GUIDED NOTES – Lesson 7-1
Graphing Logarithmic Functions

Name: Teacher Version Period: ___

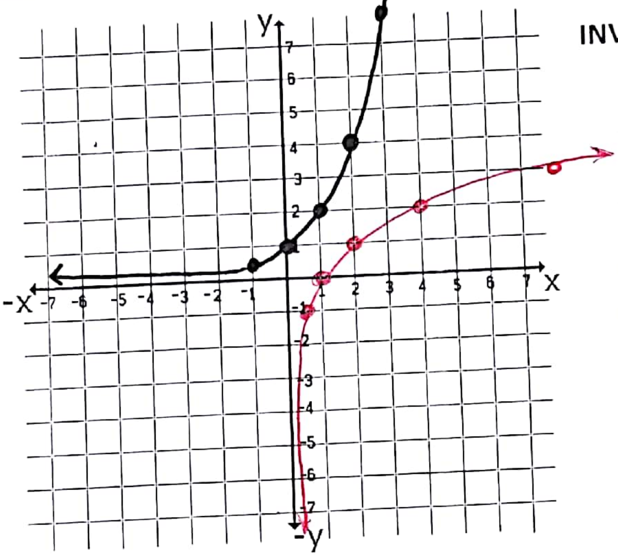
OBJECTIVE: I can identify the types of exponential functions, as well as evaluate and graph them.

GRAPHING: Logarithmic functions are really just the inverse function of exponentials.

EXPONENTIAL FUNCTION

$y = 2^x$

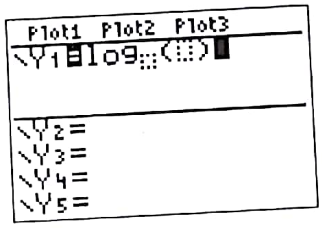
x	y
-1	.5
0	1
1	2
2	4
3	8



INVERSE FUNCTION

$x = 2^y$

x	y
.5	-1
1	0
2	1
4	2
8	3



LOGARITHMIC FUNCTION (write the inverse as a log like lesson 6-5)

$2^y = x \rightarrow \log_2 x = y$

For the parent function, $y = \log_b x$, the graph contains the ordered pairs (1, 0) and (b, 1). It has an asymptote at x = 0.

Domain:	Range:	x-intercept:	y-intercept:	Asymptote:
$(0, \infty)$	$(-\infty, \infty)$	$(1, 0)$	N/A none	$x = 0$

TRANSFORMATIONS: $f(x) = (a)\log_b(x - h) + k$

h tells us about horizontal movement.

If **h is positive...** moves left   If **h is negative...** moves right

a tells us about stretching, reflecting, and compressing.

If **a is negative...** reflects over the x-axis   If **a > 1...** compresses   If **0 < a < 1...** stretches

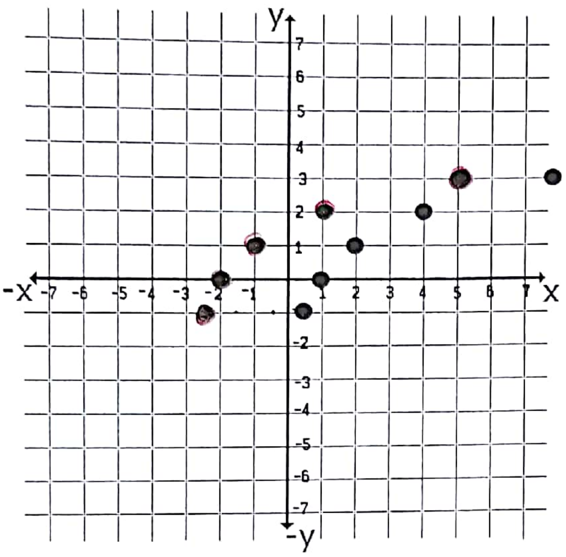
k tells us about vertical movement.

If **k is positive...** moves up   If **k is negative...** moves down

So to graph logarithmic functions with transformations...

