6.3: Transformaons of Logarithmic Funcons

Recall:

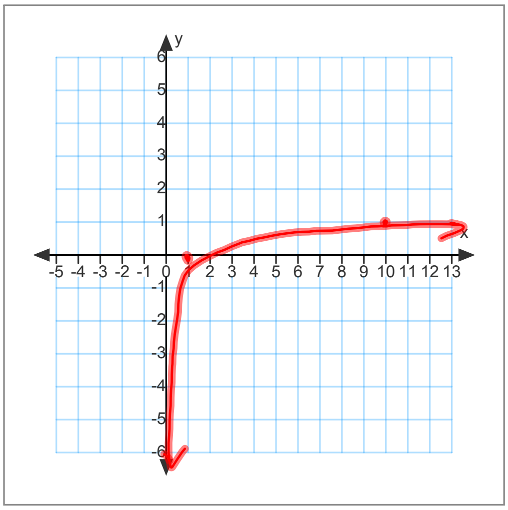
- Transformaons apply to logarithmic funcons in the same as they do to other funcons. Recall the following transformaons and their geometric effects on a graph:
- $f(x) \to f(x)+c$
- $f(x) \to f(x-d)$
- $f(x) \to af(x)$
- $f(x) \to f(kx)$

Example 1

Graph the common logarithm funcon $y = \log x$

ANCHOR POINTS

X	Y
1	0
2	0.3
3	0.48
4	0.60
5	0.70
6	0.78
7	0.84
8	0.9
9	0.95
10	1



Example 2

a) Graph the funcon $y = \log(x-2) - 5$

b) State the key features of the funcon

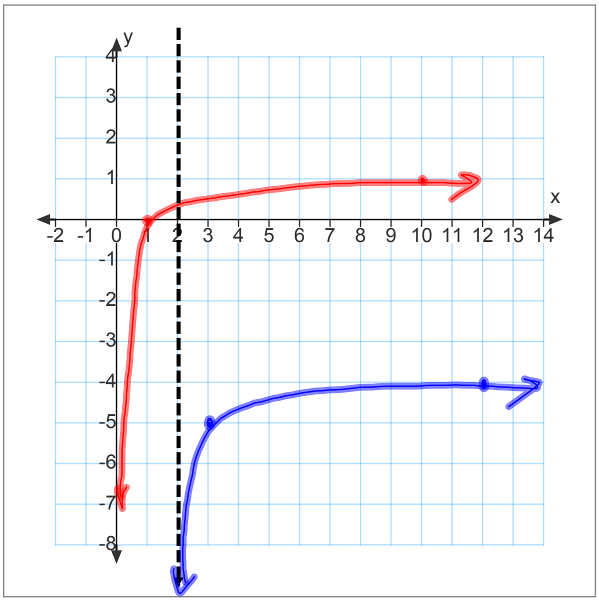
i) domain and range

ii) x - intercept (if it exists)

iii) y- intercept (if it exists)

iv) equaon of the asymptote

Sol'n: $y = \log(x-2) - 5$



- D: $\{x \mid x > 2, x \in \mathbb{R}\}$
- R: $\{y \mid y \in \mathbb{R}\}$
- x-int, $y = 0$

$y = \log(x-2) - 5$

$0 = \log(x-2) - 5$

$5 = \log(x-2)$

$10^5 = x - 2$

$10^5 + 2 = x$

$100{,}002 = x$

- no y-int.

