Name: **Key**

Date:_____

Every exponential function has an inverse function called the **logarithmic function.**

What is an inverse function?   An **inverse** switches the x and y coordinates. It makes a reflection over the line $y = x$. Use the definition of inverse to sketch the graph of the exponential function and its inverse, the logarithmic function.

We can switch between logarithmic form and exponential form: $\log_b M = N$ is equivalent to $b^N = M$

Complete the following chart:

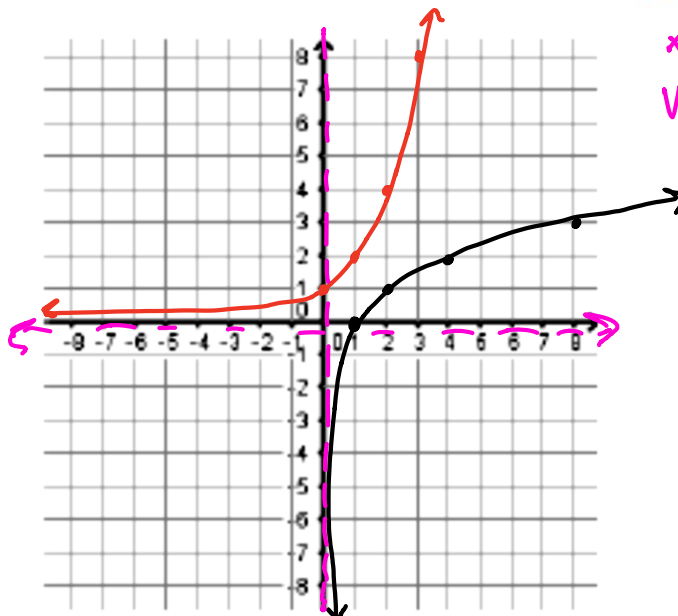| Log Form	Exp. Form
$\log_{10} 100{,}000 = 5$	$10^5 = 100{,}000$
$\log_2 8 = 3$	$2^3 = 8$
$\log_2 \left(\frac{1}{8}\right) = -3$	$2^{-3} = \frac{1}{8}$
$\log_5 s = r$	$5^r = s$

Graphing:
$$\frac{y = \log(x)}{\log(2)}$$

Graphing Log Functions

$$y = 2^x$$
Exponential Function

X	Y
-3	✗
-2	.25
-1	.5
0	1
1	2
2	4
3	8

$y = 0$
HA

D: $(-\infty, \infty)$
R: $(0, \infty)$

$$y = \log_2 x$$
Logarithmic Function

$x = 0$
VA

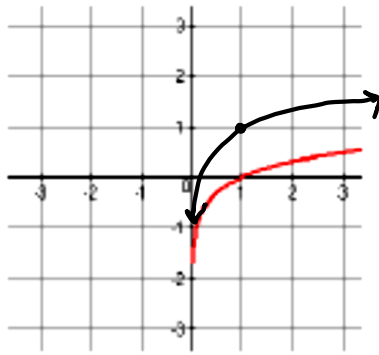| X	Y
0	1
2	1
4	2
8	3

D: $(0, \infty)$
R: $(-\infty, \infty)$

$\log_{10} x$ is called the **common log** and is written $\log x$. The log button on your calculator is the common log. For the following graphs, you will be using the common log. Sketch the graph of each transformation and state the domain and range.

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$\log_{10}(x)$

Transformations of Logarithmic Functions

1] $y = \log(x) + 1$

Domain: $(0, \infty)$
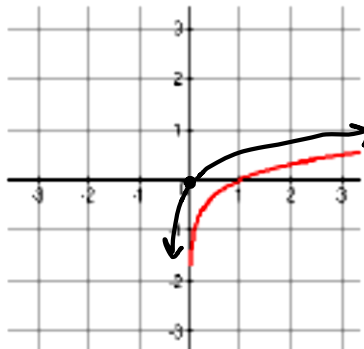Range: $(-\infty, \infty)$

2] $y = \log(x) - 1$

Domain: $(0, \infty)$
Range: $(-\infty, \infty)$

What affect does adding or subtracting a value "outside" the x have on the graph of the log function?
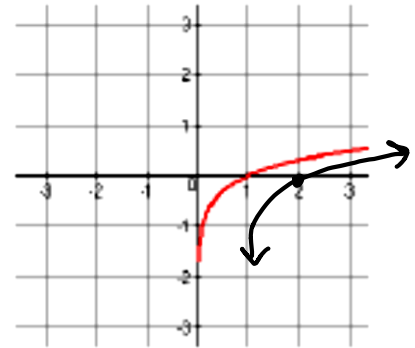
shifts it up or down

3] $y = \log(x + 1)$

Domain: $(-1, \infty)$
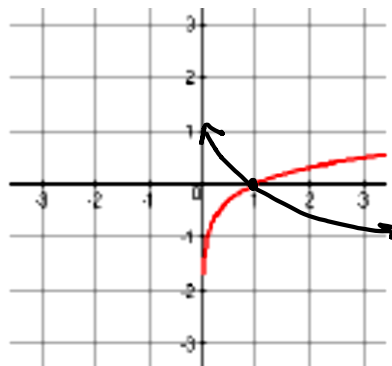Range: $(-\infty, \infty)$

4] $y = \log(x - 1)$

Domain: $(1, \infty)$
Range: $(-\infty, \infty)$

What affect does adding or subtracting a value from x have on the graph of the log function?
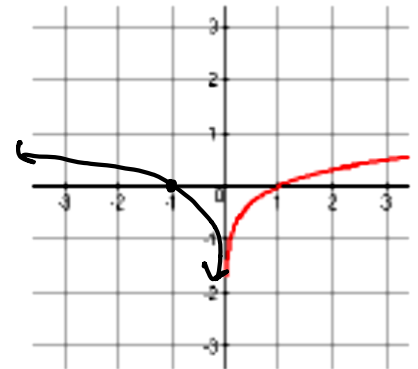
shifts right or left

