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?

Please either grab an ipad or use your phone to log into your board google account.

We will be filling out a survey for Ms. McPherson's 4C class.

Minds On

What's that button do? $\log_5 25$

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 =

log 0 =

log 0.1 =

log 0.5 =   **What do you think the button does?**

log 1 =

log 2 =

log 10 =

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 2 = 0.30

log 10 = 1

What do you think the button does?

What if we add in a few more?

$$* \; y = \log_a x$$

$$x = a^y$$

$$y = \log_{10} x$$

$$x = 10^y$$

log 100 = 2

log 1,000 = 3

log 10,000 = 4

$$\log_{10} 100$$
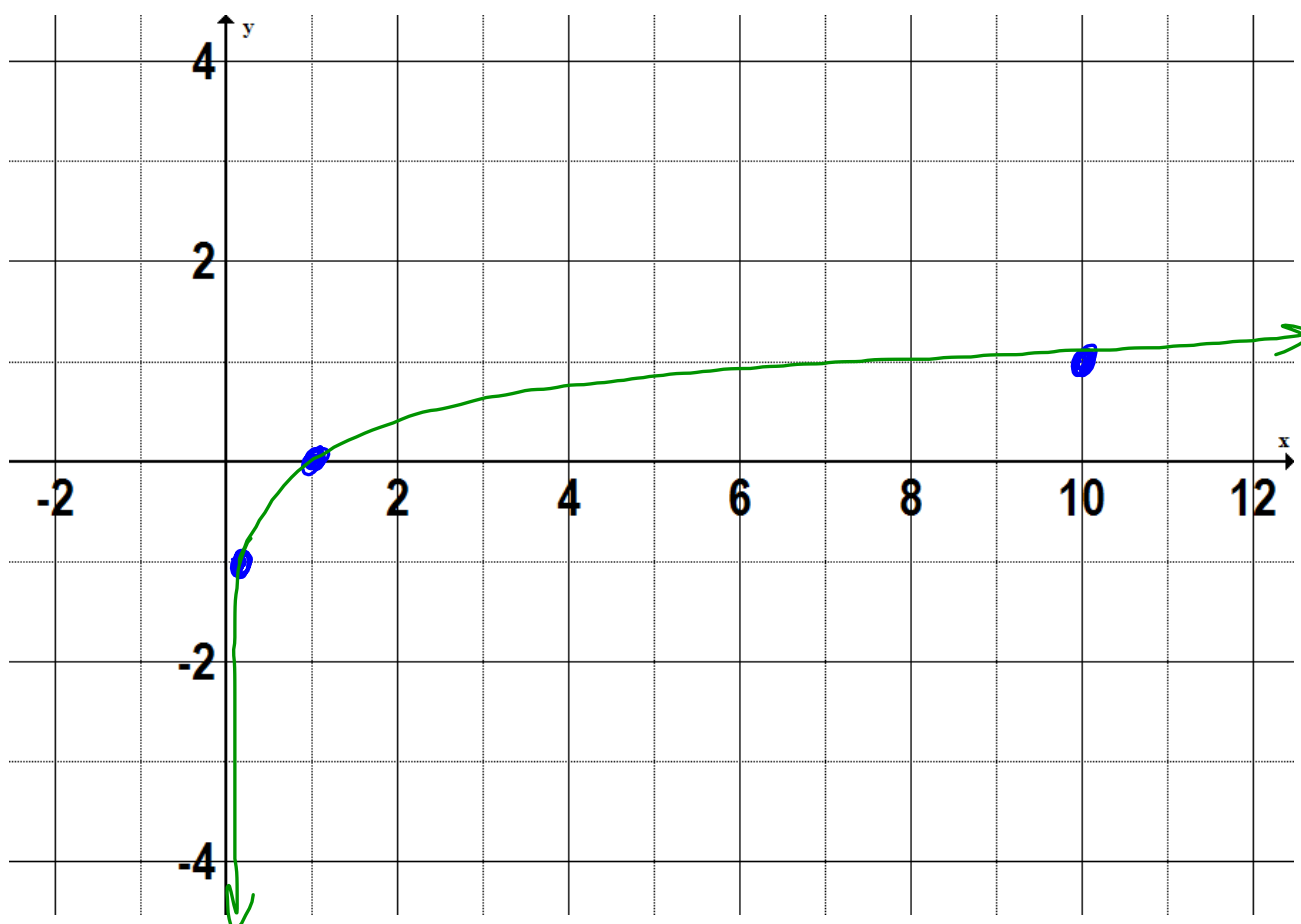
Minds On

What's that button do?

