

8.6 Natural Logarithms

Graph $y = e^x$

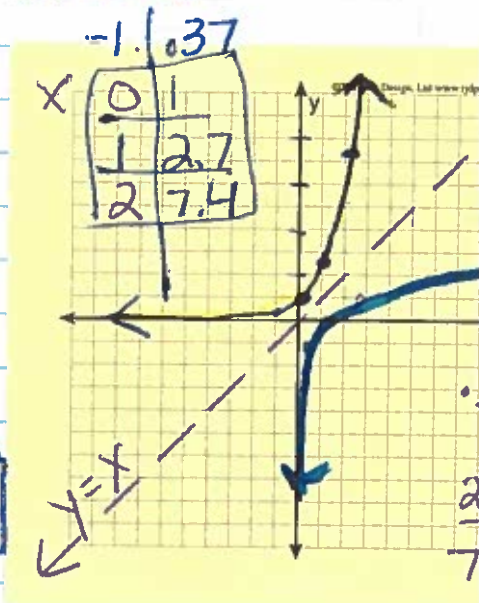
Horizontal asymptote: $y = 0$ (x-axis)

D: $(-\infty, \infty)$
R: $(0, \infty)$

$y = \log_e x \rightarrow y = \ln x$

vertical asymptote: y -axis ($x = 0$)

D: $(0, \infty)$ R: $(-\infty, \infty)$



The inverse of $y = e^x$ is $y = \ln$.

* you can't take the log or natural of zero or a negative #. It is undefined.

$$y = \ln(x+3) + 1$$

$x+3=0$ up 1
 $-3 \quad -3$
 $x = -3$

Left 3

Vertical asymptote $x = -3$

D: $(-3, \infty)$
R: $(-\infty, \infty)$

$$\textcircled{6} \ln(3x-9) = 21$$

$$e^{\ln(3x-9)} = e^{21}$$

$$3x-9 = 1318815734$$

$$\begin{array}{r} +9 \\ 3x = 1318815743 \\ \hline 3 \end{array}$$

$$x \approx 439605247.8$$

Base "e"

$$\textcircled{7} e^{x+1} = 30$$

$$\ln e^{x+1} = \ln 30$$

$$x+1 = \ln 30$$

$$x+1 = 3.401197$$

$$x = \ln(30) - 1$$

$$x \approx 2.4012$$

take the natural log both sides
the natural "e" cancel each other out

$$\ln(30) - 1 \neq \ln(29)$$

Does Not work

$\textcircled{8}$

$$e^{\frac{2x}{5}} + 7.2 = 9.1$$

$$\begin{array}{r} -7.2 \\ -7.2 \end{array}$$

$$\ln e^{\frac{2x}{5}} = \ln 1.9$$

$$x \approx 1.60$$

P. 472-473

(1-9 odd, 15-27 odd)

$$\frac{2x}{5} = .6418538862$$

$$2x = 3.209269431$$

"Condense"

Write each as a single logarithm

① $5 \ln 2 - \ln 4$

$$\ln 2^5 - \ln 4$$

$$\ln 32 - \ln 4$$

$$\ln \frac{32}{4}$$

$$\boxed{\ln 8}$$

② $3 \ln x + \ln y$

$$\ln x^3 + \ln y$$

$$\boxed{\ln x^3 y}$$

③ $\frac{1}{4} \ln 3 + \frac{1}{4} \ln x$

$$\ln 3^{\frac{1}{4}} + \ln x^{\frac{1}{4}}$$

$$\boxed{\ln 3^{\frac{1}{4}} x^{\frac{1}{4}}} = \ln$$

OR $\boxed{\ln \sqrt[4]{3x}}$

Solve.

④ $\ln x = 0.1$

$$e^{\ln x} = e^{0.1}$$

cancel out and you get the exponent

$$\boxed{x \approx 1.1052}$$

becomes an exponent with a base!

type in on calculator

⑤ $\ln 2 + \ln x = 1$

Condense 1st

$$\ln 2x = 1 \rightarrow \exp$$
$$e^{\ln 2x} = e^1$$

$$\frac{2x}{2} = \frac{2.71828}{2}$$