Math 3

3.2 Graphing Exponentials and Logs

Unit 3

SWBAT graph exponential and logarithmic functions as inverses on the coordinate plane.

Example 1: Find the inverse of the following. Remember, swap x and y, and solve for y again!

a) $y = \log_5 x$

$\log_5 y = x$

$5^x = y$

$f^{-1}(x) = 5^x$

b) $y = \log_7 x - 1$

$x = \log_7 y - 1$

$x + 1 = \log_7 y$

$\log_7 y = x + 1$

$7^{x+1} = y$

$f^{-1}(x) = 7^{x+1}$

c) $y = \log_3(x-2)$

$\log_3(y-2) = x$

$3^x = y - 2$

$3^x + 2 = y$

$f^{-1}(x) = 3^x + 2$

d) $y = \log_4(x+3) - 8$

$\log_4(y+3) - 8 = x$

$\log_4(y+3) = x + 8$

$4^{x+8} = y + 3$

$4^{x+8} - 3 = y$

$f^{-1}(x) = 4^{x+8} - 3$

Exponential Function		Logarithmic Function	
A function whose unknown (x) is located in the exponent		The inverse function of an exponential function.	
Transformations: $y = a \cdot b^{x-h} + k$		**Transformations:** $y = a \cdot \log_b(x-h) + k$	
Asymptote:	$y = k$	**Asymptote:**	$x = h$

Example 2: Graphing Exponential Functions and their Inverses

a) $f(x) = 2^{x+1}$

x	f(x)
-2	0.5
-1	1
0	2
1	4
2	8

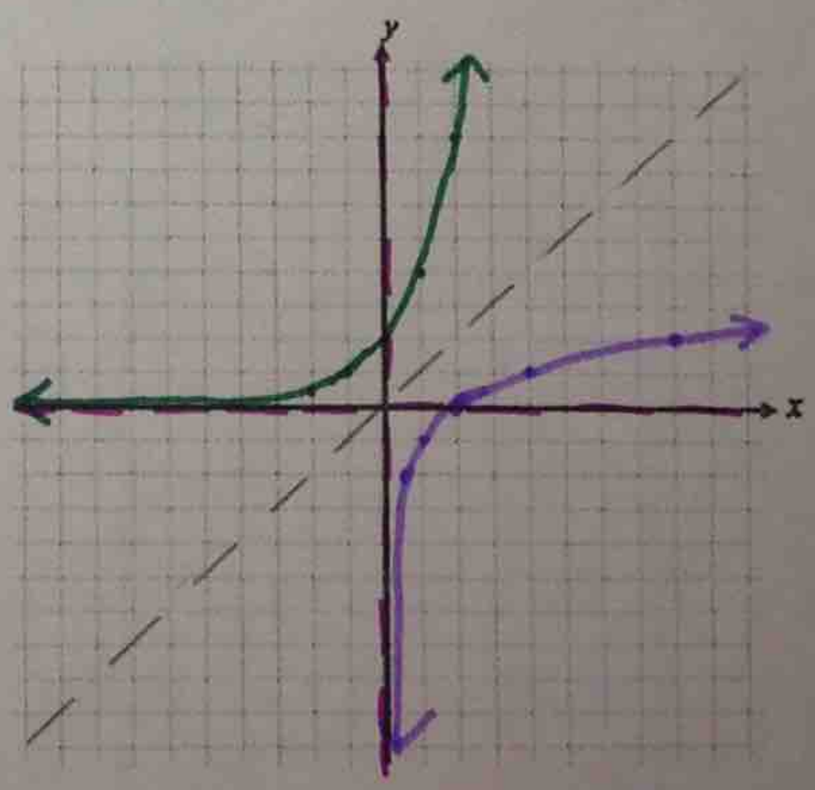
$f^{-1}(x) = \log_2 x - 1$

x	$f^{-1}(x)$
0.5	-2
1	-1
2	0
4	1
8	2

$2^{y+1} = x$

$\log_2 x = y + 1$

$\log_2 x - 1 = y$



Transformations:

Left 1

Down 1

Asymptote:

$y = 0$

$x = 0$

Domain:

$(-\infty, \infty)$

$(0, \infty)$

Range:

