

Logarithms:

A logarithm is the inverse of an exponential function. This means logarithmic and exponential expressions “undo” each other (so long as the base “b” is the same). You will notice that the “Log Rules” are basically the opposite of the “Exponent Rules.” The 7 Log Rules are (these also work for natural log with a base of e , $\ln_e$)

Expanded	Condensed
$\log_b X + \log_b Y$	$\log_b(X \cdot Y)$
$\log_b X - \log_b Y$	$\log_b(X/Y)$
$y \cdot \log_b X$	$^*\log_b X^y$

$$\log_b(1) = 0$$

$$\log_b(b^k) = k$$

$$b^{\log_b(k)} = k$$

$$\log_b X = k \iff b^k = X$$

*NOTE: $\log_b X^y$ is read as “log base b of X to the y-power”

Expand:

$$\log_3 x^2 y =$$

$$\log_b \frac{xy}{z} =$$

$$\log_2 \frac{8x^3}{2y} =$$

Condense:

$$3\log_9 2 - 2\log_9 5 =$$

$$\log_3 12 + \log_3 7 - 4\log_3 5 =$$

$$\frac{1}{2}\log_2 x - 8\log_2 y - 5\log_2 z =$$

Solve:

$$\log_9 x = \frac{1}{2}$$

$$\log_2 \frac{y}{3} = 4$$

$$3^x - 2 = 12$$

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

$$2\log_b 5 + \frac{1}{2}\log_b 9 - \log_b 3 = \log_b x$$

Simplify:

$$\log_5 5^{x+6} =$$

$$\log_2 (8x)^{\frac{1}{3}} =$$

$$\log_7 \frac{1}{49^x} =$$