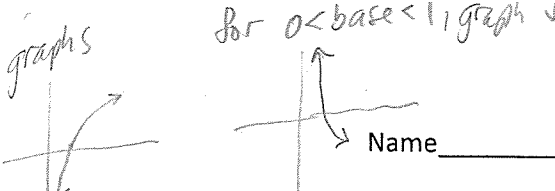


Graphing Logarithms
Adv. Alg. II (H)



Name _____

Today: We are going to learn how to graph log functions without a calculator.

Key point: x-int.

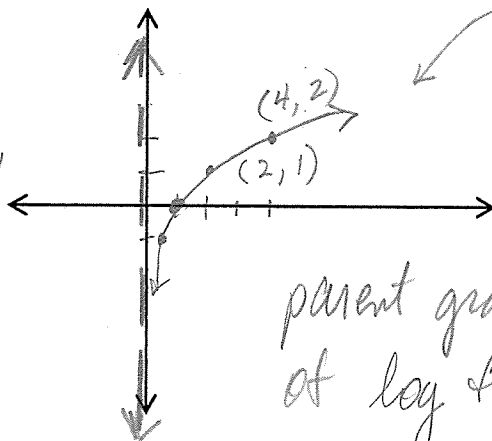
DO NOW: a) $\log_b b = \frac{1}{\text{base} > 0, b \neq 1}$ b) $\log_b 1 = \frac{0}{\text{argument} > 0}$ c) $\log_b \frac{1}{b} = \frac{-1}{\text{argument} > 0}$ d) What kind of values are allowed for the base and argument of a log?

Ex. 1 Graph $y = \log_2 x$

Think: What would be easy values of x to pick?

x	y	← (exponent)
2	1	$\log_2 2 = 1$
1	0	$\log_2 1 = 0$
$\frac{1}{2}$	-1	$\log_2 \frac{1}{2} = -1$
4	2	$\log_2 4 = 2$

any power of 2



Go over specific points being reflection of $y = 2^x$
Equation of vertical asymptote: $x = 0$
x-intercept: $(1, 0)$
Domain: $(0, \infty)$ Range: $(-\infty, \infty)$

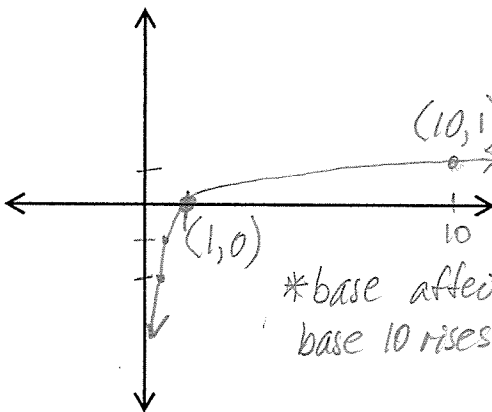
parent graph of log functs.

always for range (ask Dani her explanation)

Ex. 2 Graph $y = \log_{10} x$

Think: What would be easy values of x to pick?

x	y	
1	0	$\log_{10} 1 = 0$
10	1	$\log_{10} 10 = 1$
100	2	$\log_{10} 100 = 2$
$\frac{1}{10}$	-1	$\log_{10} \frac{1}{10} = -1$
$\frac{1}{100}$	-2	



Equation of vertical asymptote: $x = 0$
x-intercept: $(1, 0)$
Domain: $(0, \infty)$ Range: $(-\infty, \infty)$

*base affects steepness
base 10 rises slower than base 2

What are the basic characteristics of any logarithmic graph $y = \log_b x$?

VA: $x = 0$ ← VA - commonly used for vertical asymptote
D: $(0, \infty)$
R: $(-\infty, \infty)$
x-int $(1, 0)$ graph:

You should know

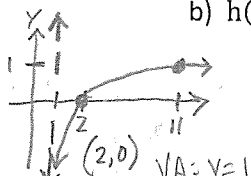
Describe what you think will happen to the graph compared to its parent graph:

a) $g(x) = \log_{10}(x - 1)$

b) $h(x) = 2 + \log_{10} x$

2 major changes:

Shifts 1x right



x-int shifts 1x → $x = 2$

x-int = $(1, 2)$ Shifts 2 up.

It is important to find the domain, range, equation of vertical asymptote, and x-intercept when graphing logs. How would you find these?

① R: $(-\infty, \infty)$ always

③ VA: set argument = zero
Solve for x.

② Domain: set argument > 0 ; solve for x. (argument must always be pos.)

x-int: set $y = 0$. Solve x.
Key point for a log graph like vertex for parabola.

Do w/ class

Graph the following, and find the domain, range, equation of vertical asymptote, x-intercept, and test points.

