Bell Work:

What are the three properties of logarithms?

Product $\log_b mn = \log_b m + \log_b n$

Quotient $\log_b \frac{m}{n} = \log_b m - \log_b n$

Power $a\log_b m = \log_b m^a$

Natural Logarithms

Write each expression as a single natural logarithm.

1. $\frac{1}{2}\ln 9 + \ln 3x$

$\ln 9^{\frac{1}{2}} + \ln 3x$

$\ln 3 + \ln 3x$

$\ln 9x$

2. $\frac{1}{3}\ln 8 - \ln x$

$\ln 8^{\frac{1}{3}} - \ln x$

$\ln 2 - \ln x$

$\ln \frac{2}{x}$

Solve each equation. Check your answers. Round your answer to the nearest hundredth.

3) $2\ln(3x-4)=7$

$\ln(3x-4)=3.5$

$3x-4=e^{3.5}$

$3x=e^{3.5}+4$

$x=\frac{e^{3.5}+4}{3}$

$x=12.37$

(4) $-7+\ln 2x=4$

$\ln 2x=11$

$2x=e^{11}$

$x=\frac{e^{11}}{2}$

$x=29937.07$

(5) $\ln x+\ln 3x=14$

$\ln 3x^2=14$

$3x^2=e^{14}$

$x^2=\frac{e^{14}}{3}$

$x=\sqrt{\frac{e^{14}}{3}}$

633.14

(6) $\ln e^x = 3$

$x = 3$

(7) $\ln e^{x+5} = 17$

$x + 5 = 17$

$x = 12$

(8) $7 \ln (2x + 5) = 8$

$\ln (2x+5) = 8/7$

$2x+5 = e^{8/7}$

$2x = e^{8/7} - 5$

$x = \frac{e^{8/7} - 5}{2}$

$x = -0.93$

Use natural logarithms to solve each equation. Round your answer to the nearest hundredth.

9) $e^x = 15$

$x = \ln 15$

$x = 2.71$

10) $e^{x-4} = 2$

$x - 4 = \ln 2$

$x = \ln 2 + 4$

$x = 4.69$

11) $e^x = 1$

$x = 0$

(12) $3e^{3x-5} = 49$

$e^{3x-5} = \frac{49}{3}$

$3x-5 = \ln\frac{49}{3}$

$3x = \ln\frac{49}{3} + 5$

$x = \frac{\ln\frac{49}{3} + 5}{3}$

$x = 2.60$

(13) $6 - e^{12x} = 5.2$

$-e^{12x} = -0.8$

$12x = \ln 0.8$

$x = \frac{\ln 0.8}{12}$

$x = -0.02$

(14) $e^{\ln x} = 21$

$x = 21$

Simplify each expression using the properties of natural logarithms.

15) $2\ln e^4$

$\ln e^8$

8

16) $\frac{\ln e^2}{2} = \frac{2}{2} = 1$