Properties of Logarithms

Let b, m, and n be positive numbers such that $b \neq 1$.

Product Property	$\log_b mn = \log_b m + \log_b n$
Quotient Property	$\log_b \frac{m}{n} = \log_b m - \log_b n$
Power Property	$\log_b m^n = n \log_b m$

Product Property:

Expand: $\log 15x$

$\log 15 + \log x$

$\log_3 2y$

$\log_3 2 + \log_3 y$

Condense: $\log_3 4 + \log_3 y$

$\log_3 4y$

$\ln 2 + \ln x$

$\ln 2x$

Quotient Property:

Expand: $\ln \frac{12}{5}$

$\ln 12 - \ln 5$

$\log_5 \frac{x}{3}$

$\log_5 x - \log_5 3$

Condense: $\log_3 4 - \log_3 y$

$\log_3 \left(\frac{4}{y}\right)$

$\ln x - \ln 3$

$\ln \left(\frac{x}{3}\right)$

Expand: $\log_4 \frac{3}{2x}$

$\log_4 3 - \log_4 2x$

$\log_4 3 - (\log_4 2 + \log_4 x)$

$\log_4 3 - \log_4 2 - \log_4 x$

Condense: $\log_5 3 + \log_5 x - \log_5 2$

$\log_5 \left(\frac{3x}{2}\right)$

Power Property:

Expand: $\log x^4$

$4 \log x$

$\log_2 m^5$

$5 \log_2 m$

$\log_3 2x^4$

$\log_3 2 + \log_3 x^4$

$\log_3 2 + 4 \log_3 x$

$\ln 8x^3$

$\ln 8 + \ln x^3$

$\ln 8 + 3 \ln x$

Condense:

$\ln 12 - \ln 4$

$\ln \left(\frac{12}{4}\right) = \ln 3$

$\log_3 \sqrt{y}$

$\log_3 y^{\frac{1}{2}}$

$\frac{1}{2} \log_3 y$

$6 \ln 2 - 4 \ln y$

$\ln \frac{2^6}{y^4} = \ln \frac{64}{y^4}$

$5 \log x - 4 \log y$

$\log \left(\frac{x^5}{y^4}\right)$