}(3)$

$\boxed{\frac{3}{4}}$

b) $\log_2 32^{\frac{1}{3}}$

$\frac{1}{3} \log_2 32$

$\frac{1}{3}(5)$

$\boxed{\frac{5}{3}}$

Example 2 Combining Laws

Express each of the following as a single logarithm.

a) $3\log_3 2 + \log_3 4$

$\log_3 2^3 + \log_3 4$

$\log_3 8 + \log_3 4$

$\log_3 32$

b) $2\log_2 9 + \log_2 6 - 3\log_2 3$

$\log_2 9^2 + \log_2 6 - \log_2 3^3$

$\log_2 81 + \log_2 6 - \log_2 27$

$\log_2 \left(\frac{81 \cdot 6}{27}\right)$

$\log_2 18$

Example 3

Solve the following and remember to verify your solution

$$\log_3 x - \log_3 4 = \log_3 12$$

$$\log_3 x = \log_3 12 + \log_3 4$$

$$\log_3 x = \log_3 48$$

$$x = 48$$

Example 4

If $\log_a x = m$ and $\log_a y = n$ then express the following in terms of *m* and *n.*

$$\log_a\left(\frac{ax}{y}\right)^2$$

$$2\log_a\left(\frac{ax}{y}\right)$$

$$2[\log_a a + \log_a x - \log_a y]$$

$$2[1 + m - n] \checkmark$$

or $2 + 2m - 2n$ ✓

Homework