$(0, \infty)$

$(-\infty, \infty)$

b) $f(x) = -3^{x-1} + 6$

x	f(x)
1	5
2	3
3	-3
4	-21

$f^{-1}(x) = \log_3(-x+6)+1$

x	$f^{-1}(x)$
5	1
3	2
-3	3
-21	4

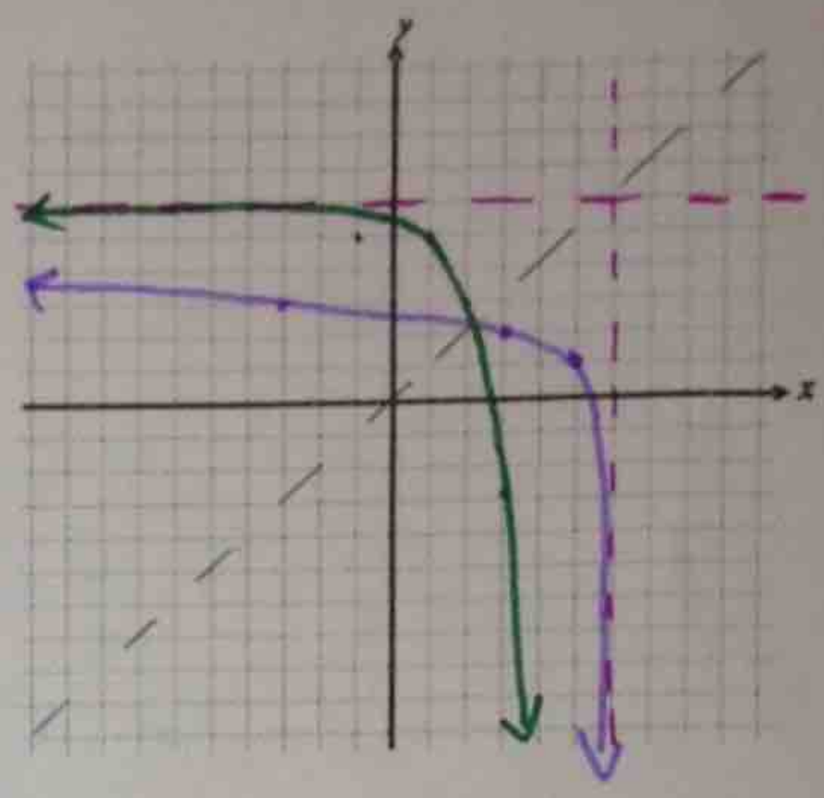
$-3^{y-1}+6 = x$

$-3^{y-1} = x-6$

$3^{y-1} = -x+6$

$\log_3(-x+6) = y-1$

$\log_3(x+6)+1 = y$



Transformations:

ROX, R1, U6

ROY, R6, U1

Asymptote:

$y=6$

$x=6$

Domain:

$(-\infty, \infty)$

$(-\infty, 6)$

Range:

