Notes: 4.3 Logarithmic functions

given: $y = a^x$ → inverse: $x = a^y$

(swap domain and range)

$a^y = x$ is equivalent to $y = \log_a x$

Example: $y = \log_2 32$ (or $\log_2 32 = y$)

→ rewrite as $2^y = 32$

→ get like bases $2^y = 2^5$

therefore $y = 5$ so… $\log_2 32 = 5$

NOTES: **ln** is an abbreviation from the Latin name "**l**ogarithmus **n**aturalis"

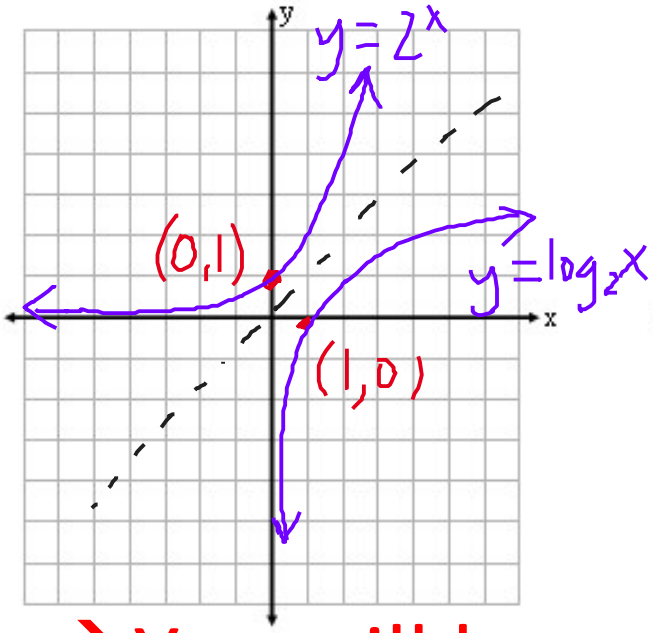
- $\log_e x \rightarrow$ normally written as $\ln x$

- e^x and $\ln x$ are inverses
- 10^x and $\log x$ are inverses
- 2^x and $\log_2 x$ are inverses

- The graphs of inverses are symmetrical across the line y = x.

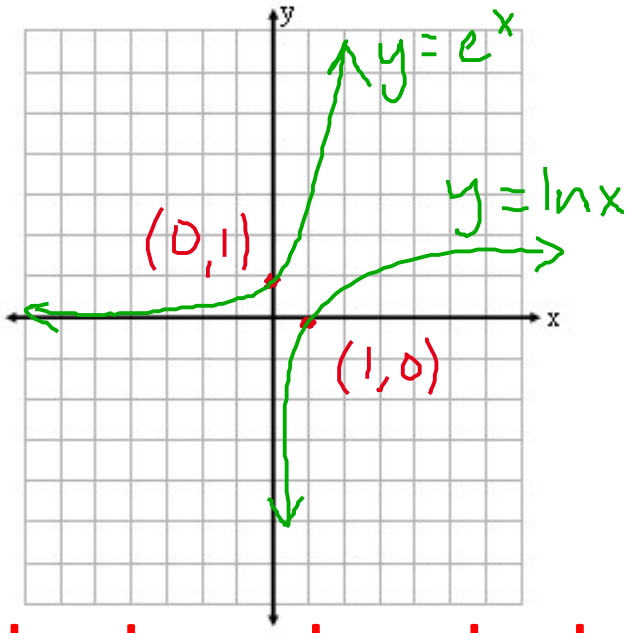
2^x and $\log_2 x$

General Logarithm



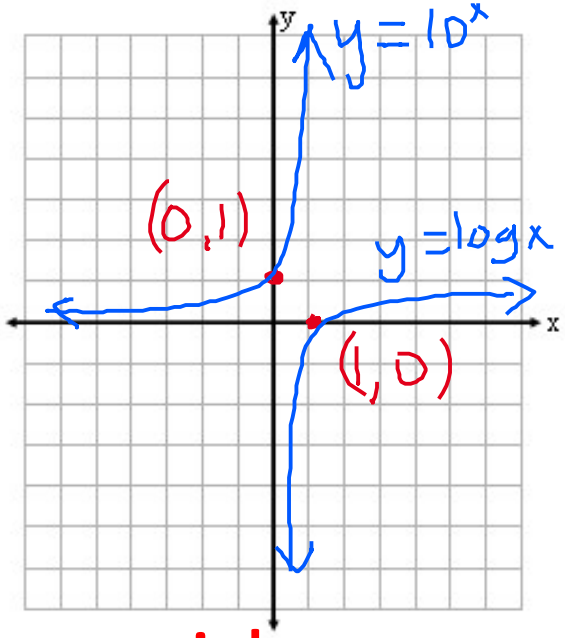
e^x and $\ln x$

Natural Logarithm



10^x and $\log x$

Common Logarithm



→You will be asked to sketch these without a graphing calculator on the quiz and test.

NOTE:

Exponential graphs have a horizontal asymptote at y = 0.

Logarithmic graphs have a vertical asymptote at x = 0.

Today's assignment: 4.3 #30,32, 1-7odd, 25-43odd

NO CALCULATOR!!

30. a) $\log_5 125 = x$

$5^x = 125$ rewrite in exponential form

show → $5^x = 5^3$

like bases $x = 3$

b) $\log_{49} 7 = x$

$49^x = 7$

$7^{2x} = 7^1$

$2x = 1$

$x = \frac{1}{2}$

c) $\log_9 \sqrt{3} = x$

$9^x = \sqrt{3}$

$3^{2x} = 3^{\frac{1}{2}}$

$2x = \frac{1}{2}$ → $\frac{1}{2} \cdot 2x = \frac{1}{2} \cdot \frac{1}{2}$

$x = \frac{1}{4}$

→Write given info, then rewrite in a different form and solve.

→Get matching bases on both sides when possible.

32.

a) $e^{\ln\sqrt{3}} = x$

$\ln_e x = \ln_e \sqrt{3}$

$x = \sqrt{3}$

b) $e^{\ln\left(\frac{1}{\pi}\right)} = x$

$\ln_e x = \ln_e \frac{1}{\pi}$

$x = \frac{1}{\pi}$

c) $10^{\log 13} = x$

$\log_{10} x = \log_{10} 13$

$x = 13$

33. Note: decimals are not a user-friendly form when working with exponents and logarithms

a) $\log_8 0.25 = x$

↓rewrite as a fraction

$8^x = \frac{1}{4}$

get like bases

$2^{3x} = \frac{1}{2^2}$

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

$3x = -2$

$x = \frac{-2}{3}$

Solve