Natural Logs

Recall, log is called a "common log" ie. $\log_{10}$

How about, $\boxed{\log_e = \ln}$ called the <u>natural log</u>
↳ lawn

where e = 2.71828...   *Euler*

Note, $\ln e = 1$
$\log_e e = 1$

All log laws still apply
ex. $\ln(M \cdot N) = \ln M + \ln N$

Finally, works like log in solving eq'ns

ex. $e^{3x} = 4$ *Could use log or ln*

$\log e^{3x} = \log 4$

$3x \log e = \log 4$

$\dfrac{3x \log e}{3 \log e} = \dfrac{\log 4}{3 \log e}$

$x = 0.462 \ldots$

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$\ln e^{3x} = \ln 4$

$3x \ln e = \ln 4$

$\dfrac{3x}{3} = \dfrac{\ln 4}{3}$

$x = 0.462 \ldots$

ex. $e^{\ln 2x} = 8$

$\ln e^{\ln 2x} = \ln 8$

$(\ln 2x) \ln e = \ln 8$ ⟶ NEVER

$2x = 8$ $\ln 2x = \ln 8$
$x = 4$ $0 = \ln 8 - \ln 2x$

$0 = \ln\left(\dfrac{8}{2x}\right)$

$e^0 = \dfrac{8}{2x}$

$1 = \dfrac{8}{2x}$

$2x = 8$

$x = 4$

ex. $e^x = 3^{x+2}$

$$\ln e^x = \ln 3^{x+2}$$

$$x \ln e = (x+2)\ln 3$$

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

$$x - x\ln 3 = 2\ln 3$$

$$x(1 - \ln 3) = 2\ln 3$$

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

$$x = -22.281 \ldots..$$

ex. $\ln(x^2 - 1) - \ln(x + 1) = 1$

$$\ln\left(\frac{x^2-1}{x+1}\right) = 1$$

$$\ln\left(\frac{(x+1)(x-1)}{x+1}\right) = 1$$

$$\ln(x-1) = 1$$

$$e^1 = x - 1$$

$$\boxed{e + 1 = x} \quad \leftarrow \text{non calc}$$

or $x = 3.718 \leftarrow$ on calculator
                          Section

$\frac{1}{3}$ WS
7 questions