

Exercise 271

For the following exercises, use properties of logarithms to write the expressions as a sum, difference, and/or product of logarithms.

$$\log_3 \frac{9a^3}{b}$$

Solution

There are three properties of logarithms to know.

$$\log(ab) = \log a + \log b \quad (1)$$

$$\log\left(\frac{a}{b}\right) = \log a - \log b \quad (2)$$

$$\log a^b = b \log a \quad (3)$$

Use property (2) followed by property (1) and then property (3).

$$\begin{aligned} \log_3 \frac{9a^3}{b} &= \log_3 9a^3 - \log_3 b \\ &= \log_3 9 + \log_3 a^3 - \log_3 b \\ &= \log_3 9 + 3 \log_3 a - \log_3 b \\ &= 2 + 3 \log_3 a - \log_3 b \end{aligned}$$

Note that $\log_3 9 = 2$ because $3^2 = 9$.