Topic 6.5 Properties of Logarithms

Essential Question:

How are the properties of logarithms used to simplify expressions and solve logarithmic equations?

CONCEPT

For positive numbers b, m, and n with $b \neq 1$, the following properties hold.

$$\log_b mn = \log_b m + \log_b n \quad \cdots\cdots\cdots \text{Product Property of Logarithms}$$

$$\log_b \frac{m}{n} = \log_b m - \log_b n \quad \cdots\cdots\cdots \text{Quotient Property of Logarithms}$$

$$\log_b m^n = n \log_b m \quad \cdots\cdots\cdots \text{Power Property of Logarithms}$$

CONCEPT Summary

	Product Property	Quotient Property	Power Property	Change of Base
ALGEBRA	$\log_b (mn) =$ $\log_b m + \log_b n$	$\log_b \left(\frac{m}{n}\right) =$ $\log_b m - \log_b n$	$\log_b (m^n) =$ $n \cdot \log_b m$	$\log_b m = \frac{\log_a m}{\log_a b}$
WORDS	The log of a product is the sum of the logs.	The log of a quotient is the difference of the logs.	The log of a number raised to a power is the power multiplied by the log of the number.	The log base b of a number is equal to the log base a of the number divided by the log base a of b.
NUMBERS	$\log_2 (20) =$ $\log_2 (4) + \log_2 (5)$	$\log_{10} \left(\frac{2}{3}\right) =$ $\log_{10} 2 - \log_{10} 3$	$\log_3 (16) = 4 \cdot \log_3 2$	$\log_5 7 = \frac{\log 7}{\log 5}$

Q: How are the properties of logarithms useful when solving problems?

Notes:

Examples & Questions

Examples 1

Q: Why would the equations $x = \log_b m$ and $y = \log_b n$ be used to start the proof?

Examples 2

Q: Why might it be useful to know how to expand logarithmic expressions?

Examples 3

Q: How do the processes of expanding a logarithm and writing an expression as a single logarithm relate to each other?

Examples 4

Q: What does the + in H^+ represent? Does it affect how you solve the equation?

Examples 5

Q: What does each variable represent when you use the Power Property of Logarithms?

Examples 6

Q: Why can you solve the equation using both base 10 logarithms and natural logarithms?

Practice and Problem Solving

Complete MathXL for School: Practice and Problem Solving (online)
Complete MathXL for School: Enrichment (online)

Challenge: #13 – key will be posted in Power School Learning.

Lesson Quiz 6.5