Pre-Calculus 12 Logs with Special Bases

The most important base number for exponential functions is the number denoted by e
Like π, e (euler's number) is an irrational number whose value is 2.718281828347045…

Evaluating Logarithms

Base 10

- $y = \log_{10} x$ is called a common logarithmic function
- also written as $y = \log x$

↖ Base 10 is implied

Base e

- the inverse of the natural exponential function $y = e^x$ is $y = \log_e x$ which is more commonly written as $y = \ln x$

* pronounced "lon" x

Ex.1) Use your calculator to find the following logs.

check on calc to make sure you get these values

a) $\log 100$

2

b) $\log \frac{1}{10}$

-1

c) $\ln 100$

4.605

* d) $\ln e^3$

3

* e) $\ln 1$

0

$e^x = 1$
$e^0 = 1$

f) $\ln e^7$

7

in exp form $e^x = e^7$
implied base "e"

g) $\log 0$

error
$\emptyset$

* h) $\log 1$

0

* i) $\ln e$

1

Ex. 2) Use your calculator to find the inverse logarithm (ie. Solve for x)

a) $\log x = 5$

$10^5 = x$

on calc 2nd log (5)

100 000

b) $\ln_e x = -0.3$

on calc 2nd ln (-0.3)

0.741

*The calculator is only useful for base 10 and base e (special bases). For non-special bases we use exponential form or change of base formula.

Change of Base Theorem

$$\log_b n = \frac{\log_a n}{\log_a b} \quad \text{where } a, b \text{ and } n > 0, a \neq 1, b \neq 1$$

* allows you to change to base of 10 or e so you can use the calc.

Ex. 3) Evaluate the following

a) $y = \log_2 3$

$\log_2 3 = \frac{\log_{10} 3}{\log_{10} 2} = \frac{\log 3}{\log 2}$ base 10 so don't have to write 10

$= 1.585$

b) $y = \log_7 \pi$

$\log_7 \pi = \frac{\log \pi}{\log 7}$

$= 0.588$

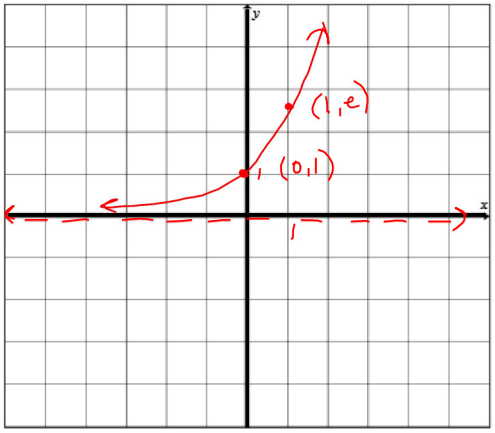
Assignment: Graph: $y = -e^{-x+1}$, $y = \ln(-x) + 1$, $y = 2e^{(x-1)}$, $y = -\ln(-x+2)$
and Change of Base worksheet (odds)

Graphing $y = e^x$ and $y = \ln x$

Ex. 1) Sketch $y = e^x$

$e \approx 2.718$

x	y
0	1
1	2.718



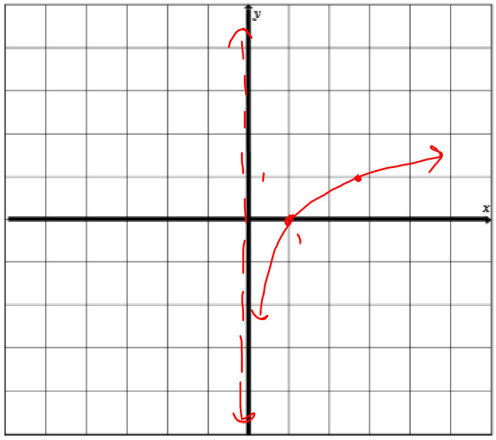
Ex. 2) Sketch $y = \ln x$

$x = e^y$

- The inverse of $y = e^x$ *is* $y = \log_e x$
- More commonly written as $y = \ln x$

switch x and y

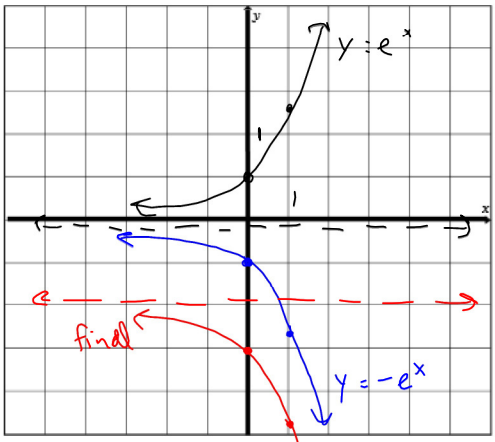
x	y
1	0
2.718	1



Ex. 3) Sketch $y = -e^x - 2$

reflects over the x-axis

down 2



Assignment: ~~Pg. 281, #4b,d, 5b, 6aiii, 9, M.C. #1, 2~~
Graph: $y = -e^{-x+1}$, $y = \ln(-x) + 1$, $y = 2e^{(x-1)}$, $y = -\ln(-x + 2)$