asymptote: $x = 2$

Example 3

a) Sketch a graph of each funcon

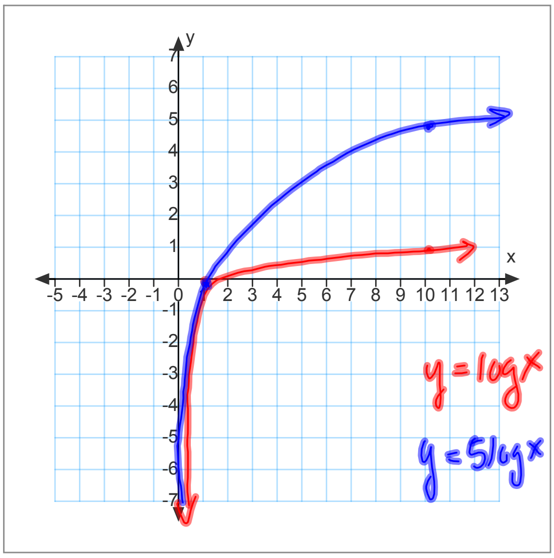
i) $y = 5\log(x+3)$

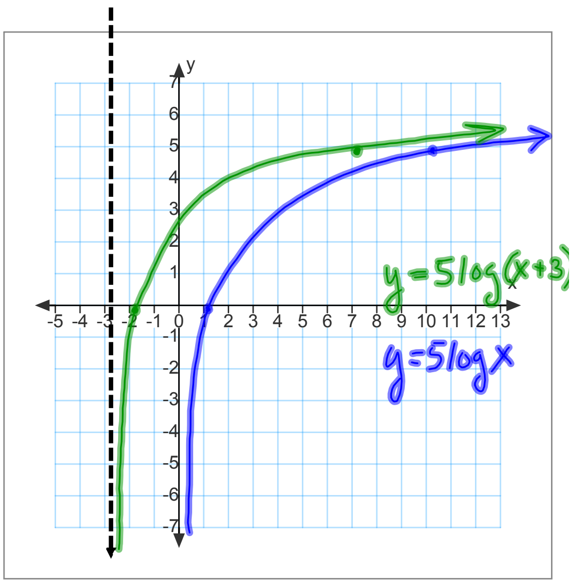
ii) $y = \log(-2x) + 4$

b) Idenfy the key features of each funcon

Sol'n:

$y = 5\log(x+3)$





key features:

Domain: $\{x \mid x > -3, x \in \mathbb{R}\}$

Range: $\{y \mid y \in \mathbb{R}\}$

Asymptote: $x = -3$

x-int: -2

y-int, set $x = 0$

$y = 5\log(x+3)$

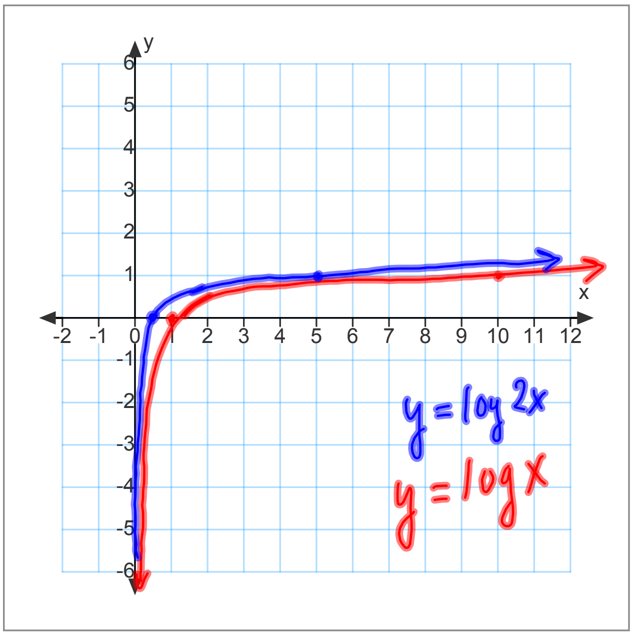
$y = 5\log(0+3)$

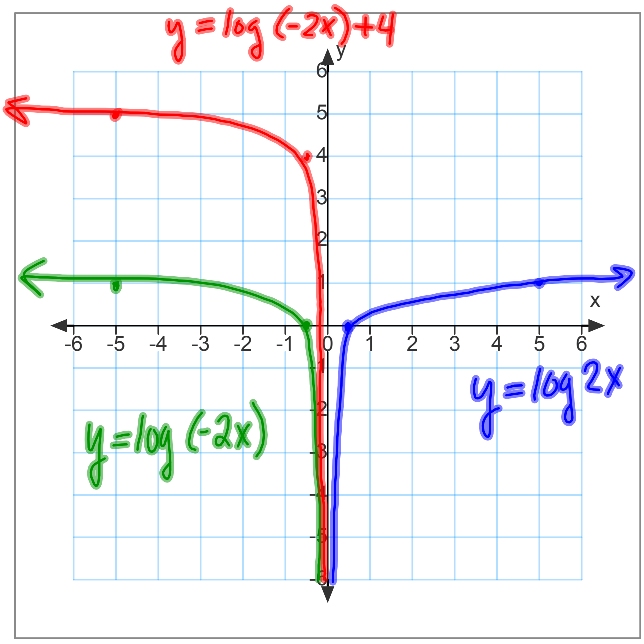
$y = 5\log 3$

$y \doteq 2.39$

$\therefore$ y-int $\doteq 2.39$

Sol'n: $y = \log(-2x) + 4$





key features:

