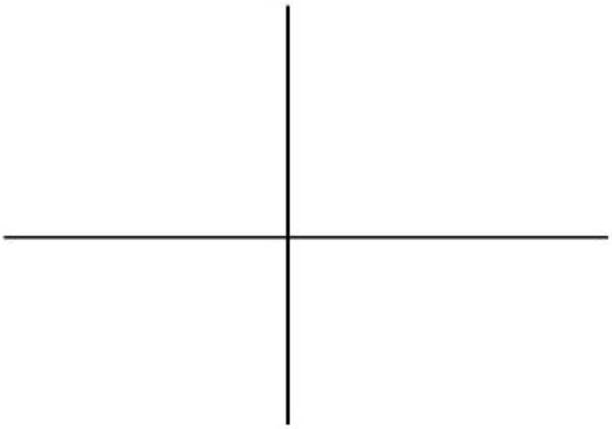
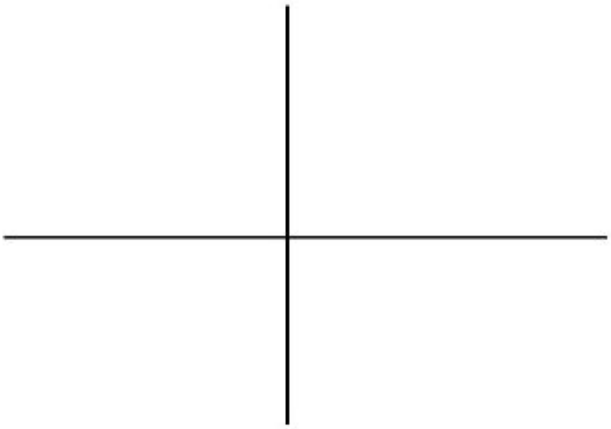
Math 1314 – College Algebra
Section 6.3-6.4 Logarithmic Functions/Graphs of Logarithmic Functions

- Are exponential functions one-to-one?

Find the inverse of $y = b^x$:
Switch x and y:





- If $b > 0$ and $b \neq 1$, the logarithmic function with base b is $\log_b x = y$ if and only if $b^y = x$

$$\log_b m = n \iff$$

Properties of Exponential Functions $f(x) = b^x$:	Properties of Logarithmic Functions $f(x) = \log_b x$:
■ Domain: $(-\infty, \infty)$	■ Domain:
■ Range: $(0, \infty)$	■ Range:
■ y-intercept: $(0, 1)$	■ _-intercept: (,)
■ Horizontal asymptote at $y = 0$	■ _____ asymptote at _____
■ Passes through the point $(1, b)$	■ Passes through the point (, 1)
■ If $b > 1$, increasing	■ If $b > 1$,
■ If $0 < b < 1$, decreasing	■ If $0 < b < 1$,

Ex: Find (a) $\log(-13)$ (b) $\log(0)$

Ex: What sign will $\log_{10}(.5)$ have? What sign will $\log_{10}(300)$ have?

Ex: Graph $y = \log_2 x$. Domain:

Ex: Find m:

(a) $\log_3 9 = m$

(b) $\log_8 \frac{1}{64} = m$

(c) $\log_4 1 = m$

(d) $\log_m \frac{1}{16} = -2$

(e) $\log_m 3 = \frac{1}{2}$

(f) $\log_5 m = 2$

- Base 10 logarithms: The logarithm with base 10 is the common logarithm. $\log x$ means $\log_{10} x$.
- $\log \frac{1}{100} = -2$ because $10^{-2} = \frac{1}{100}$
  $\log \frac{1}{10} = -1$ because $10^{-1} = \frac{1}{10}$
  $\log 1 = 0$ because $10^0 = 1$
  $\log 10 = 1$ because $10^1 = 10$
  $\log 100 = 2$ because $10^2 = 100$
  $\log 1000 = 3$ because $10^3 = 1000$

Ex: Find x to four decimal places: $\log x = 0.7482$

- The logarithm with base e is the natural logarithm. $\ln x = \log_e x$

Ex: Find (a) $\ln 17.32$ (b) $\ln(\log 0.05)$

Ex: Solve (a) $\ln x = 1.335$ (b) $\ln x = \log 5.5$

NOTE:

- $e^{(\ln(\star))} = \star$
- $10^{(\log(\star))} = \star$
- $\ln e^{(\star)} = \star$
- $\log 10^{(\star)} = \star$

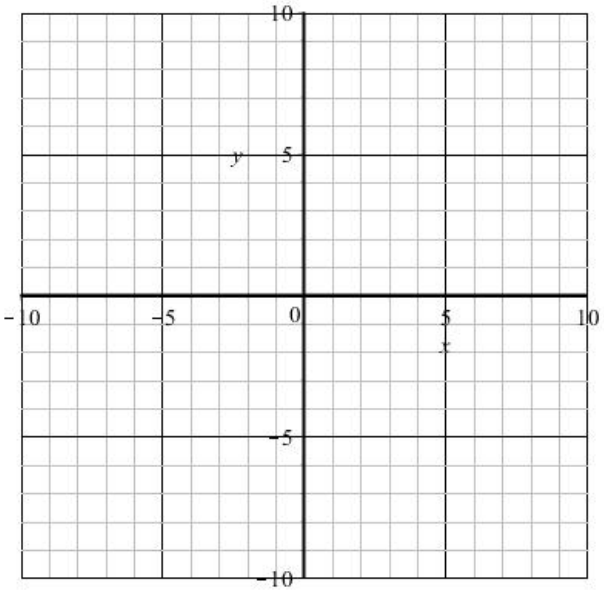
We will discuss this in more detail in the next section.

Ex: Simplify: (a) $e^{(\ln(17.5))} - 11$ (b) $\log 10^{(13)} + 6$

Ex: Graph and find the domain:
(a) $y = \ln x$ (b) $y = \log x$

- We can also shift and reflect graphs of $f(x) = \log_b x$.

  Ex: Graph $f(x) = \log_2(x+2)+5$. Find the domain, range, and vertical asymptote.



  Ex: Find the domain, range, and vertical asymptote of $g(x) = \log(12-2x)$

  Ex: Find the domain of $(f+g)(x)$

Ex: Given $f(x) = \log_2(x+2)+5$, find its inverse. Then graph both.