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

$$\mathbf{log_{10}}$$

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 / compression
reflects in the x-axis when negative
stretch when |a| > 1
compressed when 0 < |a| < 1
multiply original y-values by a

k

horizontal stretch / compression
reflects in the y-axis when negative
stretch when 0 < |k| < 1
compressed when |k| > 1
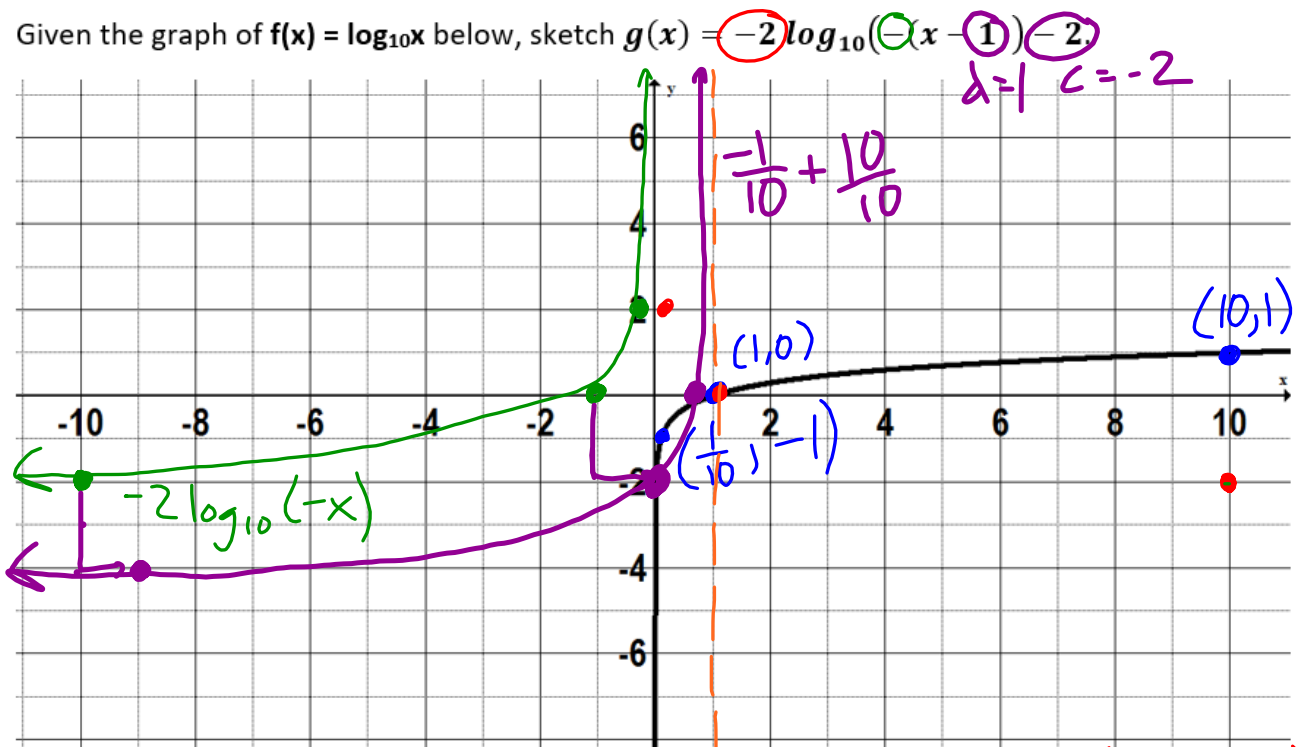divide original x-values by k

c

vertical translation

up when c > 0

down when c < 0

d

horizontal translation

right when d > 0

left when d < 0

Action

Graphing g(x) = a log₁₀(k(x - d)) + c

Given the graph of **f(x) = log₁₀x** below, sketch $g(x) = -2 \log_{10}(-(x - 1) - 2)$

$d=1 \quad c=-2$

$\frac{-1}{10} + \frac{10}{10}$

$(10,1)$

$(1,0)$

$(\frac{1}{10}, -1)$

$-2 \log_{10}(-x)$

a 1. Applied vertical stretch + reflection in x-axis. (Y values × -2)
k 2. Applied reflection in y-axis. (X-values ÷ -1)
d 3. Applied translations. (down 2, right 1)

