

LESSON
7-4

Reteach
Properties of Logarithms

Use properties of logarithms to simplify logarithms.
The Product Property uses addition instead of multiplication.

Product Property

The logarithm of a product can be written as the sum of the logarithm of the numbers.

$$\log_b mn = \log_b m + \log_b n$$

where $m, n,$ and b are all positive numbers and $b \neq 1$

Simplify: $\log_8 4 + \log_8 16 = \log_8 (4 \cdot 16) = \log_8 64 = 2$

The bases must be the same for both logarithms.

Think: 8 to what power is equal to 64, or $8^2 = 64$.

The Quotient Property uses subtraction instead of division.

Quotient Property

The logarithm of a quotient can be written as the logarithm of the numerator minus the logarithm of the denominator.

$$\log_b \frac{m}{n} = \log_b m - \log_b n$$

where $m, n,$ and b are all positive numbers and $b \neq 1$

Simplify: $\log_3 243 - \log_3 9 = \log_3 \left(\frac{243}{9} \right) = \log_3 27 = 3$

The bases must be the same for both logarithms.

Think: 3 to what power is equal to 27, or $3^3 = 27$.

Complete the steps to simplify each expression.

1. $\log_6 54 + \log_6 4$

$\log_6 (54 \cdot 4)$

$\log_6 216$

2. $\log_2 128 - \log_2 8$

$\log_2 \left(\frac{128}{8} \right)$

3. $\log_9 3 + \log_9 27$

LESSON
7-4

Reteach

Properties of Logarithms (continued)

The Power Property uses multiplication instead of exponentiation.

Power Property

The logarithm of a power can be written as the product of the exponent and the logarithm of the base.

$\log_b a^p = p \log_b a$
for any real number p

where a and b are positive numbers and $b \neq 1$

Simplify: $\log_4 64^5 = 5 \log_4 64 = 5(3) = 15$

“Bring down” the exponent to multiply.

Think: 4 to what power is equal to 64, or $4^? = 64$.

Logarithms and exponents undo each other when their bases are the same.

Inverse Properties	
<p>The logarithm of b^x to the base b is equal to x.</p> <p style="text-align: center;">$\log_b b^x = x$</p> <p style="text-align: center;">↑ ↑</p> <p>The logarithm undoes the exponent when the bases are the same.</p> <p>Simplify: $\log_7 7^{4x} = 4x$</p> <p>The base of the log is 7 and the base of the exponent is 7.</p>	<p>b raised to the logarithm of x to the base b is equal to x.</p> <p style="text-align: center;">$b^{\log_b x} = x$</p> <p style="text-align: center;">↑ ↑</p> <p>The exponent undoes the logarithm when the bases are the same.</p> <p>Simplify: $3^{\log_3 64} = 64$</p> <p>The base of the exponent is 3 and the base of the log is 3.</p>

Simplify each expression.

4. $\log_5 125^2$
 $2 \log_5 125$

5. $\log_2 16^4$
 $4 \log_2 16$

6. $\log_9 81^3$

7. $\log_6 6^{5y}$

8. $4^{\log_4 75}$

9. $2^{\log_2 3x}$

Assignment: pg 516 #1-14, 20-31