Algebra 2B Notes

Name: _____

7-4 Properties of Logarithms

Date: _____ Hr: _____

Objective:

- To use the properties of logarithms

Common Core Content Standard:

Prepares for F.LE.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e, evaluate the logarithm using technology.

Since logarithms are exponents, both have similar properties.

Take Note

Properties **Properties of Logarithms**

For any positive numbers m, n, and b where $b \neq 1$, the following properties apply.

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

Example 1: **Simplifying Logarithms**

What is each expression written as a single logarithm? If possible, simplify the single logarithm.

a.) $\log_3 x - 2\log_3 7$

b.) $\log_8 48 + \log_8 \frac{4}{3}$

You can expand a single logarithm to involve the sum or difference of two or more logarithms.

Example 2: **Expanding Logarithms**

What is each logarithm expanded? Simplify your answer if possible.

a. $log_5 \frac{125}{xy}$

b. $log x^2 y^2 z^{-1}$

The log key on a calculator finds $\log_{10}$ of a number. To evaluate a logarithm with other bases, use the Change of Base Formula or the alpha-window key sequence on your graphing calculator.

Take note

Property Change of Base Formula

For any positive numbers m, b, and c, with $b \neq 1$ and $c \neq 1$,

$$\log_b m = \frac{\log_c m}{\log_c b}.$$

Example 3: **Evaluating Logarithms with Bases Other Than 10**

What is the value of each expression?

a. $\log_9 111$

b. $\log_{216} 36$

Example 4: The pH of a substance equals $-\log[H^+]$, where $[H^+]$ is the concentration of hydrogen ions. The concentration of hydrogen ions in pure water is 10^{-7}. What is the pH level of pure water?