Name: _____ Date: _____

Learning Goal 0.2	Expectations for algebra from previous years.

exp.

Power Law	**Product Law**	**Quotient Law**	**Change of Base**
$(x^a)^b = x^{a\times b}$	$x^a x^b = x^{a+b}$	$\frac{x^a}{x^b} = x^{a-b}$	—
$\log(x^a) = a\log x$	$\log(xy) = \log x + \log y$	$\log\left(\frac{x}{y}\right) = \log x - \log y$	$\log_b x = \frac{\log_a x}{\log_a b}$

$\log(x+y) \neq \log x \times \log y$

Example Simplify the following expression, stating any possible restrictions on the variable.

a. $\log_8 32 + \log_{16} 2$ * SO MANY POWERS OF 2

$= \frac{\log_2 32}{\log_2 8} + \frac{\log_2 2}{\log_2 16}$

$= \frac{5}{3} + \frac{1}{4}$

$= \frac{20}{12} + \frac{3}{12} = 23/12$

b. $4\log_3 x - \frac{1}{2}(\log_3 x + 5\log_3 x)$ Power

$= 4\log_3 x - \frac{1}{2}(\log_3 x + \log_3 x^5)$ Product

$= 4\log_3 x - \frac{1}{2}\log_3 x^6$ Power

$= \log_3 x^4 - \log_3 (x^6)^{1/2}$

$= \log_3 x^4 - \log_3 x^3$ Quotient

$= \log_3 x$

c. $\log_7 x^4 + \frac{1}{3}(\log_7 x^2 - \log_7 \sqrt{5x})$

$= \log_7 x^4 + \frac{1}{3}(\log_7 x^2 - \log_7 (5x)^{1/2})$ Quotient

$= \log_7 x^4 + \frac{1}{3}\log_7 \left(\frac{x^2}{(5x)^{1/2}}\right)$ Power

$= \log_7 x^4 + \log_7 \left(\frac{x^2}{(5x)^{1/2}}\right)^{1/3}$

$= \log_7 x^{8/2} + \log_7 \left(\frac{x^{1/2}}{5^{1/6}}\right)$ Product.

$= \log_7 \left(\frac{x^{9/2}}{5^{1/6}}\right)$

$\left(\frac{x^{4/2}}{(5x)^{1/2}}\right)^{1/3} = \left(\frac{x^{3/2}}{5^{1/2}}\right)^{1/3} = \frac{x^{1/2}}{5^{1/6}}$

d. $\frac{\log 16x^8}{4} - \frac{\log 27x}{3}$

$= \frac{1}{4}\log(16x^8) - \frac{1}{3}\log(27x)$ Power Law

$= \log(16x^8)^{1/4} - \log(27x)^{1/3}$

$= \log(2x^2) - \log(3x^{1/3})$ Quotient

$= \log\left(\frac{2x^{6/3}}{3x^{1/3}}\right)^{1/3}$

$= \log\left(\frac{2x^{5/3}}{3}\right)$

$= \log\left(\frac{2x \times \sqrt[3]{x^2}}{3}\right)$

Assignment Handout Quiz Next Day!

Example Solve for x. State any restrictions on the variable and verify your answers.

a. $\log_2 x = \log_2 18 - \log_2 6$

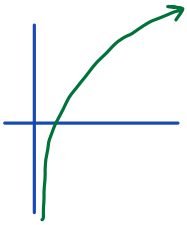
Quotient

$\log_2 x = \log_2 \left(\frac{18}{6}\right)$

$\log_2 x = \log_2 3$

$x = 3$ ✓

NPV: $x > 0$



b. $64^{3x-1} = \left(\frac{1}{16}\right)^{2x+4}$

$(2^6)^{3x-1} = (2^{-4})^{2x+4}$

$\log(2^{6(3x-1)}) = \log(2^{-4(2x+4)})$

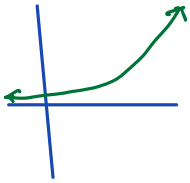
$6(3x-1) = -4(2x+4)$

$18x - 6 = -8x - 16$

$18x = -8x - 10$

$26x = -10$

$x = \frac{-10}{26} = \frac{-5}{13}$.



c. $2\log(3-x) = \log 4 + \log(6-x)$

Power

$\log(3-x)^2 = \log 4 + \log(6-x)$

Product

$10^{\log(3-x)^2} = 10^{\log 4(6-x)}$

$(3-x)^2 = 4(6-x)$

$9 - 6x + x^2 = 24 - 4x$

$x^2 - 2x - 15 = 0$

$(x-5)(x+3) = 0$

$x = 5$ $\quad$ $x = -3$

extraneous.

$3 - x > 0$

$3 > x$

$6 - x > 0$

$6 > x$

d. $\log(4^{2x-3}) = \log(3^{x+2})$

$\log(4^{2x-3}) = \log(3^{x+2})$

Power

$(2x-3)\log 4 = (x+2)\log 3$

$(2\log 4)x - 3\log 4 = (\log 3)x + 2\log 3$

$(\log 16)x - \log 64 = (\log 3)x + \log 9$

$(\log 16)x - (\log 3)x - \log 64 = \log 9$

$x(\log 16 - \log 3) = \log 9 + \log 64$

$x = \frac{\log 9 + \log 64}{\log 16 - \log 3}$