7.5 Properties of Logarithms

$\log_b mn = \log_b m + \log_b n$

Proof:

let $x = \log_b m$ and $y = \log_b n$

$b^x = m$ $\quad$ $b^y = n$

$m \cdot n = b^x \cdot b^y$

$mn = b^{x+y}$

$\log_b mn = x+y$

$\log_b mn = \log_b m + \log_b n$

Example: Write in expanded form $\log_3 xy$

$\log_3 x + \log_3 y$

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

Example: Write in expanded form $\log_7 \frac{2}{y}$

$\log_7 2 - \log_7 y$

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

Example: Write in expanded form $\log_5 x^2$

$2\log_5 x$

Examples- Write in expanded form:

1. $\log_8 \frac{2x}{y}$

$\log_8 2x - \log_8 y$

$\log_8 2 + \log_8 x - \log_8 y$

2. $\log_7 \frac{3x^2}{5y^3}$

$\log_7 3x^2 - \log_7 5y^3$

$\log_7 3 + 2\log_7 x - [\log_7 5 + 3\log_7 y]$

3. $\log_2 \sqrt{x}$ $\frac{1}{2}\log_2 x$

$\log_2 x^{1/2}$

Examples- Write in condensed form:

1. $\ln 5 - \ln 8$

$\ln \frac{5}{8}$

2. $\log x + 2\log y$

$\log xy^2$

3. $\log 8 + 2\log 5 - \log 10$

$\log \frac{8 \cdot 5^2}{10}$

$\log \frac{200}{10} = \log 20$

Evaluate: $\log_4 16 + \log_4 \frac{1}{4}$

$2 + (-1) = 1$

$\log_4 \left(16 \cdot \frac{1}{4}\right)$

$\log_4 4$

1

Evaluate: $\log_4 8 + \log_4 8$

$\log_4 64 = 3$

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3 – 6, 15, 18, 20, 21, 24, 29 – 33, 35, 38,
41 – 44,