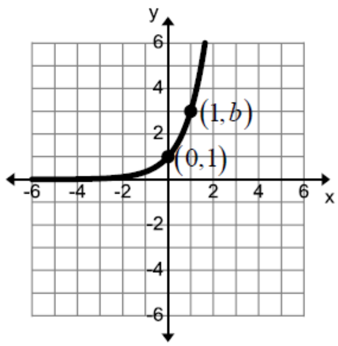
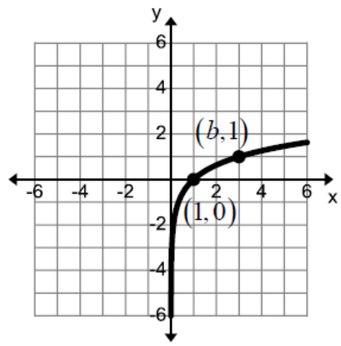
Secondary Math 3 Properties/Domains/Solving Logarithms Notes

Objectives: Use definition/properties of logs to:

1. Rewrite equations in exponential form
2. Rewrite equations in logarithmic form
3. Evaluate logarithmic expressions without a calculator

$f(x)=b^x,\ b\neq 0,\ b\neq 1$	$f(x)=\log_b x,\ b\neq 0,\ b\neq 1$
 	
Domain: $(-\infty,\infty)$ Range: $(0,\infty)$ Horizontal Asymptote: $y=0$ Intercept: $(0,1)$ End Behavior: $\lim_{x\to\infty} f(x)=\infty$; $\lim_{x\to-\infty} f(x)=0$	Domain: $(0,\infty)$ Range: $(-\infty,\infty)$ Vertical Asymptote: $x=0$ Intercept: $(1,0)$ End Behavior: $\lim_{x\to\infty} f(x)=\infty$; $\lim_{x\to0^+} f(x)=-\infty$

Exponential and logarithmic functions are inverses of each other. Two of the most widely used logarithms are the common log, which is base 10, and is written as $\log_{10} x=\log x$ and the natural log, which is base *e*, and is written as $\log_e x=\ln x$.

Definition of a Logarithm

$$\log_b x=c \text{ if and only if } b^c=x$$
$$\ln x=c \text{ if and only if } e^c=x$$

Objective 1 Examples:

Rewrite each of the following in exponential form.

a. $\log_4 64=3$

b. $\log_5 \frac{1}{25}=-2$

c. $\log_{65} 1=0$

Objective 2 Examples:

Rewrite each of the following in logarithmic form.

a. $3^4 = 81$ b. $10^{-2} = \frac{1}{100}$ c. $6^1 = 6$

Basic Properties of Logarithms
where $b > 0$, $b \neq 1$, $x > 0$, and c is any real number

1.	$\log_b 1 = 0$	1.	$\ln 1 = 0$
2.	$\log_b b = 1$	2.	$\ln e = 1$
3.	$\log_b b^c = c$	3.	$\ln e^c = c$
4.	$b^{\log_b x} = x$	4.	$e^{\ln x} = x$

Objective 3 Examples:

Use the properties of logarithms to evaluate the expression without a calculator.

a. $\log 10^{-4}$ b. $e^{\ln 6}$ c. $\log_3 1$ d. $\log_{50} 50$

Secondary Math 3H Domains and Graphs of Logarithms

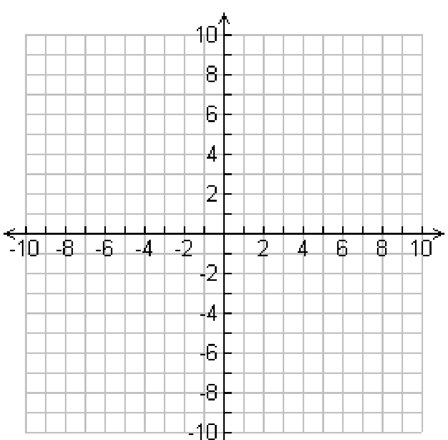
Objectives:

1. Find the domain of logarithmic functions
2. Graph logarithmic functions

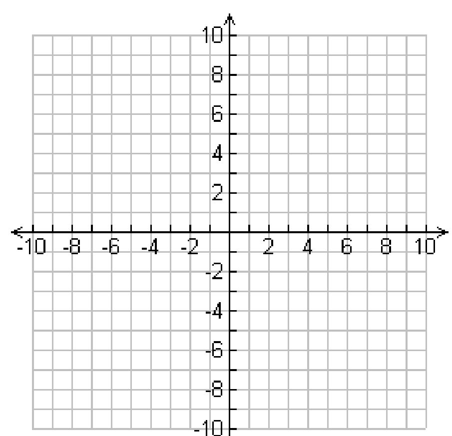
You cannot take the log of 0 or a negative number, so f(x)=log(x) has a domain of x>0, or the domain is (0, ∞)

Examples: Find the domain and graph the function.

a. $f(x) = \log_4(x+1)$



b. $f(x) = -2\log_5(-2x+6)+3$



Secondary Math 3H Solving Logarithmic Equations Part 1 Notes

The Principle of Exponential Equality
For any real number b, where $b \neq -1, 0,$ or 1, $b^{x_1} = b^{x_2}$ is equivalent to $x_1 = x_2$. In other words, powers of the same base are equal if and only if the exponents are equal.

Example Set #1: Use the properties of exponents to solve each equation

a. $\log_2 8 = x$

b. $\log_7 x = 2$

c. $\log_x 125 = 3$

Example set #2: Use the properties of exponents to solve each equation

a. $27^2 = 9^{x+1}$

b. $\log_4(3x-2) = 2$

Example Set #3: Use the properties of exponents to solve each equation

a. $9^{x-3} = 81^{x+6}$

b. $\log_x \frac{1}{216} = -3$

c. $(\frac{1}{8})^{6-x} = 4^8$