

## Section 3.3 – Properties of Logarithms

**MEMORIZE: Properties of Logarithms**

1. Product Property:  $\log_a(uv) = \log_a u + \log_a v$       ex.  $\log_4(3x) = \log_4 3 + \log_4 x$
2. Quotient Property:  $\log_a \frac{u}{v} = \log_a u - \log_a v$       ex.  $\log_5 \frac{10}{y} = \log_5 10 - \log_5 y$
3. Power Property:  $\log_a u^n = n \log_a u$       ex.  $\log_7 x^{12} = 12 \log_7 x$

We will use these properties to solve equations involving logarithms.

Example 1: Use the properties of logarithms to EXPAND each of the following expressions.

a. $\log_b \frac{3x}{z}$	b. $\log_b \sqrt[5]{x^2 y}$	c. $\ln 4xy\sqrt{z}$
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Example 2: Use the properties of logarithms to CONDENSE each of the following expressions.

a. $3\log x + \log 3 - 4\log y$	b. $2\log_5 x - 3\log_5 2 + 2\log_5 4$	c. $\frac{1}{2}\ln 9 + 3\ln(2x) + 2\ln(y^2)$
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Example 3: Use the properties of logarithms to evaluate each expression WITHOUT a calculator.

a. $\log_5 \sqrt[3]{5}$	b. $\ln e^6 - \ln e^2$	c. $\log_4 8$
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