

## Section 9.0 B Properties of Logarithms

$$1) \log_a MN = \log_a M + \log_a N$$

$$2) \log_a \frac{M}{N} = \log_a M - \log_a N$$

$$3) \log_a M^r = r \log_a M$$

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$$\text{ex: } \log_{11} \frac{15}{7} = \log_{11} 15 - \log_{11} 7$$

$$\underbrace{\sqrt[n]{b}} = b^{\frac{1}{n}}$$

$$\begin{aligned} \text{ex: } \log_a \frac{x^5}{y^7} &= \log_a x^5 - \log_a y^7 \\ &= 5 \log_a x - 7 \log_a y \end{aligned}$$

$$\begin{aligned} \text{ex: } \ln \sqrt[4]{xy} &= \ln (xy)^{\frac{1}{4}} = \frac{1}{4} \ln(xy) \\ &= \frac{1}{4} (\ln x + \ln y) \\ &= \frac{\ln x + \ln y}{4} \end{aligned}$$

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$$\begin{aligned} \text{ex: } \log_a 3 + \log_a y \\ \log_a 3y \end{aligned}$$

ex:  $15 \ln(x+3) - 5 \ln x$

$$\ln(x+3)^{15} - \ln x^5$$

$$\ln \frac{(x+3)^{15}}{x^5}$$

ex:  $\frac{1}{4} (\log_5(x+2) - \log_5 x)$

$$\frac{1}{4} \log_5(x+2) - \frac{1}{4} \log_5 x$$

$$\log_5(x+2)^{1/4} - \log_5 x^{1/4}$$

$$\log_5 \sqrt[4]{\frac{x+2}{x}}$$