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)?
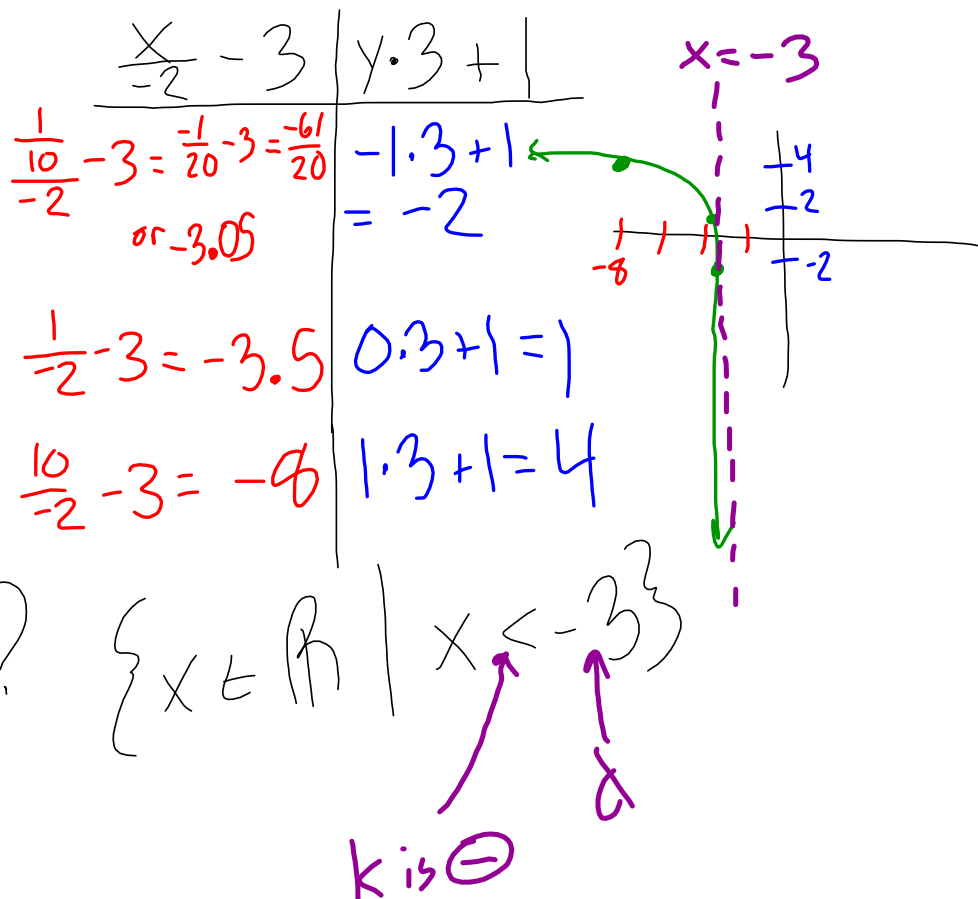
$$\{x \in \mathbb{R} \mid x > d\} \text{ when } k > 0$$

or

$$\{x \in \mathbb{R} \mid x < d\} \text{ when } k < 0$$

Action

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

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

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

$$\frac{x}{-2} - 3 \quad \Big| \quad y \cdot 3 + 1$$

$$\frac{\frac{1}{10}}{-2} - 3 = \frac{-1}{20} - 3 = \frac{-61}{20} \quad \Big| \quad -1 \cdot 3 + 1 = -2$$

or -3.05

$$\frac{1}{-2} - 3 = -3.5 \quad \Big| \quad 0 \cdot 3 + 1 = 1$$

$$\frac{10}{-2} - 3 = -8 \quad \Big| \quad 1 \cdot 3 + 1 = 4$$

$x = -3$

Domain? $\{x \in \mathbb{R} \mid x < -3\}$

d

k is $\ominus$

Consolidation

Where are they now?

f(x) = log₁₀x 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	y	X: -5 -3	y: 0.5 -1
$\frac{1}{10}$	-1	-3.5	-1.5
1	0	-8	-1
10	1	-53	-0.5

$$Domain = \{x \in \mathbb{R} \mid x < -3\}$$

Consolidation

Practice

Pg. 457

2b, 4, 8, 9

Consolidation