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

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

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

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

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

$3 \ln x + 2 \ln y$

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

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

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

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

$\log a^5 + \log b^3 - \log c^6$

$5\log a + 3\log b - 6\log c$

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

$\ln x^2 + \ln y^6 - \ln c^3$

$2\ln x + 6\ln y - 3\ln c$

9. $\ln \frac{\sqrt[2]{x^1}}{y^3}$

$\ln \frac{x^{\frac{1}{2}}}{y^3}$

$\ln x^{\frac{1}{2}} - \ln y^3$

$\frac{1}{2}\ln x - 3\ln y$

10. $\log \frac{\sqrt[4]{x^3 y^2}}{\sqrt[3]{z^1}}$

$\log \frac{x^{\frac{3}{4}} \cdot y^2}{z^{\frac{1}{3}}}$

$\log x^{\frac{3}{4}} + \log y^2 + \log z^{\frac{1}{3}}$

$\frac{3}{4}\log x + 2\log y + \frac{1}{3}\log z$

11. $\log \frac{x^5 y}{\sqrt[3]{z^1}}$

$\log \frac{x^5 \cdot y}{z^{\frac{1}{3}}}$

$\log x^5 + \log y - \log z^{\frac{1}{3}}$

$5\log x + \log y - \frac{1}{3}\log z$

12. $\log \frac{m^3 \sqrt[2]{n^1}}{k^2}$

$\log \frac{m^3 \cdot n^{\frac{1}{2}}}{k^2}$

$\log m^3 + \log n^{\frac{1}{2}} - \log k^2$

$3\log m + \frac{1}{2}\log n - 2\log k$