WU Graph. List HA, Domain & Range

1.) $f(x) = 4 \bullet 2^{x+1} - 3$

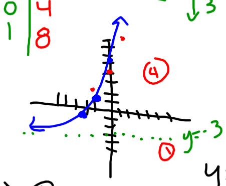
↓Growth

HA ①

$y = 4 \cdot 2^x$

x	y
-1	2
0	4
1	8

Shift ② ←1 ↓3



④ ③ $y = -3$

$y = a \cdot b^{x-h} + k$

D: ℝ

R: $y > -3$

Apr 2-7:53 AM

Graph. List HA, Domain & Range

2.) $f(x) = (1/2)\,(1/3)^{x-1}$ -3

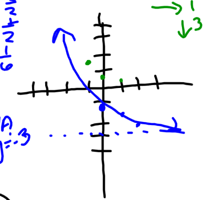
↓Decay

HA

$y = \left(\frac{1}{2}\right)\left(\frac{1}{3}\right)^x$

x	y
-1	$\frac{3}{2}$
0	$\frac{1}{2}$
1	$\frac{1}{6}$

Shift →1 ↓3



HA $y = -3$

D:

R: ℝ $y > -3$

Apr 13-10:45 AM

Random problems of difficulty

$\ln e^4 = x$

$\log_e e^4 = x$ add x

$e^x = e^4$

$\boxed{x = 4}$

$\ln x$ = $\log_e x$ base "e" natural log

$\log x = \log_{10} x$ base 10 common log

May 1-11:47 AM

ReWrite From Log to Exponential

1. $\log_7 49 = 2$ $7^2 = 49$
2. $\log_2 16 = 4$ $2^4 = 16$
3. $\log_5 125 = 3$ $5^3 = 125$
4. $\log_{16} 4 = \frac{1}{2}$ $16^{\frac{1}{2}} = 4$
5. $\log_4 \frac{1}{4} = -1$ $4^{-1} = \frac{1}{4}$
6. $\log_3 \frac{1}{9} = -2$ $3^{-2} = \frac{1}{9}$

Apr 2-7:55 AM

Warm Up: Evaluate

1. $\log_{12} 144 =$ 2
2. $\log_5 125 =$ 3
3. $\log 1000 =$ 3
4. $\log_{81} 1/3 =$ x
5. $\log_4 1 =$ 0
6. $\log_3 1/9 =$ -2
7. $\log_2 1/16 =$ -4
8. $\log_9 1 =$ 0
9. $\log_8 8 =$ 1
10. $\log_3 1/3 =$ -1
11. $\log_{1/4} 2 =$ $-\frac{1}{2}$
12. $\log_{-3} -27 =$ 3

$81^x = \frac{1}{3}$

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

Apr 2-7:54 AM

Find Inverses: - Switch x & y - Switch forms

1. $y = 6^x$
   $x = 6^y$
   $\boxed{\log_6 x = y}$
2. $y = \ln(x-5)$
   $x = \ln(y-5)$ exp base answ
   $e^x = y - 5$
   $\boxed{e^x + 5 = y}$
3. $y = \log_8 x$ ←answ exp base
   $x = \log_8 y$
   $\boxed{8^x = y}$
4. $y = e^{x+2}$
   $x = e^{y+2}$
   $\log_e x = y + 2$
   $\boxed{\ln x - 2 = y}$
5. $y = 2^x - 3$ answ base exp
   $x + 3 = 2^y$ ←exp answ base
   $\boxed{\log_2 (x+3) = y}$

Apr 2-7:54 AM

Use your Calc to Evaluate

13. $\ln\sqrt{5}$ $\boxed{.805}$

14. $\log 110$ $\boxed{2.04}$

15. $\ln\frac{1}{2}$ $\boxed{-.693}$

$\sqrt{5}=5^{\frac{1}{2}}$

Apr 2-7:55 AM

GRAPHING LOGARITHMIC FUNCTIONS You can use the inverse relationship between exponential and logarithmic functions to graph logarithmic functions.

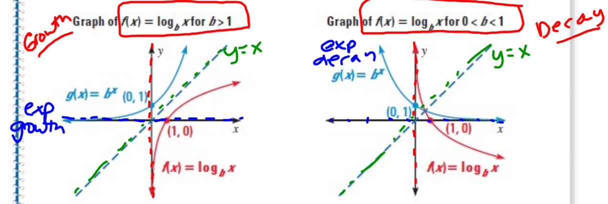
7.4 Continued with...

KEY CONCEPT *For Your Notebook*

Parent Graphs for Logarithmic Functions

The graph of $f(x) = \log_b x$ is shown below for $b > 1$ and for $0 < b < 1$. Because $f(x) = \log_b x$ and $g(x) = b^x$ are inverse functions, the graph of $f(x) = \log_b x$ is the reflection of the graph of $g(x) = b^x$ in the line $y = x$.

