

## Precalculus

# Simplify linear combination of logarithms using all techniques

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## Example

Compute as a rational number, without using calculator.

$$\begin{aligned}
 \log_7(24) + \log_{\frac{1}{7}}(3) - \log_{49}(64) &= \log_7(24) + \frac{\log_7(3)}{\log_7(\frac{1}{7})} - \frac{\log_7(64)}{\log_7(49)} \\
 &= \log_7(24) + \frac{\log_7(3)}{-1} - \frac{\log_7(64)}{2} \\
 &= \log_7(24) - \log_7(3) - \frac{1}{2} \log_7(64)
 \end{aligned}$$

$$\left[ \begin{array}{l} \log_a x - \log_a y = \log_a \left( \frac{x}{y} \right) \\ \log_a x^r = r \log_a x \end{array} \right]$$

$$= \log_7 \left( \frac{24}{3} \right) - \log_7 \left( 64^{\frac{1}{2}} \right)$$

$$= \log_7(8) - \log_7(\sqrt{64})$$

$$= \log_7 8 - \log_7 8 = 0$$

$$\text{[alternatively:]} \quad = \log_7 \left( \frac{8}{8} \right) = \log_7(1) = 0.$$