11.4 Explore: Logarithms

1. Complete the table below for the function $f(x) = 10^x$. Then, reverse the coordinates and enter them in Table 2.

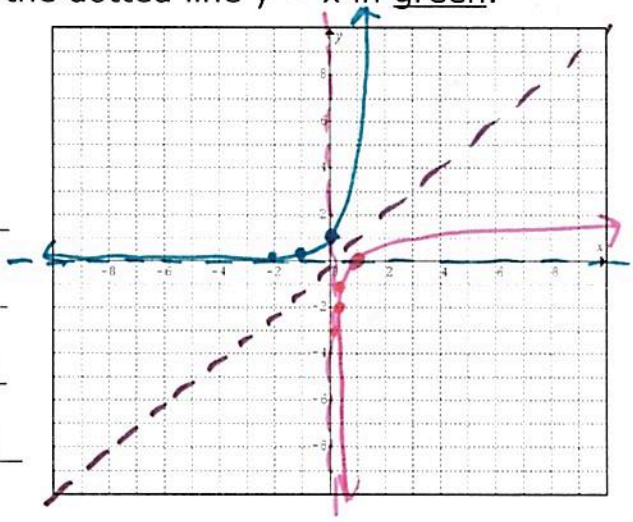
Table 1: $f(x) = 10^x$

x	f(x)
-2	$\frac{1}{100}$
-1	$\frac{1}{10}$
0	1
1	10
2	100
3	1000

Table 2: $f(x) = \log x$

x	g(x)
$\frac{1}{100}$	-2
$\frac{1}{10}$	-1
1	0
10	1
100	2
1000	3

Plot the points from each table on the graph below and extend the graph. Plot Table 1 in blue, and plot Table 2 in red. Finally, draw in the dotted line y = x in green.



f(x)-Blue Graph:

Domain: $\mathbb{R}$

Range: $y > 0$

Asymptote: $y = 0$

Intercept: $0, 1$

g(x)-Red Graph:

Domain: $x > 0$

Range: $\mathbb{R}$

Asymptote: $x = 0$

Intercept: $(1, 0)$

What is the relationship between the blue graph and the red graph?

Inverses

2. Complete the table below for the function $f(x) = e^x$. Then, reverse the coordinates and enter them in Table 2.

Table 1:

x	f(x)
-2	.135
-1	.368
0	1
1	2.718
2	7.389
3	20.09

Table 2:

x	g(x)
.135	-2
.368	-1
1	0
2.718	1
7.389	2
20.09	3

Plot the points from each table on the graph below and extend the graph. Plot Table 1 in blue, and plot Table 2 in red. Finally, draw in the dotted line $y = x$ in green.

f(x)-~~Blue~~ Pink Graph:

Domain: IR

Range: $y > 0$

Asymptote: $y = 0$

Intercept: (0,1)

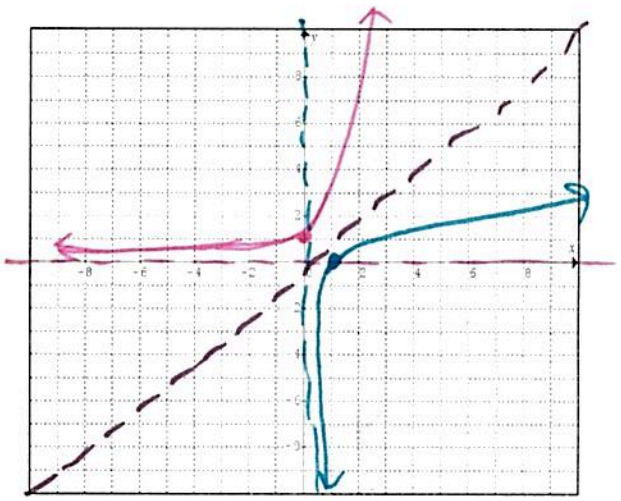
g(x)-~~Red~~ Blue Graph:

Domain: $x > 0$

Range: IR

Asymptote: $x = 0$

Intercept: (1,0)



What is the relationship between the blue graph and the red graph?

Inverses

- The inverse of an exponential function is a logarithmic function.
- Exponential to Log example: $y = (\text{Base})^x \rightarrow y = \log_{\text{Base}}(x)$
- If no base is given for log(x), it is assumed to be Base 10.
- If no base is given for ln(x), it is assumed to be Base e.

11.5 Graphing Transformation of Log Functions Name Izzy
PAP Algebra 2

Example 1 Graph $y = \log_2 x$.
First get three points on the inverse.

