Simplifying Exponentials & Logs

Review properties:

$a^{\log_a x} = x$ $\qquad$ $\log_a a^x = x$

$e^{\ln x} = x$ $\qquad$ $\ln e^x = x$

Ex: $2^{\log_2 x - 4}$

$$\frac{2^{\log_2 x}}{2^4} = \boxed{\frac{x}{16}}$$

Ex: $2^{\log_2 (x-4)} = x-4$

Ex: $e^{3\ln x^3} = e^{\ln x^3} = x^3$

Ex: $\log_9 27 = x$

$9^x = 27$

$(3^2)^x = 3^3$

$3^{2x} = 3^3$

$2x = 3$

$\boxed{x = 3/2}$

Ex: $\log_8 32 = x$

$8^x = 32$

$(2^3)^x = 2^5$

$2^{3x} = 2^5$

$3x = 5$

$\boxed{x = 5/3}$

Ex: $\log_{(10)} 10^4 = 4$

Ex: $\ln e^{(x^2-3)} = x^2 - 3$

Ex: Simplify: $\ln 8 - \ln 2$

$\ln\left(\frac{8}{2}\right)$

$\ln 4 = \ln 2^2 = \boxed{2\ln 2}$

another way:

$\ln 8 - \ln 2$

$\ln 2^3 - \ln 2$

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

Ex: $\ln 144 + \cancel{\ln 1} - \ln 6$

$2\ln 12^2 - \ln 6$

$2(\ln(2^2 \cdot 3)) - \ln(2 \cdot 3)$

$2(2\ln 2^2 + \ln 3) - (\ln 2 + \ln 3)$

$4\ln 2 + 2\ln 3 - \ln 2 - \ln 3 = \boxed{3\ln 2 + \ln 3}$

$\ln\left(\frac{144}{6}\right) = \ln(24)$

$= \ln(2^3 \cdot 3)$

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

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