1. Plot the parent function ordered pairs and asymptote. (1, 0) and (b, 1)
2. Move each ordered pair and the asymptote h units and k units

$y = log_2(x + 3)$



Domain: $(-3, \infty)$

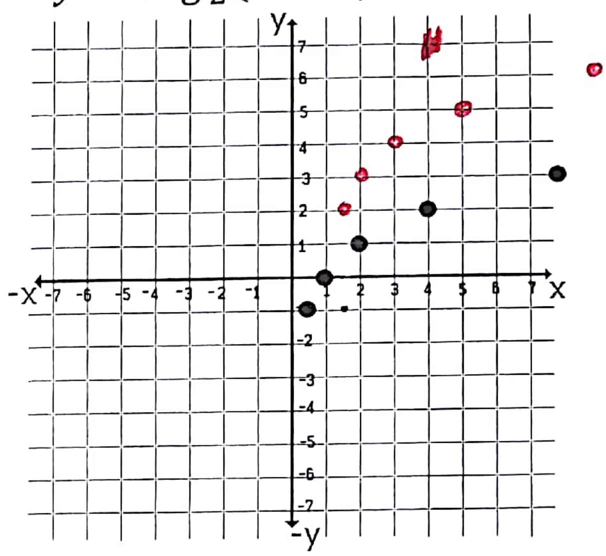
Range: $(-\infty, \infty)$

x-intercept: $(-2, 0)$

y-intercept: $\approx (0, 1.5)$

Asymptote: $x = -3$

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



Domain: $(1, \infty)$

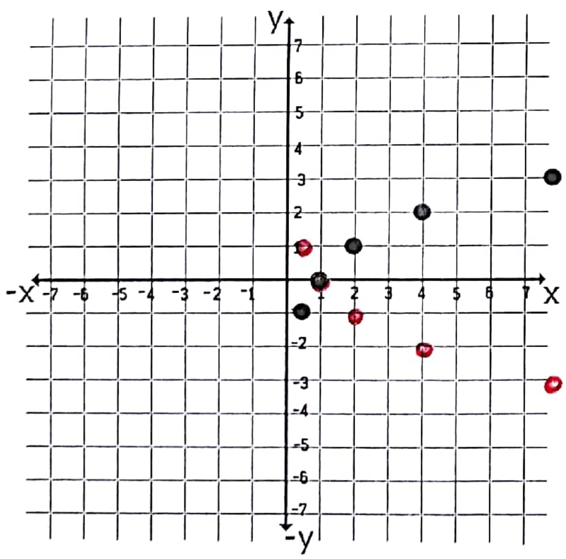
Range: $(-\infty, \infty)$

x-intercept: $\approx (1.3, 0)$

y-intercept: none

Asymptote: $x = 1$

$y = -log_2 x$



Domain: $(0, \infty)$

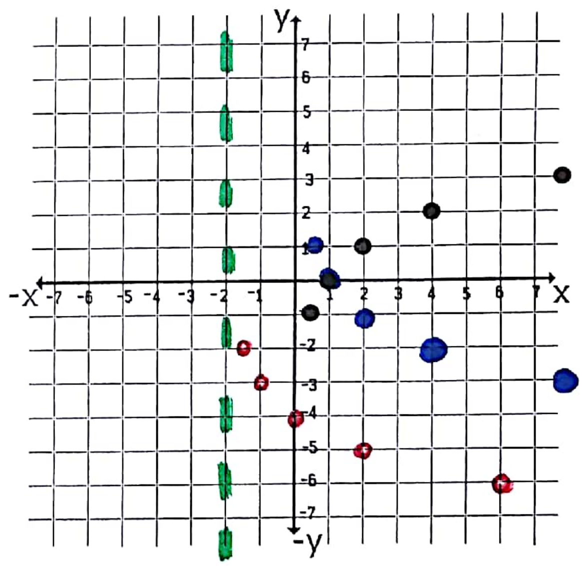
Range: $(-\infty, \infty)$

x-intercept: $(1, 0)$

y-intercept: none

Asymptote: $x = 0$

$y = -log_2(x + 2) - 3$



Domain: $(-2, \infty)$

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

x-intercept: $\approx (-1.9, 0)$

y-intercept: $(0, -4)$

Asymptote: $\boxed{x = -2}$

COMMON LOG-BASE 10

When we use a common log with base 10, it is not necessary to indicate the base.

$log 15$ really means (to the calculator) $log_{10} 15$ which is 1.176

Use the log button on the calculator to take the base 10 log of any number.

Evaluate: Log 4 $\quad$ Log -2 = error $\quad$ Log 7

.602 $\quad$ $x > 0$ $\quad$ .845

How do we evaluate logarithms that are not common? Not all of the logs we need to take will be base 10....

Change of base formula:

$$\boxed{\log_a M = \frac{\log_b M}{\log_b a}}$$

so try that with $log_{20} 135$

$$\frac{\log 135}{\log 20} = 1.637$$

Evaluate using change of base: $log_2 8$ $\quad$ $log_3 4$ $\quad$ $log_{\frac{1}{2}} 9$

$$\frac{\log 8}{\log 2} = 3 \qquad \frac{\log 4}{\log 3} = 1.262 \qquad \frac{\log 9}{\log \frac{1}{2}} = -3.169$$

But wait!!! If you have a newer calculator you can do the following....