Range: $(-\infty, \infty)$

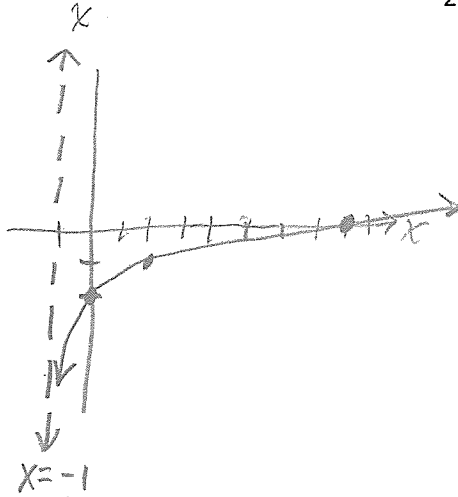
reflects graph over x-axis

1) $f(x) = \log_3(x+1) - 2$

think backwards

x	y
2	-1
0	-2
8	0

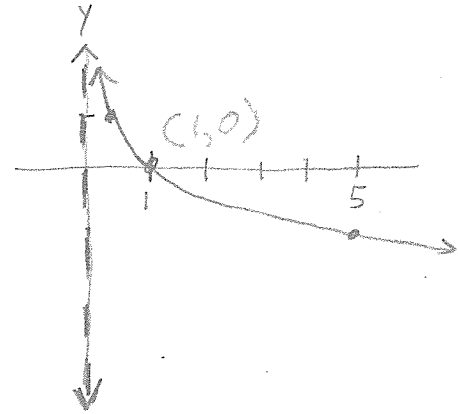
D: $x+1 > 0 \Rightarrow x > -1$
 VA: $x+1=0 \Rightarrow x=-1$



2) $g(x) = -\log_5 x$

D: $x > 0$
 R: $(-\infty, \infty)$
 VA: $x=0$
 x-int: $(1, 0)$

x	y
5	-1
1	0
25	-2
1/5	1



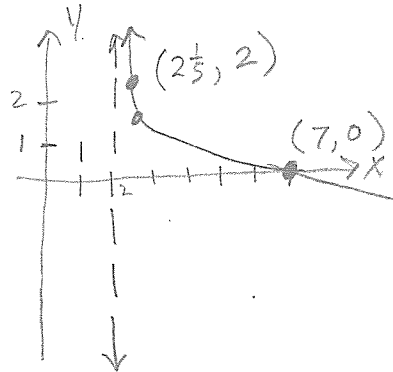
label VA!

Should be able to do quickly.

3) $h(x) = 1 - \log_5(x-2) \rightarrow -\log_5(x-2) + 1$

$\log_5(x-2) = 1 \rightarrow 5 = x-2$
 $7 = x$

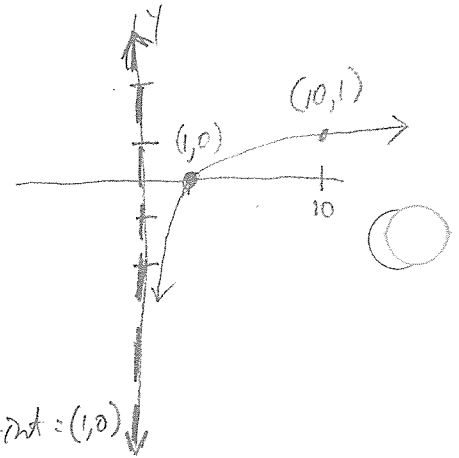
D: $x-2 > 0 \Rightarrow x > 2$
 R: $(-\infty, \infty)$
 VA: $x-2=0 \Rightarrow x=2$
 x-int: $(7, 0)$



4) $f(x) = \ln x$

x	y
1/10	-1
1	0
10	1
100	2

VA: $x=0$
 D: $(0, \infty)$
 R: $(-\infty, \infty)$
 x-int: $(1, 0)$



5) $g(x) = \ln(2-x) \rightarrow \log_e(2-x)$

D: $2-x > 0 \rightarrow 2 > x$
 R: $(-\infty, \infty)$
 VA: $2-x=0 \rightarrow x=2$

x-int: $(1, 0)$

$0 = \ln(2-x)$
 $10^0 = 2-x$
 $1 = 2-x$
 $x=1$

x	y
1	0
0	0.69
-0.7	1
1.6	-1

$\log_e e = 1$
 $2-x=e$
 $x=2-e$
 $x \approx -0.7$

 $\log_e \frac{1}{e} = -1$
 $2-x = \frac{1}{e}$
 $x = 2 - \frac{1}{e}$
 $x \approx 1.6$