Inverse Equation: $y = 2^x$

x	y
-1	1/2
0	1
1	2

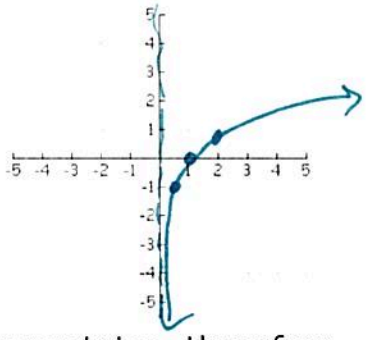
Domain: IR

Range: $y > 0$

HA: $y = 0$

Now, using the fact that logs are inverses of exponential functions, create a table for $y = \log_2 x$ and graph.

x	y
1/2	-1
1	0
2	1



Exponential functions have a horizontal asymptote; therefore, a log function should have a vertical asymptote. Make sure to include the asymptote, as a dotted/dashed line, on all your log graphs.

VA: $x = 0$ Domain: $x > 0$ Range: IR

Example 2 Graph $y = 3\log_3 x + 2$.

First, note the transformations of $y = 3\log_3 x + 2$? V. Stretch up 2

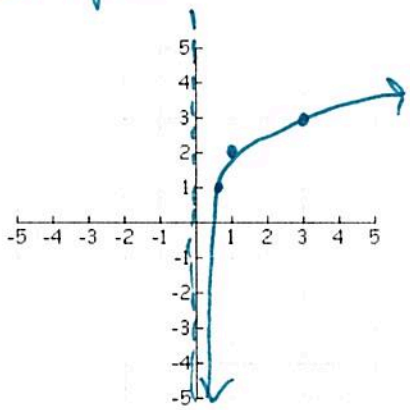
Step 1: Make a table of values for $y = 3^x$
Step 2: Make a table of values for $y = \log_3 x$.
Step 3: Make a table of values for $y = 3 \log_3 x + 2$
Step 4: Graph the shifted equation.

x	y
-1	1/3
0	1
1	3

x	y
1/3	-1
1	0
3	1

+2

x	y
1/3	1
1	2
3	3



VA: $x = 0$ Domain: $x > 0$ Range: IR

a) Did the vertical asymptote move from the parent function? Why or why not?

No Because Didn't Shift left or Right

3) Graph $y = \log_4(x + 2)-3$.

Step 1: Make a table of values for y = 4^x

Step 2: Make a table of values for y = $\log_4 x$

Step 3: Make a table of values for y = $\log_4(x+2)-3$

Step 4: Graph the shifted equation.

Transformations:

$y=4^x$

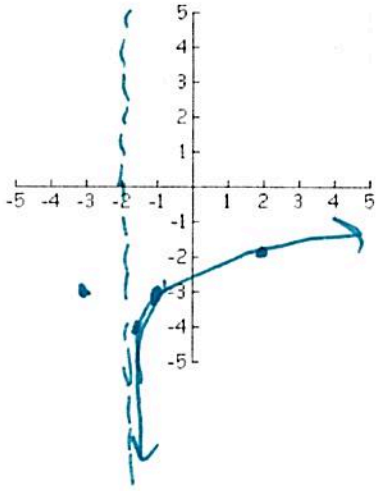
x	y
-1	1/4
0	1
1	4

$\log_4 x$

x	y
1/4	-1
1	0
4	1

$\log_4(x+2)-3$; -2 ; -3

x	y
-1.75	-4
-1	-3
2	-2



VA: $x=-2$ Domain: $x>-2$ Range: $\mathbb{R}$

a) Did the vertical asymptote move from the parent function? Why or why not?

Yes horiz. shift left 2

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

Transformations: left 2, down 1

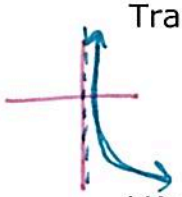
VA: $x=-2$

Domain: $x>-2$

Range: $\mathbb{R}$

5) Given $y= -\log x+2$

Transformations: V. Reflect. up 2



VA: $x=0$

Domain: $x>0$

Range: $\mathbb{R}$

6) Given $y= 2\ln(x-1)$

Transformations: V. Stretch, Right 1

VA: $x=0$

Domain: $x>0$

Range: $\mathbb{R}$

7) Given $y= -2\log_3 x-5$

Transformations: V. Reflection, V. Stretch, Down 5

VA: $x=0$

Domain: $x>0$

Range: $\mathbb{R}$

11.5 Graphing Transformation of Log Functions Name Key
PAP Algebra 2 Homework

For #1-4, graph the given log functions. Identify transformations and fill out the tables, graph, and give the domain, range, and vertical asymptote of each.

