Section 5.4: cont'd

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11:54 AM

recall:

$$\log_a(MN) = \log_a M + \log_a N$$

$$\log_a M^N = N \log_a M$$

quotient rule:

$$\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$$

why? digression

$$\log_a\left(\frac{M}{N}\right) = \log_a\left(M \cdot N^{-1}\right)$$

$$= \log_a M + \log_a N^{-1}$$

$$= \log_a M - \log_a N$$

example: simplify

$$\tfrac{1}{2}\log 400 - \log 2$$

$$\log 400^{\frac{1}{2}} - \log 2$$

$\log 20 - \log 2$

$\log \frac{20}{2}$

$\log 10$

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not: $\frac{1}{2}\log 5 + \frac{1}{2}\log 2$

$\frac{1}{2}(\log 5 + \log 2)$

example: write in terms of $\ln 2$, $\ln 3$, and/or $\ln x$. Your answer should look like: $A \ln 2 + B \ln 3 + C \ln x$ with no exponents

① $\ln 6 = \ln(2 \cdot 3) = \ln 2 + \ln 3$

② $\ln\left(\frac{2}{9}\right) = \ln 2 - \ln 9 = \ln 2 - \ln 3^2$

$= \ln 2 - 2\ln 3$

③ $\ln \frac{\sqrt{x}}{3} = \ln \sqrt{x} - \ln 3 = \frac{1}{2}\ln x - \ln 3$

④ $\ln \sqrt{\frac{x}{3}} = \ln \frac{\sqrt{x}}{\sqrt{3}} = \ln \sqrt{x} - \ln \sqrt{3}$

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

or

$= \frac{1}{2}\ln\left(\frac{x}{3}\right) = \frac{1}{2}(\ln x - \ln 3)$ ← either

⑤ $\ln(24x^3) = \ln 24 + \ln x^3$

$= \ln(8 \cdot 3) + 3\ln x$

$= \ln 8 + \ln 3 + 3\ln x$

$= \boxed{3\ln 2 + \ln 3} + 3\ln x$

note: $\ln 24 = \ln 4 + \ln 6$

$= \ln 2 + \ln 2 + \ln 2 + \ln 3$

$= \boxed{3\ln 2 + \ln 3}$