

REWRITING EXPRESSIONS You can use the properties of logarithms to expand and condense logarithmic expressions.

REWRITE EXPRESSIONS

When you are expanding or condensing an expression involving logarithms, you may assume any variables are positive.

EXAMPLE 2 Expand a logarithmic expression

Expand $\log_6 \frac{5x^3}{y}$.

$$\begin{aligned}\log_6 \frac{5x^3}{y} &= \log_6 5x^3 - \log_6 y && \text{Quotient property} \\ &= \log_6 5 + \log_6 x^3 - \log_6 y && \text{Product property} \\ &= \log_6 5 + 3 \log_6 x - \log_6 y && \text{Power property}\end{aligned}$$



EXAMPLE 3 TAKS PRACTICE: Multiple Choice

Which of the following is equivalent to $\log 3 + 3 \log 4 - \log 6$?

- (A) $\log 6$ (B) $\log 8$ (C) $\log 32$ (D) $\log 61$

Solution

$$\begin{aligned}\log 3 + 3 \log 4 - \log 6 &= \log 3 + \log 4^3 - \log 6 && \text{Power property} \\ &= \log (3 \cdot 4^3) - \log 6 && \text{Product property} \\ &= \log \frac{3 \cdot 4^3}{6} && \text{Quotient property} \\ &= \log 32 && \text{Simplify.}\end{aligned}$$

▶ The correct answer is C. (A) (B) (C) (D)



GUIDED PRACTICE for Examples 2 and 3

5. Expand $\log 3x^4$.

6. Condense $\ln 4 + 3 \ln 3 - \ln 12$.

CHANGE-OF-BASE FORMULA Logarithms with any base other than 10 or e can be written in terms of common or natural logarithms using the *change-of-base formula*. This allows you to evaluate any logarithm using a calculator.

KEY CONCEPT

For Your Notebook

Change-of-Base Formula

If a , b , and c are positive numbers with $b \neq 1$ and $c \neq 1$, then:

$$\log_c a = \frac{\log_b a}{\log_b c}$$

In particular, $\log_c a = \frac{\log a}{\log c}$ and $\log_c a = \frac{\ln a}{\ln c}$.