

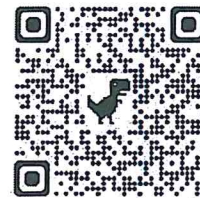
Product rule:  $\log(ab) = \log a + \log b$

Quotient rule:  $\log \frac{a}{b} = \log a - \log b$

Power rule:  $\log a^p = p \log a$

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Algebra II



## Logarithm Rules

- apply product/quotient rules first

- apply power rule last

Express as multiple logs

1.  $\log xy$

$$\log x + \log y$$

2.  $\ln \frac{7}{x}$

$$\ln 7 - \ln x$$

3.  $\ln x^3$

$$3 \ln x$$

4.  $\log \frac{x^4 y^2}{z}$

$$\log x^4 + \log y^2 - \log z$$
$$4 \log x + 2 \log y - \log z$$

5.  $\ln x^3 y^2$

$$\ln x^3 + \ln y^2$$
$$3 \ln x + 2 \ln y$$

6.  $\log \frac{a^2 b}{c^4}$

$$\log a^2 + \log b - \log c^4$$
$$2 \log a + \log b - 4 \log c$$

$$7. \log \frac{a^5 b^3}{c^6}$$

$$\begin{aligned} & \log a^5 + \log b^3 - \log c^6 \\ & 5 \log a + 3 \log b - 6 \log c \end{aligned}$$

$$8. \ln \frac{x^2 y^6}{c^3}$$

$$\begin{aligned} & \ln x^2 + \ln y^6 - \ln c^3 \\ & 2 \ln x + 6 \ln y - 3 \ln c \end{aligned}$$

$$9. \ln \frac{\sqrt[3]{x^4}}{y^3}$$

$$\begin{aligned} & \ln \frac{x^{\frac{4}{3}}}{y^3} \\ & \ln x^{\frac{4}{3}} - \ln y^3 \\ & \frac{4}{3} \ln x - 3 \ln y \end{aligned}$$

$$10. \log \frac{\sqrt[4]{x^3 y^2}}{\sqrt[3]{z^4}}$$

$$\begin{aligned} & \log \frac{x^{\frac{3}{4}} y^2}{z^{\frac{4}{3}}} \\ & \log x^{\frac{3}{4}} + \log y^2 - \log z^{\frac{4}{3}} \\ & \frac{3}{4} \log x + 2 \log y - \frac{4}{3} \log z \end{aligned}$$

$$11. \log \frac{x^5 y}{\sqrt[3]{z^4}}$$

$$\begin{aligned} & \log \frac{x^5 y}{z^{\frac{4}{3}}} \\ & \log x^5 + \log y - \log z^{\frac{4}{3}} \\ & 5 \log x + \log y - \frac{4}{3} \log z \end{aligned}$$

$$12. \log \frac{m^3 \sqrt[3]{n^4}}{k^2}$$

$$\begin{aligned} & \log \frac{m^3 n^{\frac{4}{3}}}{k^2} \\ & \log m^3 + \log n^{\frac{4}{3}} - \log k^2 \\ & 3 \log m + \frac{4}{3} \log n - 2 \log k \end{aligned}$$