Algebra 2 Properties of Logarithms DATE:

Properties of Logarithms

$$\log_b M \cdot N = \log_b M + \log_b N$$

$$\log_b \frac{M}{N} = \log_b M - \log_b N$$

$$\log_b M^x = x \cdot \log_b M$$

Simplifying Logarithms

Write each logarithmic expression as a single logarithm.

$\log_4 64 - \log_4 16 = \log_4 \frac{64}{16}$

$= \log_4 4$

Examples:

$6 \log_5 x + \log_5 y =$

$3 \log 7 + \log x - 6 \log y =$

$\frac{1}{2}(\log_x 4 + \log_x y) - 3 \log_x 2 =$

Expanding Logarithms

Expand each logarithm.

$\log_2 7b = \log_2 7 + \log_2 b$

$\log_7 a^3 b^4 = \log_7 a^3 + \log_7 b^4$

$3 \cdot \log_7 a + 4 \cdot \log_7 b$

Examples:

$\log\left(\frac{y}{3}\right)^2 =$

$\log 2(x+5)^2 =$

$\log_3 \sqrt[4]{\frac{x^2}{y}} =$

$\log_b \frac{\sqrt{x}\sqrt[3]{y^2}}{\sqrt[5]{z^2}}$

Examples

Use the properties of logarithms to evaluate each expression.

$3\log_2 2 - \log_2 4$

$\log 1 + \log 100$

Application: Sound Intensity (decibels)

$$L = 10 \log \frac{I}{10^{-12}}$$

L = apparent loudness

I = intensity of sound

Find the loudness of a chainsaw with an intensity of sound = 1.6×10^{-3}

$$L = 10 \log \frac{1.6 \times 10^{-4}}{10^{-12}}$$

$$L = 92 \text{ db}$$

Another chainsaw has an intensity of sound = 5.4×10^{-2}
How much louder/quieter is this chainsaw?