

Name: _____ Date: _____ Period: _____

5.3 PROPERTIES OF LOGARITHMS

DISCOVER the Properties of Logarithms by analyzing the given information. Fill in the blanks in the table.

PROPERTY	EXAMPLE(S)	RULE	Verify with Calculator
Foundations	$\log_3 1 = \underline{0}$ $\log_7 1 = \underline{0}$	$\log_b 1 = 0$	
	$\log_2 2 = 1$ $\log_{12} 12 = 1$	$\log_b b = 1$	
Exponential-Logarithmic Inverse	$\underline{5}^{\log_5 25} = \underline{25}$	$b^{\log_b M} = M$	
	$\log_2 2^6 = 6$	$\log_b b^M = M$	
Product	$\log_3 (8) = \log_3 2 + \log_3 4$	$\log_b MN = \log_b M + \log_b N$	
Quotient	$\log_6 \left(\frac{2}{3}\right) = \log_6 2 - \log_6 3$	<i>*Based on the Product Property, can you determine what this equals?</i> $\log_b \frac{M}{N} = \log_b M - \log_b N$	
Power	$\sqrt{\log 5^2} = 2 \log 5$	$\log_b M^x = x \log_b M$	
One-to-One	$\log_2 x = \log_2 5$ then $x = 5$	<i>if</i> $\log_b M = \log_b N$ then $M = N$	
Change of Base	$\log_2 7 = \frac{\log 7}{\log 2} = \frac{\ln 7}{\ln 2}$	$\log_b a = \frac{\log_n a}{\log_n b}$	

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A: log BASEC

calculator steps to evaluate log.

5.3 PROPERTIES

1 EVALUATE $\log_7 1 = 0$

2 EVALUATE $\log_{20} 20 = 1$

3 EXPAND. $\log_3(5x) = \log_3 5 + \log_3 x$

4 EXPAND. $\log_2\left(\frac{y}{9}\right) = \log_2 y - \log_2 9$

5 EXPAND & SIMPLIFY. $\log_5(25m^2) = \log_5 25 + \log_5 m^2$
 $= \log_5 25 + 2\log_5 m$
 $= 2 + 2\log_5 m$

6 EXPAND & SIMPLIFY.

$$\begin{aligned} \log_3\left(\frac{27}{\sqrt{x}}\right) &= \log_3 27 - \log_3 \sqrt{x} \\ &= \log_3 27 - \log_3 x^{\frac{1}{2}} \\ &= \log_3 27 - \frac{1}{2} \log_3 x \\ &= 3 - \frac{1}{2} \log_3 x \end{aligned}$$

RECALL

$$\begin{aligned} \sqrt{x} &= x^{\frac{1}{2}} \\ \sqrt[3]{x} &= x^{\frac{1}{3}} \\ \sqrt[n]{x} &= x^{\frac{1}{n}} \end{aligned}$$

YT 7 EXPAND & SIMPLIFY.

$$\log_7(49y^4) = \log_7 49 + 4\log_7 y = 2 + 4\log_7 y$$

YT 8 EXPAND & SIMPLIFY.

$$\begin{aligned} \log_4\left(\frac{x^2}{y^3}\right) &= \log_4 x^2 - \log_4 y^3 \\ &= 2\log_4 x - 3\log_4 y \end{aligned}$$