Domain: $\{x \mid x < 0, x \in \mathbb{R}\}$

Range: $\{y \mid y \in \mathbb{R}\}$

Asymptote: $x = 0$

y-int: none.

X-int, set $y = 0$:

$y = \log(-2x) + 4$

$0 = \log(-2x) + 4$

$-4 = \log(-2x)$

$10^{-4} = -2x$

$\frac{1}{10^4} = -2x$

$-0.00005 = x$

X-int is -0.00005.

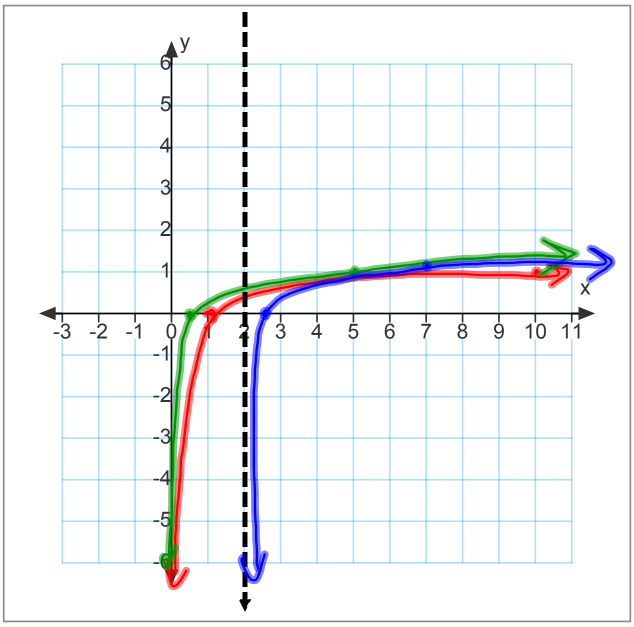
<u>Example 4</u>

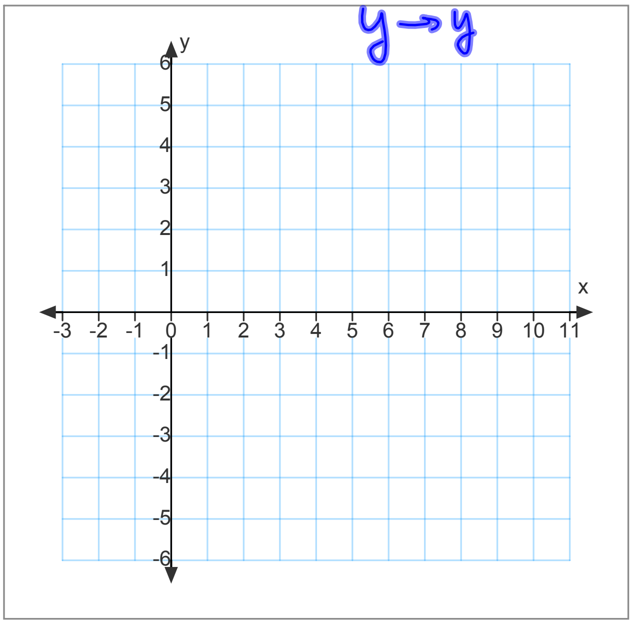
$y = \log[2(x-2)]$

a) Sketch a graph of the funcon $y = \log(2x-4)$

$y = \log 2(x-2)$ $\quad x \to \frac{1}{2}x + 2$

$y \to y$





Steps to perform mulple transformaons:

Step 1: Ensure that the funcon is in the form $y = a\log[k(x-d)]+c$

Step 2: Apply any horizontal or vercal stretches or compressions

Step 3: Apply any reflecons

Step 4: Apply any horizontal or vercal translaons