7-4 Properties of Logarithms Day 2

Objective:

Use properties to simplify logarithmic expressions.

Translate between logarithms in any base.

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Exponential and logarithmic operations undo each other since they are inverse operations.

Inverse Properties of Logarithms and Exponents

For any base b such that $b > 0$ and $b \neq 1$,

ALGEBRA	EXAMPLE
$\log_b b^x = x$	$\log_{10} 10^7 = 7$
$b^{\log_b x} = x$	$10^{\log_{10} 2} = 2$

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Simplify each expression.

a. $\log_3 3^{11}$ **b. $\log_3 81$** **c. $5^{\log_5 10}$**

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a. Simplify $\log 10^{0.9}$ **b. Simplify $2^{\log_2(8x)}$**

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Most calculators calculate logarithms only in base 10 or base e (see Lesson 7-6). You can change a logarithm in one base to a logarithm in another base with the following formula.

Change of Base Formula

For $a > 0$ and $a \neq 1$ and any base b such that $b > 0$ and $b \neq 1$,

ALGEBRA	EXAMPLE
$\log_b x = \frac{\log_a x}{\log_a b}$	$\log_4 8 = \frac{\log_2 8}{\log_2 4}$

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Evaluate $\log_{32} 8$

Method 1 Change to base 10 (Big logarithm over little logarithm)

Method 2 Change to base 2, because both 32 and 8 are powers of 2. (Only works in this situation)

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Evaluate $\log_9 27$.

Method 1 Change to base 10.

Method 2 Change to base 3, because both 27 and 9 are powers of 3.

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