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5.4 Log Properties Notes

Warm up	Simplify (no negative exponents)	
	$x^2 \cdot x^8$ x^{10}	$(a^3)^4$ a^{12}
		$\frac{z^4}{z^7}$ $a^{-3} \rightarrow \frac{1}{a^3}$
Properties of Logarithms	Exponential Laws	Logarithm Laws
	$x^a \cdot x^b = x^{a+b}$ $\frac{x^a}{x^b} = x^{a-b}$ $(x^a)^b = x^{ab}$ $b^0 = 1$ $b^1 = b$ $b^n = b^n$	<i>Applies to any base log</i> $\log(ab) = \log(a) + \log(b)$ $\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$ $\log(a^b) = b \cdot \log(a)$ $\log_b 1 = 0$ $\log_b(b) = 1$ $\log_b(b^n) = n$
Product Property Examples	Directions: Write each log in expanded form (#1 & #2) and write the log expressions as a single log (#3 & #4)	
	1. $\log_2 5x$	2. $\log_7 6$
	$\log_2 5 + \log_2 x$	$\log_7(3 \cdot 2)$ $\log_7 3 + \log_7 2$
	3. $\log_2 7 + \log_2 4$	4. $\log_4 2x + \log_4 4x^2$
	$\log_2(7 \cdot 4)$ $\log_2 28$	$\log_4(2x \cdot 4x^2)$ $\log_4(8x^3)$

Quotient Property

Directions: Write each log in expanded form (1&2) and each log expression in single log form (3 & 4).

5. $\log \frac{m}{7}$

$$\log m - \log 7$$

6. $\log_5 \left(\frac{1}{3}\right)$

$$\log_5 1 - \log_5 3$$

could simplify
 $0 = \log_5 3$

7. $\log_4 x^9 - \log_4 x^2$

$$\log_4 \left(\frac{x^9}{x^2}\right)$$

$$\log_4 (x^7)$$

8. $\log_2 15 - \log_2 15$

$$\log_2 \left(\frac{15}{15}\right) \Rightarrow \log_2 (1)$$

can evaluate
 $\rightarrow \log_2 2^0$

$$\sqrt[3]{x} \leftrightarrow x^{\frac{1}{3}}$$

$$\sqrt{x} \leftrightarrow x^{\frac{1}{2}}$$

Power Property

Directions: Write each log in expanded form (1 & 2) and each log expression in single log form (3 & 4).

1. $\log_7 x^2$

$$2 \log_7 x$$

2. $\log_2 8^7$

$$7 \log_2 8$$

If asked to evaluate
 $7 \cdot \log_2 2^3 \rightarrow 7 \cdot 3 \rightarrow 21$

3. $6 \log_2 x$

$$\log_2 x^6$$

4. $\frac{1}{3} \log 8$

$$\log 8^{\frac{1}{3}} \rightarrow \log \sqrt[3]{8}$$

$\rightarrow \log 2$

Putting it All together: Expand the log completely.

1. $\log_6 xyz^4$

$$\log_6 x + \log_6 y + \log_6 z^4$$

$$\log_6 x + \log_6 y + 4 \log_6 z$$

2. $\log_4 \frac{a^9}{b}$

$$\log_4 a^9 - \log_4 b$$

$$9 \log_4 a - \log_4 b$$

Putting it All together: Condense to a single log

3. $7 \log_4 u - 3 \log_4 v^2$

$$\log_4 u^7 - \log_4 (v^2)^3$$

$$\log_4 \left(\frac{u^7}{v^6}\right)$$

4. $2 \log 6 - \log 9$

$$\log 6^2 - \log 9$$

$$\log \left(\frac{36}{9}\right)$$

$$\log 4$$