

**7-4 Day 3 Properties of Logarithms**

Remember that when you raise one power to another power, you *multiply* the exponents.

$$(a^m)^n = \underline{\underline{a^{mn}}}$$

*Power Property of Logarithms*

For any real number  $p$  and positive numbers  $a$  and  $b$  ( $b \neq 1$ )

WORDS	NUMBERS	ALGEBRA
<i>The logarithm of a power is the product of the exponent and the logarithm of the base.</i>	$\begin{aligned}\log 10^3 &= \log(10 \cdot 10 \cdot 10) \\ &= \log 10 + \log 10 + \log 10 \\ &= 3 \log 10\end{aligned}$	$\begin{aligned}\log_b a^p \\ &= p \log_b a\end{aligned}$

**1. Simplifying Logarithms with Exponents**

Express as a product. Simplify, if possible.

a)  $\log_3 81^2$

$$2 \cdot \log_3 81 = 2(4) = 8$$

b)  $\log_5 \left(\frac{1}{5}\right)^3$

$$3 \cdot \log_5 \left(\frac{1}{5}\right) = 3(-1) = -3$$

c)  $\log 10^4$

$$4 \cdot \log 10 = 4(1) = 4$$

d)  $\log_5 25^2$

$$2 \cdot \log_5 25 = 2(2) = 4$$

# 7-4 Day 3

## Properties of Logarithms



- Students will be able to use the power property of logarithms to simplify logarithms with 80% accuracy.

$$(a^m)^n = a^{m \cdot n}$$

### *Power Property of Logarithms*

For any real number  $p$  and positive numbers  $a$  and  $b$  ( $b \neq 1$ )

WORDS	NUMBERS	ALGEBRA
The logarithm of a power is the product of the exponent and the logarithm of the base.	$\log 10^3$ $\log(10 \cdot 10 \cdot 10)$ $\log 10 + \log 10 + \log 10$ $3 \cdot \log 10$	$\log_b a^p =$ $p \cdot \log_b a$

### 3. Simplifying Logarithms with Exponents

Express as a product. Simplify, if possible.

a)  $\overbrace{\log_3 81^2}$

$$2 \cdot \log_3 81 = 2(4) = 8$$

b)  $\overbrace{\log_5 (1/5)^3}$

$$3 \cdot \log_5 \left(\frac{1}{5}\right) = -3$$

c)  $\overbrace{\log 10^4}$

$$4 \cdot \log 10 = 4$$

d)  $\overbrace{\log_5 25^2}$

$$2 \cdot \log_5 25 = 4$$

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

### Worksheet 7-4 Day 3

Use the Power Property to express as a product. Simplify, if possible.

1.  $\log_2 16^3$

2.  $\log_5 125^{\frac{1}{3}}$

3.  $\log_3 5^2$

4.  $\log_5 \left(\frac{1}{125}\right)^2$

5.  $\log_3 27^4$

6.  $\log_4 64^3$

7.  $\log_2 16^3$

8.  $\log_3 3^5$