Learning Goal: I will be able to graph transformations of logarithmic functions.

Minds On: What's that button do?

Action: Graphing Transformations

Consolidation: Where are they now?

Minds On

What's that button do? $\log_2 8 = 3$

Yesterday we learned what $\log_a x$ means.

It means, the exponent that must be applied to base *a* to get a value of *x*.

Your calculator has a **log** button, let's figure out what it does! (NO SPOILERS!)

Perform the following calculations:

log -1 = error

log 0 = error

log 0.1 =

log 0.5 =

log 1 =

log 2 =

log 10 =

What do you think the button does?

Minds On

What's that button do?

log -1 = error

log 0 = error

log 0.1 = -1

log 0.5 = -0.30

log 1 = 0 → $\log_{10} 1 = 0$

log 2 = 0.30

log 10 = 1 → $\log_{10} 10 = 1$

What do you think the button does?

What if we add in a few more?

log 100 = 2

log 1,000 = 3

log 10,000 = 4

Minds On

What's that button do?

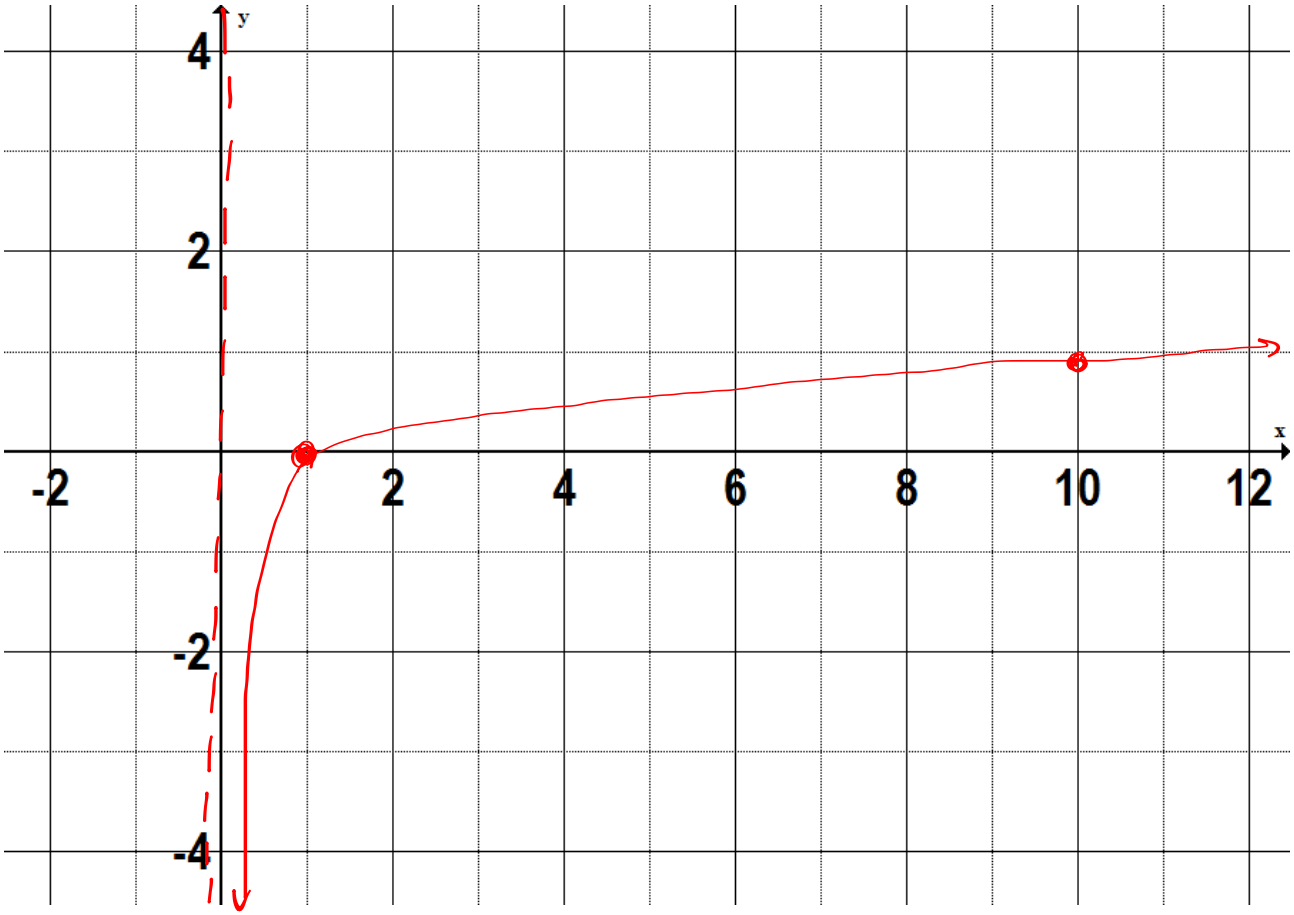
The **log** button on your calculator is actually

$$\log_{10}$$

Action

Graphing $f(x) = \log_{10} x$

Let's find some "nice" points to graph f(x) on the grid below.



