Write the following logs in exponential form:

$y = \log_8 25$ $\quad\quad$ $30 = \log_3 x$

Write the following exponential equations in log form:

$12 = 5^x$ $\quad\quad$ $y = 2^{-3x}$

36

Properties of Logs

for all positive #'s M, N, b, and x:

Product Rule

$$\log_b M \bullet N = \log_b M + \log_b N$$

Quotient Rule

$$\log_b \frac{M}{N} = \log_b M - \log_b N$$

Power Rule

$$\log_b M^x = x \log_b M$$

Product Rule

$\log_b M\cdot N = \log_b M + \log_b N$

$\log_b M = x$

$\log_b N = y$

$b^x = M$

$b^y = N$

$\log_b M\cdot N$

$M\cdot N = b^x \cdot b^y$

$= b^{x+y}$

Quotient Rule

$\log_3 27 = 3$

$\log_3 3 = 1$

$\log_3\left(\frac{27}{3}\right) = 3-1$

$\log_3 9 = 2$

$2 = 2$

Power Rule

Product Rule example:

$\log_2 8 = 3$

$\log_2 4 = 2$

$\log_2 32 = 5$

$5 = 5$ ✓

$2\log_2 4 = 2(2)$

$= 4$

$\log_2 4^2$

$\log_2 16 = 4$

$\log_b(b^{x+y}) = x+y$

$= \log_b M + \log_b N$

Write the following logs in expanded form:

$\log_4 5x = \log_4 5 + \log_4 X$

$\log_4 12 = \log_4 3 + \log_4 4$

$\log_4 3 + 1$

$\log_4 \frac{x}{6}$ -3 2

$\log_4 x - (\log_4 3 + \frac{1}{2})$

$\log 3x^2$

$\log_4 \frac{x^2}{y^3}$

$\ln x^5$

$\ln \frac{3x^2}{5y^3}$

$\ln 3x^2 - \ln 5y^3$

$\ln 3 + \ln x^2 - (\ln 5 + \ln y^3)$

$\ln 3 + 2\ln x - (\ln 5 + 3\ln y)$

Write the following expression as a single log:

$\log_4 7 + \log_4 5$

$\log_4 35$

$7 \cdot 5$

$\ln x - \ln y$ $\ln\frac{x}{y}$

$2\log_4 3 - \log_4 5$ $\log_4 3^2 - \log_4 5$ $\log_4 \frac{9}{5}$

$\log_4 \frac{3^2}{5}$

$4\ln x + 2\ln y$ $\ln x^4 + \ln y^2$

$\ln x^4 \cdot y^2$

$\frac{1}{3}\ln xy - \frac{2}{3}\ln xy$

$\ln(xy)^{1/3} - \ln(xy)^{2/3}$

$\ln\frac{(xy)^{1/3}}{(xy)^{2/3}} = \ln\frac{\sqrt[3]{xy}}{\sqrt[3]{(xy)^2}}$

$\ln\sqrt[3]{\frac{xy}{(xy)^2}} = \ln\sqrt[3]{\frac{1}{xy}}$

Change of Base

#37

$$\log_b a = \frac{\log_x a}{\log_x b} \quad or \quad \frac{\ln a}{\ln b}$$

$$\log_4 7 = \frac{\log_3 7}{\log_3 4}$$

$$\log_4 7 = j$$

$$\ln 4^j = \ln 7$$

$$\ln 4^j = \ln 7$$

$$j \ln 4 = \ln 7$$

$$j = \frac{\ln 7}{\ln 4}$$

$$= \log_4 7$$

Write the log using only common logs:

$\log_2 x = \frac{\log x}{\log 2}$

$\log_{\frac{1}{2}} x \quad \frac{\log x}{\log \frac{1}{2}}$

$\ln 4x$

$= \frac{\log 4x}{\log e}$

Write the log using only natural logs:

$\log_3 m = \frac{\ln m}{\ln 3}$

$\log_2 (a+b) = \frac{\ln(a+b)}{\ln 2}$

Solve:

$\log_2 16 = 4$

$\frac{\log 16}{\log 2} = 4$

$\frac{\ln 16}{\ln 2} = 4$

$\log_5 16$

$\frac{\log 16}{\log 5} \quad \frac{\ln 16}{\ln 5}$

Describe how to transform the graph of $y = \ln x$ into the given function:

$f(x) = \log_3 x = \dfrac{\ln x}{\ln 3} = \left(\dfrac{1}{\ln 3}\right)\ln x$

VS: $\left(\dfrac{1}{\ln 3}\right)$

$f(x) = \log_{\frac{1}{4}} x = \dfrac{\ln x}{\ln \frac{1}{4}} = \left(\dfrac{1}{\ln \frac{1}{4}}\right)\ln x$ VS: $\left(\dfrac{1}{\ln \frac{1}{4}}\right)$