

**Properties of Logarithms**

For any positive numbers m , n , and b , where $b \neq 1$, the following properties apply.

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

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

Power Property $\log_b m^n = n \log_b m$

Problem 1 Simplifying Logarithms

Got It? What is each expression written as a single logarithm?

a. $\log_4 5x + \log_4 3x$

b. $2 \log_4 6 - \log_4 9$

A Practice Write each expression as a single logarithm.

1. $\log_2 9 - \log_2 3$

2. $\log_7 x + \log_7 y - \log_7 z$

Problem 2 Expanding Logarithms

Got It? What is each logarithm expanded?

a. $\log_3 \frac{250}{37}$

b. $\log_3 9x^5$

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A Practice Expand each logarithm.

3. $\log_3 7(2x - 3)^2$

4. $\log_8 8\sqrt{3a^5}$

You have seen logarithms with many bases. The **log** key on a calculator finds \log_{10} of a number. To evaluate a logarithm with any base, use the **Change of Base Formula**.

Take note

Property Change of Base Formula

For any positive numbers m , b , and c , with $b \neq 1$ and $c \neq 1$,

$$\log_b m = \frac{\log_c m}{\log_c b}$$

Problem 3 Using the Change of Base Formula

Got It? Use the Change of Base Formula. What is the value of each expression?

a. $\log_8 32$

b. $\log_4 18$

A Practice Use the Change of Base Formula to evaluate each expression.

5. $\log_{12} 20$

6. $\log_3 33$