Action

Graphing $g(x) = a \log_{10}(k(x - d)) + c$

What do each of the parameters: a, k, d, c

do to our function $f(x) = \log_{10} x$?

a

vertical stretch: $|a| > 1$

Vertical compression: $|a| < 1$

multiply y-values by a

if a is negative, reflects in x-axis

k

horizontal stretch: $|k| < 1$

horizontal compression: $|k| > 1$

divide x-values by k

if k is negative, reflects in y-axis

d

shifts left: $d < 0$

shifts right: $d > 0$

add d to x-values

c

shifts up: $c > 0$

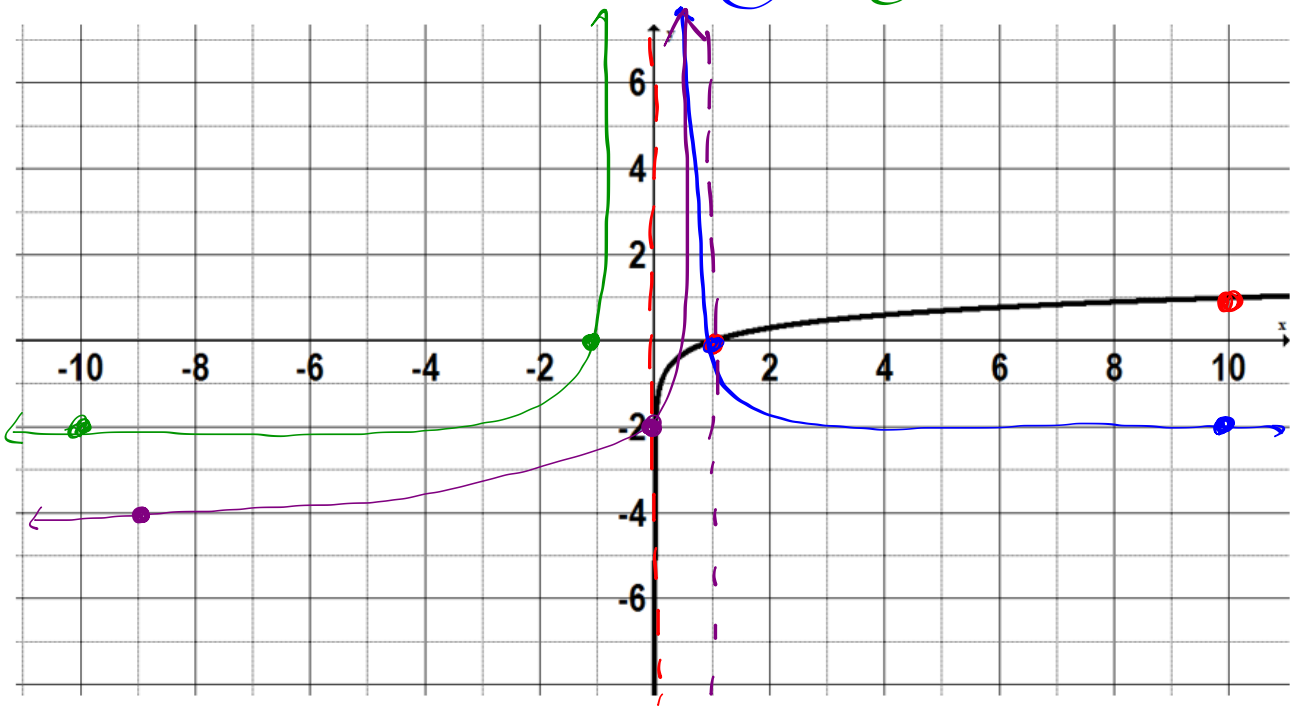
shifts down: $c < 0$

add c to y-values

Action

Graphing $g(x) = a \log_{10}(k(x - d)) + c$

Given the graph of $f(x) = \log_{10}x$ below, sketch $g(x) = -2log_{10}(-(x-1)) - 2$.



What is the domain of g(x)?

$\{x \in \mathbb{R} \mid x < 1\}$

Action

Graphing $g(x) = a \log_{10}(k(x - d)) + c$

How can we express the domain of g(x)?

Domain

If $k > 0$, domain $= \{x \in \mathbb{R} \mid x > d\}$

If $k < 0$, domain $= \{x \in \mathbb{R} \mid x < d\}$

Action

Determining the coordinates of the points of $\mathbf{g(x) = a\ log_{10}(k(x - d)) + c}$

Given the table of values of $\mathbf{f(x) = log_{10}x}$ below, determine the coordinates of the corresponding points of $g(x) = 3log_{10}(-2(x+3))+1$

x	y
$\frac{1}{10}$ = 0.1	-1
1	0
10	1

$\frac{x}{-2} - 3$	$3y + 1$
-3.05	-2
-3.5	1
-9	4

Consolidation

Where are they now?

f(x) = $\log_{10}x$ has the following points:

$$\left(\frac{1}{10}, -1\right), (1, 0), (10, 1)$$

State the coordinates of the "images" of the points above for each function below.

$$g(x) = -2\,log_{10}x + 2$$

x-values unchanged

y-values: $-2y + 2$

New Points = $\left(\frac{1}{10}, 4\right), (1, 2), (10, 0)$

Consolidation

Where are they now?

f(x) = $\log_{10}x$ has the following points:

$$\left(\frac{1}{10}, -1\right), (1, 0), (10, 1)$$

State the coordinates of the "images" of the points above for each function below.

$$h(x) = 0.5\, log_{10}\left(-\frac{1}{5}(x+3)\right) - 1$$

x-values: $-5x - 3$

y-values: $0.5y - 1$

$(-3.5, -1.5), (-8, -1), (-53, -0.5)$

Consolidation

Practice

Pg. 457

2b, 4, 8, 9