Growth



Decay

Note that the y-axis is a vertical asymptote of the graph of $f(x) = \log_b x$. The domain of $f(x) = \log_b x$ is $x > 0$, and the range is all real numbers.

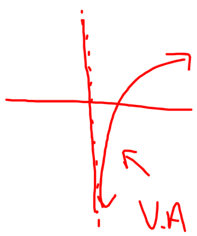
Apr 2-7:55 AM

$y=\log_b x$

General Shape

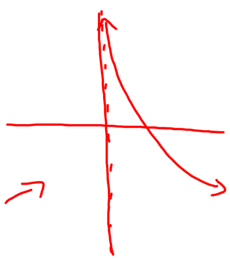
Growth

$b>1$



Decay

$0<b<1$



V.A. $x=0$

Apr 27-12:12 PM

Graphing Logs

Growth

1.) $y = \log_2 x$

$b>0$

$2^y = x$

Steps

(dont switch variables)

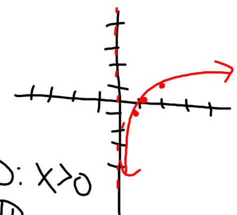
1st rewrite to exp

2nd plot 3 points in "y"

x	y
$\frac{1}{2}$	-1
1	0
2	1

3rd $x=0$ Vertical

V.A. Asymptote



D: $x>0$

R: $\mathbb{R}$

Apr 2-7:56 AM

Graph.

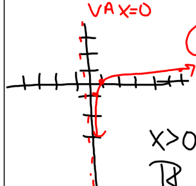
1.) $f(x) = \log_6 x$

$y=\log_6 x$

$6^y = x$

x	y
$\frac{1}{6}$	-1
1	0
6	1

VA $x=0$



$x>0$

$\mathbb{R}$

1st Rewrite

2nd 3pts in y

3rd Graph

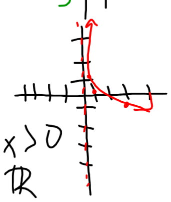
4th Domain Range

2.) $f(x) = \log_{1/3} x$

$y=\log_{\frac{1}{3}} x$

$\left(\frac{1}{3}\right)^y = x$

x	y
3	-1
1	0
$\frac{1}{3}$	1



$x>0$

$\mathbb{R}$

Apr 2-7:56 AM

$y=\log_b(x-h)+k$ VA $x=h$

ex $y=\log_3(x+1)-2$

1st Take just the root

2nd rewrite

3rd Plot 3 pts in "y"

4th Shift "h" ⇔ "k" ⇕

5th "h" value is V.A.

1st $y=\log_3 x$

2nd $3^y = x$

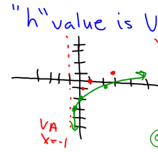
3rd

x	y
$\frac{1}{3}$	-1
1	0
3	1

← 1

↓ 2

$x=-1$



VA $x=-1$

D: $x>-1$

R: $\mathbb{R}$

ex $y=\log_3(x+1)-2$

Apr 27-12:23 PM

TRANSLATIONS You can graph a logarithmic function of the form $y = \log_b(x - h) + k$ by translating the graph of the parent function $y = \log_b x$.

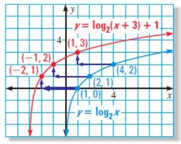
EXAMPLE 8 Translate a logarithmic graph

Graph $y = \log_2(x + 3) + 1$. State the domain and range.

Solution

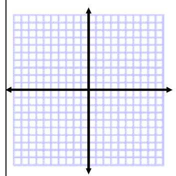
STEP 1 **Sketch** the graph of the parent function $y = \log_2 x$, which passes through (1, 0), (2, 1), and (4, 2).

STEP 2 **Translate** the parent graph left 3 units and up 1 unit. The translated graph passes through (−2, 1), (−1, 2), and (1, 3). The graph's asymptote is $x = -3$. The domain is $x > -3$, and the range is all real numbers.



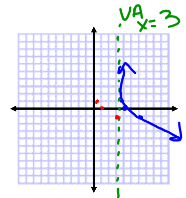
Apr 2-7:56 AM

16. $y = \log_5 x$



17. $y = \log_{1/3}(x - 3)$

VA $x = 3$



$y = \log_{\frac{1}{3}} x$

x	y
3	−1
1	0
$\frac{1}{3}$	1

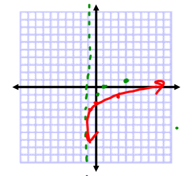
$\left(\frac{1}{3}\right)^y = x$

Shift → 3

D: $x > 3$ R: $\mathbb{R}$

18. $f(x) = \log_4(x + 1) - 2$

VA $x = -1$



$y = \log_4 x$

$4^y = x$

x	y
$\frac{1}{4}$	−1
1	0
4	1

Shift ← 1 ↓2

Apr 2-7:56 AM

Hw Pg 504, #46,47, 49, 50, 51,52

Apr 13-12:04 PM