5] $y = -\log x$

Domain: $(0, \infty)$
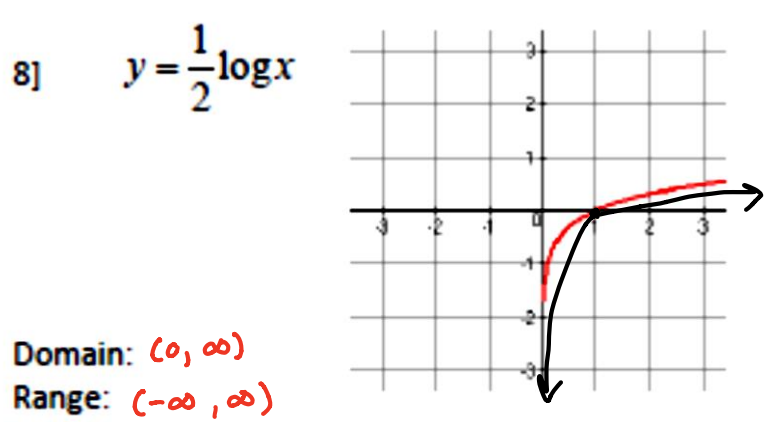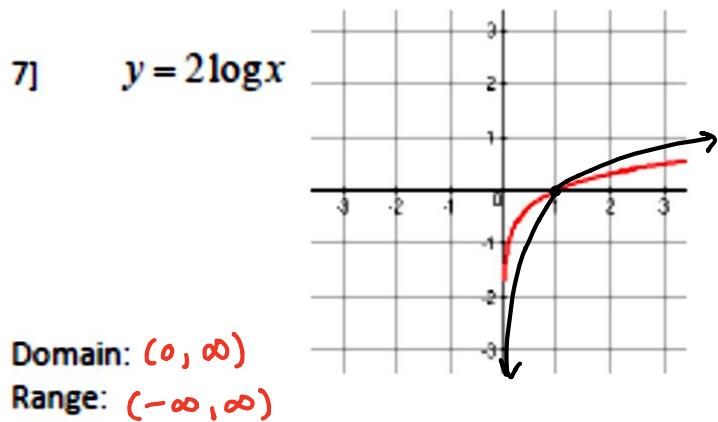Range: $(-\infty, \infty)$

6] $y = \log(-x)$

Domain: $(-\infty, 0)$
Range: $(-\infty, \infty)$

What affect does multiplying x by a negative have on the graph?
reflects over the y-axis

What affect does multiplying by a negative out front have on the graph?
reflects over the x-axis

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7] $y = 2\log x$

Domain: $(0, \infty)$
Range: $(-\infty, \infty)$

8] $y = \dfrac{1}{2}\log x$

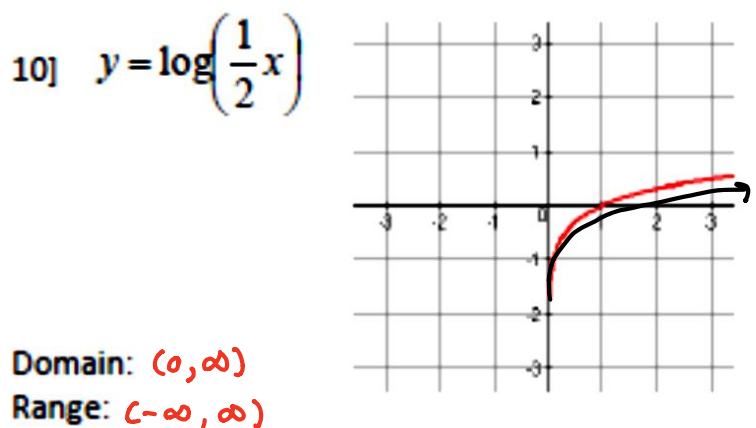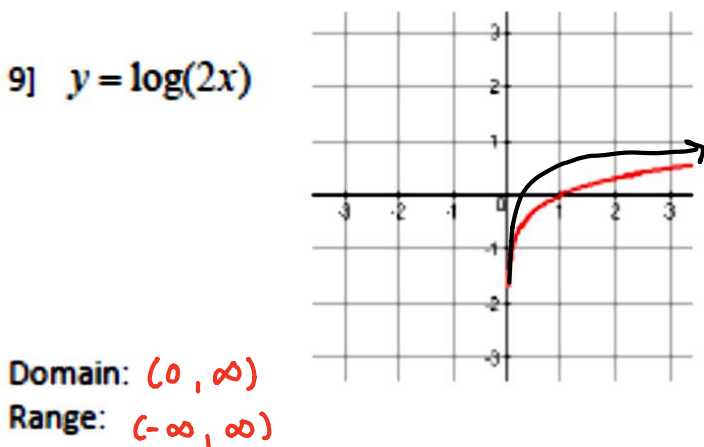Domain: $(0, \infty)$
Range: $(-\infty, \infty)$

What affect does multiplying the log by a constant greater than 1 have on the graph?

vertically stretches

What affect does multiplying the log by a constant between 0 and 1 have on the graph?

vertically shrinks

9] $y = \log(2x)$

Domain: $(0, \infty)$
Range: $(-\infty, \infty)$

10] $y = \log\left(\dfrac{1}{2}x\right)$

Domain: $(0, \infty)$
Range: $(-\infty, \infty)$

What affect does multiplying the x by a constant greater than 1 have on the graph?

horizontally shrinks

What affect does multiplying the x by a constant between 0 and 1 have on the graph?

horizontally stretches

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