9.3 Laws of Logs

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How do I use the laws of logs to expand or condense expressions?

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Condensed Form vs. Expanded Form

1. $\log(AB) = \log A + \log B$

$x^2 \cdot x^3 = x^{2+3}$

$\cancel{\frac{\log A}{\log B}}$

2. $\log\left(\frac{A}{B}\right) = \log A - \log B$

$\frac{x^5}{x^2} = x^{5-2}$

3. $\log A^B = B \log A$

$(x^2)^3 = x^{2 \cdot 3}$

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Condense

$$\log_3 12 + \tfrac{1}{2}\log_3 7 - \log_3 2$$

SAME BASE

$$\log_3 12 + \log_3 \sqrt{7} - \log_3 2$$

$$\log_3 (12\sqrt{7}) - \log_3 2$$

$$\log_3 \left(\frac{12\sqrt{7}}{2}\right) = \boxed{\log_3 (6\sqrt{7})}$$

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Expand

$$\ln\left(\frac{ab}{\sqrt[3]{c}\,(d+1)}\right)$$

$\ln(ab) - \ln(\sqrt[3]{c}(d+1))$

$\ln a + \ln b - (\ln(\sqrt[3]{c}\cdot(d+1)))$

$\ln a + \ln b - \ln\sqrt[3]{c} - \ln(d+1)$

$\boxed{\ln a + \ln b - \frac{1}{3}\ln c - \ln(d+1)}$

$\sqrt[3]{c} = c^{\frac{1}{3}}$

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Change of Base...

$$\log_B x = \frac{\log x}{\log B} = \frac{\ln x}{\ln B}$$

ex $\log_2 5 = \frac{\log 5}{\log 2}$

ALPHA WINDOW