Name: _____ Date: _____

Learning Goal 8.1	Solving exponential and logarithmic equations with same base and with different bases, including base e.

More Questions – Solutions

Power Law	**Product Law**	**Quotient Law**
$\log_b x^y = y \log_b x$	$\log_b(xy) = \log_b x + \log_b y$	$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$

1. Write each expression in terms of individual logarithms.

a. $\log_4 \frac{x}{yz}$

$= \log_4 x - \log_4 yz$
$= \log_4 x - (\log_4 y + \log_4 z)$
$= \log_4 x - \log_4 y - \log_4 z$

b. $\log_3 \left(\frac{9}{\sqrt[3]{x^2}}\right)$

$= \log_3 9 - \log_3 \sqrt[3]{x^2}$
$= 2 - \log_3 x^{2/3}$
$= 2 - \frac{2}{3}\log_3 x$
$= \frac{6 - 2\log_3 x}{3}$
$= \frac{2(3 - \log_3 x)}{3}$

2. Simplify using logarithm laws.

a. $\log_4 48 + \log_4\left(\frac{2}{3}\right) + \log_4 8$

$= \log_4\left(48 \times \frac{2}{3}\right) + \log_4 8$
$= \log_4(32) + \log_4 8$
$= \log_4(32 \times 8)$
$= \log_4(256)$
$= \log_4(4^4)$
$= 4$

b. $\log_6 \sqrt{12} + \log_6 \sqrt{3}$

$= \log_6 \sqrt{12} \times \sqrt{3}$
$= \log_6 \sqrt{36}$
$= \log_6 6$
$= 1$

c. $n \log_b x + \log_b x^{4-n} - \log_b x^{2n+3}$

$= \log_b x^n + \log_b x^{4-n} - \log_b x^{2n+3}$
$= \log_b (x^n \times x^{4-n}) - \log_b x^{2n+3}$
$= \log_b \left(x^{n+(4-n)}\right) - \log_b x^{2n+3}$
$= \log_b x^4 - \log_b x^{2n+3}$
$= \log_b \left(\frac{x^4}{x^{2n+3}}\right)$
$= \log_b \left(x^{4-(2n+3)}\right)$
$= \log_b x^{1-2n}$
$= (1-2n) \log_b x$

3. Given that $\log 2 = x$ and $\log 3 = y$, express each of the following in terms of x and y.

a. $\log 6$

$= \log(2 \times 3)$
$= \log 2 + \log 3$
$= x + y$

b. $\log\left(\frac{4}{9}\right)$

$= \log\left(\frac{2^2}{3^2}\right)$
$= \log(2^2) - \log(3^2)$
$= 2 \log 2 - 2 \log 3$
$= 2x - 2y$
$= 2(x - y)$