

3.4 More Properties of Logarithms

ESSENTIAL QUESTION

How are the properties of logs used to expand and condense logarithmic expressions and solve equations involving logs?

The following properties work for logs with any base, including natural logs.

Properties of Logs

1. Product Rule: $\log_b xy = \log_b x + \log_b y$
2. Quotient Rule: $\log_b \frac{x}{y} = \log_b x - \log_b y$
3. Power Rule: $\log_b x^a = a \log_b x$
4. Change of Base: $\log_b x = \frac{\log x}{\log b} = \frac{\ln x}{\ln b}$

Expand each logarithmic expression:

1. $\log_3 3x$
2. $\log_3 3x^2$
3. $\ln \sqrt{x}$
4. $\log \frac{x^2 - 1}{x^3 - 1}$
5. $\log_2 \frac{5xy^3}{(x-1)(2x-3)}$

Condense each expression into a single log.

1. $2 \ln(x-4) + \ln(x+4)$
2. $3 \log x - 4 \log y + \log(x+5)$
3. $2(\log_5 x + \log_5 2y) - 3 \log_5(x+y)$

Use change of base so you can evaluate these logs using your calculator.

1. $\log_5 12$

2. $\log_2 1.026$

3. $\log_7 143.2$

Solve for x.

$$\log(x+2) + \log(x - 1) = 4$$

Solve for x.

$$\ln(3x + 4) - \ln(2x+1) = 5$$