Rules of Logs

(1) $\ln(MN) = \ln M + \ln N$

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

(3) $\ln(M^k) = k \ln M$

$\ln(M^k) \neq (\ln M)^k$

(4) $\log_b M = \frac{\ln M}{\ln b}$

Prove the rules and find y' where

$y = \sqrt{x(x+4)}$, $x > 0$

Rules of Logs 13/8/25

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(1) $\ln(MN) = \ln M + \ln N$

$e^{\ln MN} = e^{\ln M + \ln N}$

$MN = e^{\ln M} \cdot e^{\ln N}$

$MN = MN$

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

$e^{\ln \frac{M}{N}} = e^{\ln M - \ln N}$

$\frac{M}{N} = \frac{e^{\ln M}}{e^{\ln N}} = \frac{M}{N}$

(3) $\ln(M^k) = k \ln M$

$e^{\ln(M^k)} = e^{k \ln M}$

$M^k = (e^{\ln M})^k = M^k$

(4) $\log_b M = \frac{\ln M}{\ln b}$

$M = b^{\frac{\ln M}{\ln b}}$

$\Rightarrow \ln M = \ln\left(b^{\frac{\ln M}{\ln b}}\right)$

$= \frac{\ln M}{\ln b} \cdot \ln b$

$= \ln M$

$$y = \sqrt{x(x+4)}, \quad x > 0$$

$$\log y = \frac{1}{2} \log(x(x+4))$$

$$\frac{d}{dx} \log y = \frac{1}{2} \frac{d}{dx} \left(\log x + \log(x+4) \right)$$

$$\frac{1}{y} \cdot y' = \frac{1}{2} \left(\frac{1}{x} + \frac{1}{x+4} \right)$$

$$y' = \frac{\sqrt{x(x+4)}}{2x} + \frac{\sqrt{x(x+4)}}{2(x+4)}$$