$(-\infty, 6)$

$(-\infty, \infty)$

c) $f(x) = \log_2 x - 3$

x	f(x)
0.5	-4
1	-3
2	-2
4	-1
8	0

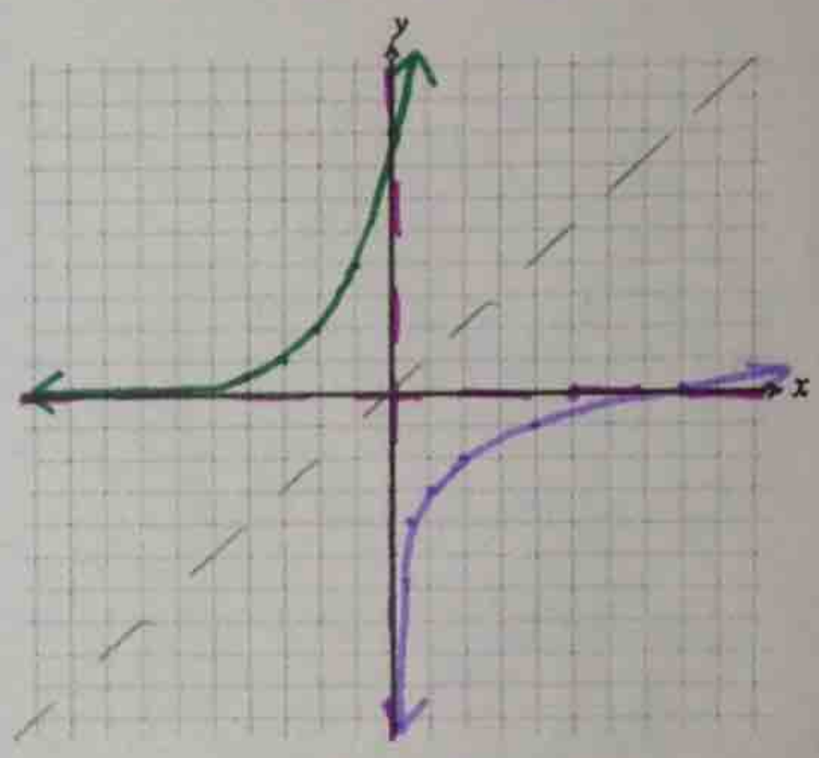
$f^{-1}(x) = 2^{x+3}$

x	$f^{-1}(x)$
-4	0.5
-3	1
-2	2
-1	4
0	8

$\log_2 y - 3 = x$

$\log_2 y = x+3$

$2^{x+3} = y$



Transformations:

Down 3

Left 3

Asymptote:

$x=0$

$y=0$

Domain:

$(0, \infty)$

$(-\infty, \infty)$

Range:

$(-\infty, \infty)$

$(0, \infty)$

d) $f(x) = -\log_4(x+4)+2$

x	f(x)
-3.75	3
-3	2
0	1
12	0

$f^{-1}(x) = 4^{-x+2} - 4$

x	$f^{-1}(x)$
3	-3.75
2	-3
1	0
0	12

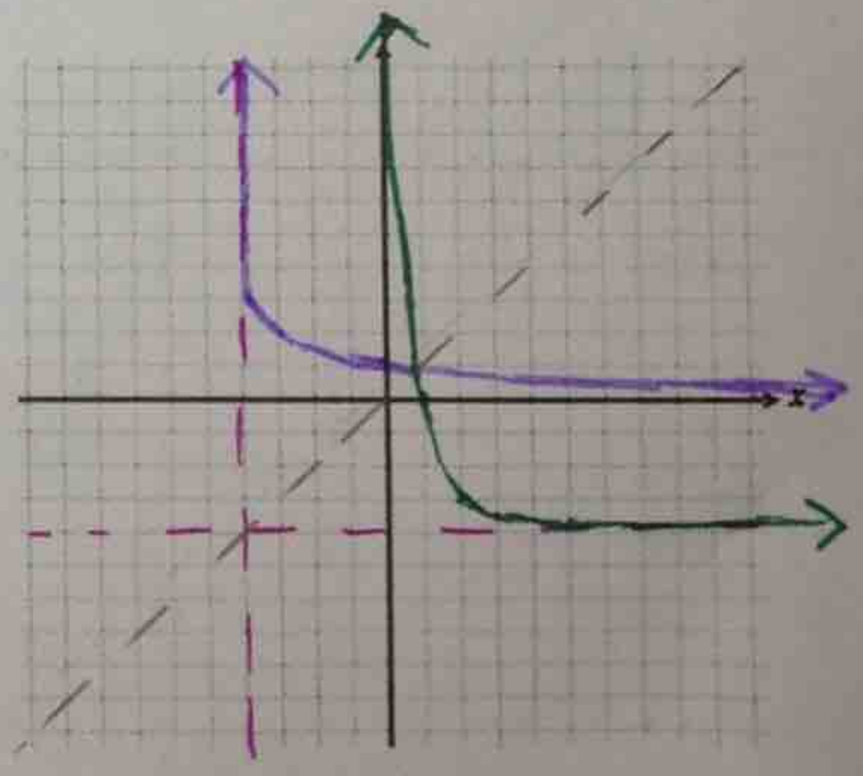
$-\log_4(y+4)+2 = x$

$-\log_4(y+4 = x-2$

$\log_4(y+4) = -x+2$

$4^{-x+2} = y+4$

$4^{-x+2} - 4 = y$



Transformations:

ROX, L4, U2

RO4, R2, D4

Asymptote:

$x=-4$

$y=-4$

Domain:

$(-4, \infty)$

$(-\infty, \infty)$

Range:

$(-\infty, \infty)$

$(-4, \infty)$