

Ex 1: Use $\log_5 4 \approx 0.861$ and $\log_5 9 \approx 1.365$ to evaluate the logarithm.

a. $\log_5 36 \rightarrow \log_5 4 \cdot 9$
 $4 \cdot 9 = 36$
 $\log_5 4 + \log_5 9$
 $0.861 + 1.365 \approx \boxed{2.226}$

b. $\log_5 \frac{4}{9} \rightarrow \log_5 4 - \log_5 9$
 $0.861 - 1.365$
 ≈ -0.504

c. $\log_5 81 \rightarrow \log_5 9^2 =$
 $2 \log_5 9$
 $2(1.365) \approx \boxed{2.73}$

Ex. 2 Expand $\log_3 \frac{7x^2}{9y}$

① $\log_3 7x^2 = \log_3 9y$
 ② $\log_3 7 + \log_3 x^2 = (\log_3 9 + \log_3 y)$
 ③ $\log_3 7 + 2\log_3 x = \log_3 9 + \log_3 y$

Try it! 1. Expand $\log \frac{7y^3}{4x^2}$

① $\log 7y^3 - \log 4x^2$
 ② $\log 7 + \log y^3 - (\log 4 + \log x^2)$
 ③ $\log 7 + 3\log y = \log 4 + 2\log x$

Ex. 3 Condense $\ln 3 + 2\ln x - \ln y$

① $\ln 3 + \ln x^2 - \ln y$
 ② $\ln 3x^2 = \ln y$
 ③ $\ln \frac{3x^2}{y}$

Try it! 2. Condense $\log 2 + 3\log 3 - \log 9$

① $\log 2 + \log 3^3 - \log 9$
 ② $\log 2 \cdot 3^3 - \log 9 \rightarrow \log 54 - \log 9$
 ③ $\log \frac{54}{9} \rightarrow \log 6$

* Means to break down a single logarithm into multiple logarithms using the properties.

* Means to combine multiple logarithms into a single logarithm using the properties.

Change of Base Formula

**Can use either common logs OR natural logs.

$$\log_c a = \frac{\log a}{\log c} = \frac{\ln a}{\ln c}$$

Ex 4: Use the change of base formula to evaluate $\log_6 11$.

a. Using common logs:

$$\frac{\log 11}{\log 6} \approx 1.338$$

b. Using natural logs:

$$\frac{\ln 11}{\ln 6} \approx 1.338$$

Try it!

Use the change-of-base formula to evaluate the logarithm.

3. $\log_{16} 26$

$$\frac{\log 26}{\log 16} \approx 1.175$$

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Product Property

$$\log_b m \cdot n = \log_b m + \log_b n$$

Quotient Property

$$\log_b \frac{m}{n} = \log_b m - \log_b n$$

Power Property

$$\log_b m^n = n \log_b m$$