9-3 Study Guide and Intervention

Properties of Logarithms

Properties of Logarithms Properties of exponents can be used to develop the following properties of logarithms.

Product Property of Logarithms	For all positive numbers m, n, and b, where $b \neq 1$, $\log_b mn = \log_b m + \log_b n$.
Quotient Property of Logarithms	For all positive numbers m, n, and b, where $b \neq 1$, $\log_b \frac{m}{n} = \log_b m - \log_b n$.
Power Property of Logarithms	For any real number p and positive numbers m and b, where $b \neq 1$, $\log_b m^p = p \log_b m$.

Example Use $\log_3 28 \approx 3.0331$ and $\log_3 4 \approx 1.2619$ to approximate the value of each expression.

a. $\log_3 36$

$$\log_3 36 = \log_3 (3^2 \cdot 4)$$
$$= \log_3 3^2 + \log_3 4$$
$$= 2 + \log_3 4$$
$$\approx 2 + 1.2619$$
$$\approx 3.2619$$

b. $\log_3 7$

$$\log_3 7 = \log_3 \left(\frac{28}{4}\right)$$
$$= \log_3 28 - \log_3 4$$
$$\approx 3.0331 - 1.2619$$
$$\approx 1.7712$$

c. $\log_3 256$

$$\log_3 256 = \log_3 (4^4)$$
$$= 4 \cdot \log_3 4$$
$$\approx 4(1.2619)$$
$$\approx 5.0476$$

Exercises

Use $\log_{12} 3 \approx 0.4421$ and $\log_{12} 7 \approx 0.7831$ to evaluate each expression.

1. $\log_{12} 21$

2. $\log_{12} \frac{7}{3}$

3. $\log_{12} 49$

4. $\log_{12} 36$

5. $\log_{12} 63$

6. $\log_{12} \frac{27}{49}$

7. $\log_{12} \frac{81}{49}$

8. $\log_{12} 16{,}807$

9. $\log_{12} 441$

Use $\log_5 3 \approx 0.6826$ and $\log_5 4 \approx 0.8614$ to evaluate each expression.

10. $\log_5 12$

11. $\log_5 100$

12. $\log_5 0.75$

13. $\log_5 144$

14. $\log_5 \frac{27}{16}$

15. $\log_5 375$

16. $\log_5 1.\overline{3}$

17. $\log_5 \frac{9}{16}$

18. $\log_5 \frac{81}{5}$

Lesson 9-3