1. $y = \log_2(x-1)+3$

Transformations:

$y=2^x$

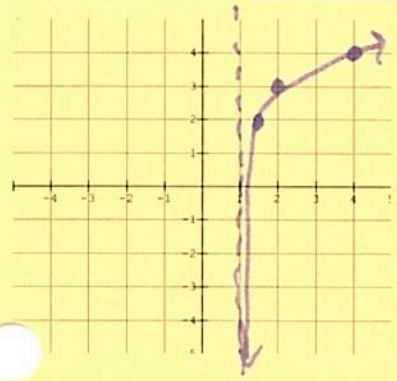
x	y
-1	1/2
0	1
1	2

$y=\log_2(x)$

x	y
1/2	-1
1	0
2	1

+1 +3

x	y
1.5	2
2	3
4	4



VA: $x=1$

Domain: $x>1$

Range: $\mathbb{R}$

2. $y = 4\log_3 x$

Transformations:

$y=3^x$

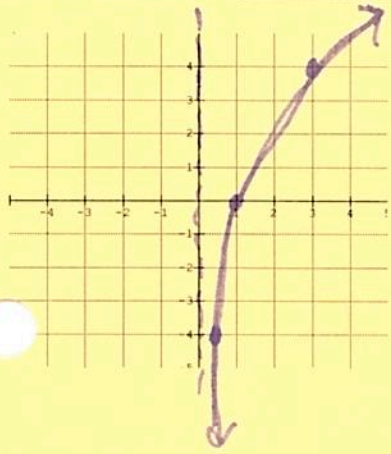
x	y
-1	1/3
0	1
1	3

$\log_3(x)$

x	y
1/3	-1
1	0
3	1

×4

x	y
1/3	-4
1	0
3	4



VA: $x=0$

Domain: $x>0$

Range: $\mathbb{R}$

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

Transformations:

$y=4^x$

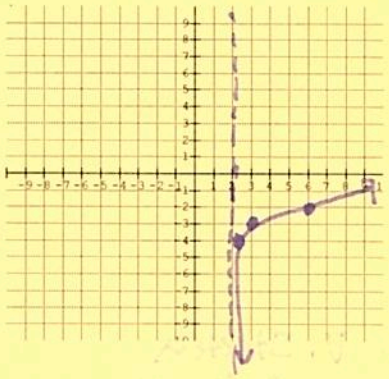
x	y
-1	1/4
0	1
1	4

$\log_4(x)$

x	y
1/4	-1
1	0
4	1

+2 -3

x	y
2.25	-4
3	-3
6	-2



VA: $x=2$

Domain: $x>2$

Range: $\mathbb{R}$

4. $y = -\log_2(x+3)$

Transformations:

$y=2^x$

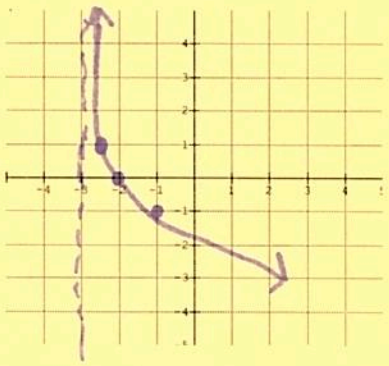
x	y
-1	1/2
0	1
1	2

$\log_2(x)$

x	y
1/2	-1
1	0
2	1

-3 *-1

x	y
-2.5	1
-2	0
-1	-1



VA: $x=-3$

Domain: $x>-3$

Range: $\mathbb{R}$

For 5-8, find the following information given the logarithmic functions. (Make a sketch if necessary).

5. $y = \log_5(x-3) - 5$

Transformations: Right 3 Down 5

VA: $x = 3$

Domain: $x > 3$

Range: $\mathbb{R}$

6. $y = -2\ln(x+1)$

Transformations: V. Stretch
V. Reflection
left 1

VA: $x = -1$

Domain: $x > -1$

Range: $\mathbb{R}$

7. $y = \frac{1}{3}\log x + 5$

Transformations: V. Compression
up 5

VA: $x = 0$

Domain: $x > 0$

Range: $\mathbb{R}$

8. $y = \frac{5}{3}\log_2(x-2)$

Transformations: V. Stretch
Right 2

VA: $x = 2$

Domain: $x > 2$

Range: $\mathbb{R}$