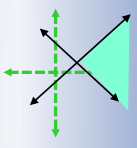
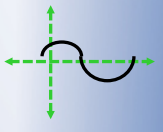
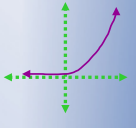
$5x-2y \leq 75$



$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$



$S = Pe^{rt}$



$APY = (1+\frac{r}{n})^{n}-1$

Math 1090 ~ Business Algebra

Section 4.3 Logarithmic Functions

Objectives:

- Identify the logarithmic function as the inverse of an exponential function.
- Translate between exponential and logarithmic form.
- Determine the domain of a logarithmic function.
- Sketch transformations of a logarithmic function.

For $a > 0$, $a \neq 1$, the logarithmic function $y = \log_a x$ has domain $x > 0$, base a and is defined by $a^y = x$.

$a>0, a\neq 1$

$y = \log_a x \iff a^y = x$

read as "log base a of x"

always be positive!

ex from past:

$3 \cdot 5 = 15 \iff 15 \div 3 = 5$

Ex 1: Write $8 = 2^3$ in logarithmic form.

$2^3 = 8 \iff \log_2 8 = 3$

$a = 2$

$y = 3$

$x = 8$

Ex 2: Rewrite $\log_3\left(\frac{1}{27}\right) = -3$ in exponential form.

$a = 3$

$x = \frac{1}{27}$

$y = -3$

$3^{-3} = \frac{1}{27}$

$a>0, a\neq 1$

$y = \log_a x \iff a^y = x$

Ex 3: Evaluate

a) $\log_5\left(\frac{1}{25}\right) = -2$

$5^? = \frac{1}{25}$

b) $\log_7 49 = 2$

$7^? = 49$

c) $\log_2\left(16^{-1}\right) = \log_2\left(2^{-4}\right) = -4$

$16^{-1} = (2^4)^{-1} = 2^{-4}$

Ex 4: Graph and state the domain.

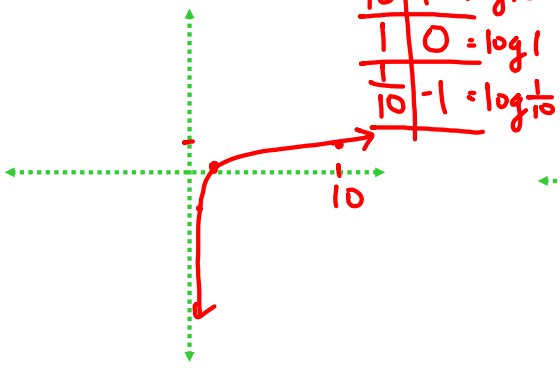
Note
$log \rightarrow log_{10}$
$ln \rightarrow log_e$

a) $y = \log x$

domain $x > 0$

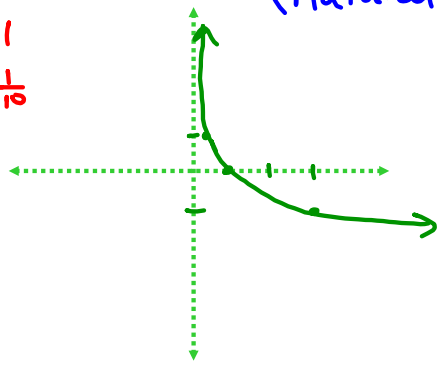
VA: $x = 0$

x	y
10	1 $= \log 10$
1	0 $= \log 1$
$\frac{1}{10}$	-1 $= \log \frac{1}{10}$



b) $y = -\log_3 x$

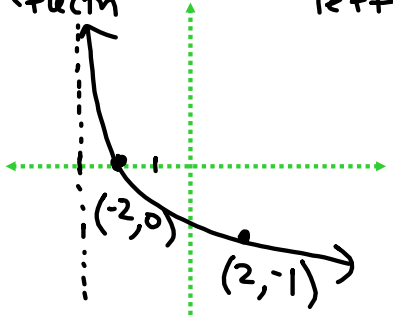
(ln means natural log)

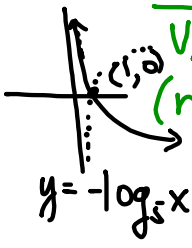


c) $y = -\log_5(x+3)$ VA: $x = -3$

vert. reflctn

shift left 3





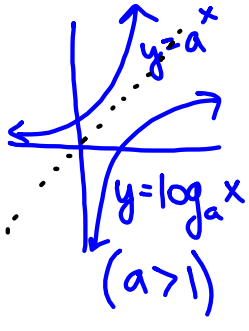
$y = \log_3 x$	$-\log_3 x$
(1, 0)	(1, 0)
(3, 1)	(3, -1)
$(\frac{1}{3}, -1)$	$(\frac{1}{3}, 1)$

VA: $x = 0$

(no horiz. shift $\Rightarrow$ VA still $x = 0$)

Remember: ① exponential curves go through (0,1) $\Rightarrow$ log curves go through (1,0)

② exp. curves have HA: $y = 0$ $\Rightarrow$ log curves have VA: $x = 0$ $\therefore$

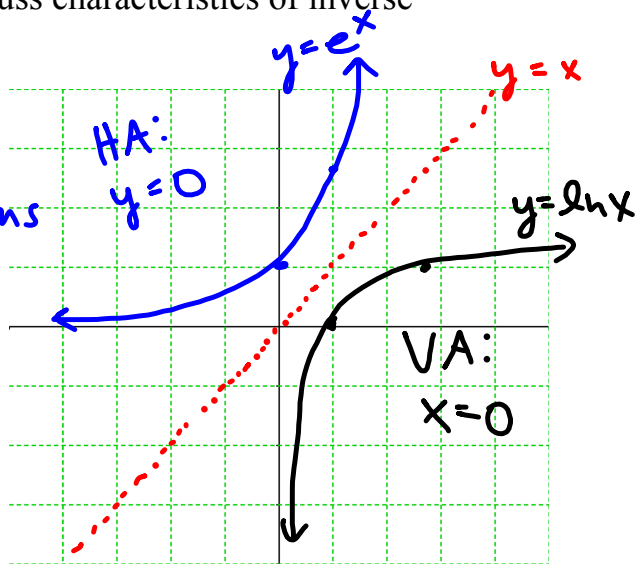


Ex 5: Graph $y = e^x$ and $y = \ln x$. Discuss characteristics of inverse functions demonstrated by the graph.

inverse fn graphs are mirror reflections across line $y = x$

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

x	$\ln x$
1	0
e	1



Ex 6: Evaluate these expressions.

a) $e^{\ln 5} = 5$

b) $\log_4 4^a = a$

c) $\ln e^5 = 5$

d) $9^{\log_9 11} = 11$