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## PROPERTIES OF LOGARITHMS

Use the properties of logarithms to write the expression as a sum or difference of logarithms. Assume  $x$  and  $y$  are both positive.

1.  $\log \frac{3}{x}$

$$\log 3 - \log x$$

2.  $\log_2 y^5$

$$5 \cdot \log_2 y$$

3.  $\log_2 x^{-2}$

$$-2 \cdot \log_2 x$$

4.  $\ln \frac{x^2}{y^3}$

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

$$2 \cdot \ln x - 3 \ln y$$

5.  $\log xy^3$

$$\log x + \log y^3$$

$$\log x + 3 \log y$$

6.  $\ln \frac{\sqrt[3]{x}}{\sqrt[3]{y}}$

$$\ln x^{1/3} - \ln y^{1/3}$$

$$\frac{1}{3} \ln x - \frac{1}{3} \ln y$$

Use the properties of logarithms to write the expression as a single logarithm. Assume  $x$ ,  $y$  and  $z$  are all positive.

7.  $\log x + \log 5$   $\log 5x$

8.  $\ln y - \ln 3$   $\ln \frac{y}{3}$

9.  $\frac{1}{3} \log z$   $\log z^{1/3} = \log \sqrt[3]{z}$

10.  $2 \ln x + 3 \ln y$   $\ln x^2 + \ln y^3$   
 $= \ln x^2 y^3$

11.  $4 \log(xy) - 3 \log yz$   $\log (xy)^4 - \log (yz)^3$   
 $= \frac{\log (xy)^4}{\log (yz)^3} = \log \frac{(xy)^4}{(yz)^3}$

12.  $4 \ln(x+6) - 3 \ln x$   $\ln (x+6)^4 - \ln x^3$   
 $= \frac{\ln (x+6)^4}{\ln x^3} = \ln \frac{(x+6)^4}{x^3}$

13.  $3 \ln x + 5 \ln y - 6 \ln z$   $\ln x^3 + \ln y^5 - \ln z^6$   
 $\ln x^3 \left( \frac{\ln y^5}{\ln z^6} \right) = \ln x^3 \left( \frac{y^5}{z^6} \right)$

14.  $\frac{1}{3} (\log_4 x - \log_4 y)$   $\log_4 \sqrt[3]{\frac{x}{y}}$