Unit 3: Converting Exponential Expressions into Logarthmic Expression

vice versa

$$y = a^x \longleftrightarrow \log_a y = x$$

equivalent!

base of exponent

base of the log

ex find x:

$$8 = 2^x \longrightarrow \log_2 8 = x$$

$$\frac{\log 8}{\log 2} = x$$

$$x = 3$$

$$\boxed{\log} = \log_{10}$$

$$\boxed{\ln} = \log_e$$

$e = 2.718\ldots$

e.x. convert to log form

☆ Before converting, you must isolate your exponential term (or you log term)

$$3^{y-1} + 4 \; -4 = x \; -4$$

$$3^{y-1} = x - 4$$

$y = a^{x} \leftrightarrow \log_a y = x$

$$\log_3(x-4) = y - 1$$

$$\log_3(x-4) \neq \log_3 x - 4$$

ex. convert to an log exp

$$-(2^x) - 3 = y$$

① isolate exp term

$$\frac{-(2^x)}{-1} = \frac{y+3}{-1}$$

② convert by following:

$y = a^x \leftrightarrow \log_a y = x$

$$2^x = -y - 3$$

$$\log_2(-y-3) = x$$

ex find the value of y

$$4^y = 64$$

$$\log_4 64 = y$$

$$y = \frac{\log 64}{\log 4}$$

$$\boxed{y = 3}$$

ex. Convert to exp form

1) $\log_2(x+1) = y - 7$

$x + 1 = 2^{y-7}$

2) $\log_2 x + 1 = y - 7$

step ①: make sure log term is isolated.

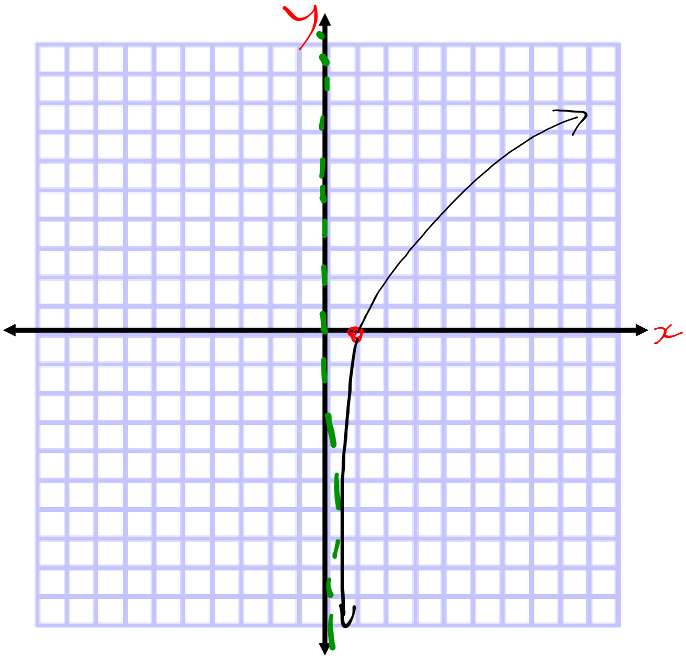
step ②: convert following

$y = a^x \Leftrightarrow \log_a y = x$

Unit 4: Graphing Log Function

$$f(x) = a\log_c b(x-h) + k$$

asymptote: $x = h$



c can do the same job as 'a'
- direction up/down
- scale

if $c>1$, facing up
if $0<c<1$, facing down

ex of a log function

$a=1$ $h=0$ $c=2$
$b=1$ $k=0$

$f(x) = \log_2 x$ $x=0$

Typical exam question

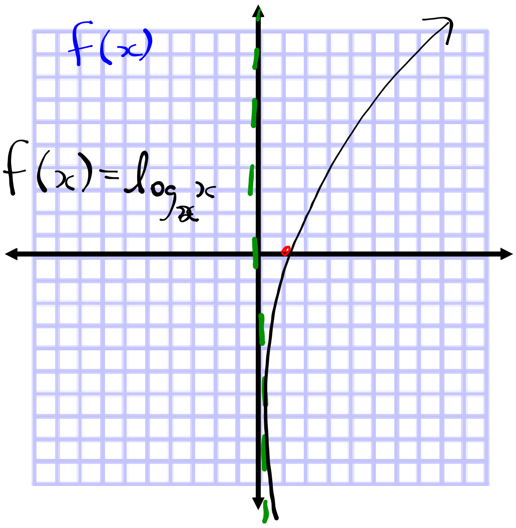
What can we say about the parameter of g(x)?

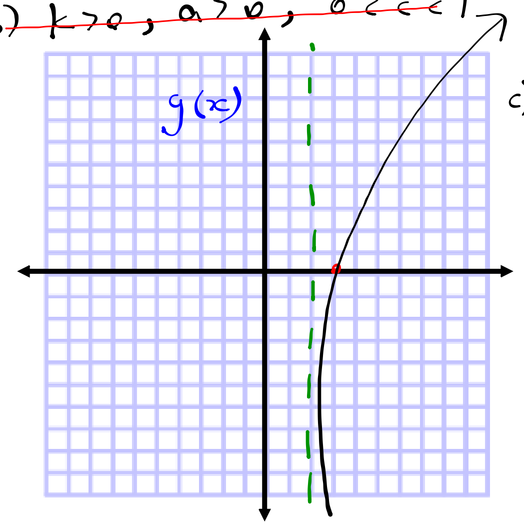
a) $h > 0$, $a < 0$, $0 < c < 1$.

b) ~~$k > 0$, $a > 0$, $0 < c < 1$~~

c) ~~$h > 0$~~
~~$a < 0$~~
~~$b < 0$~~

$f(x) = \log_{\frac{1}{2}} x$





$y = a^x \longleftrightarrow \log_a y = x$ graphing:

graph

$f(x) = \log_{1/2} x$

$f(x) = a \log_c b(x-h) + k$

$a = 1$
$b = 1$

$h = 0$

$k = 0$ $c = \frac{1}{2}$

asymptote $x = 0$

$y = \log_{1/2} x$

$x = \frac{1}{2}^y$

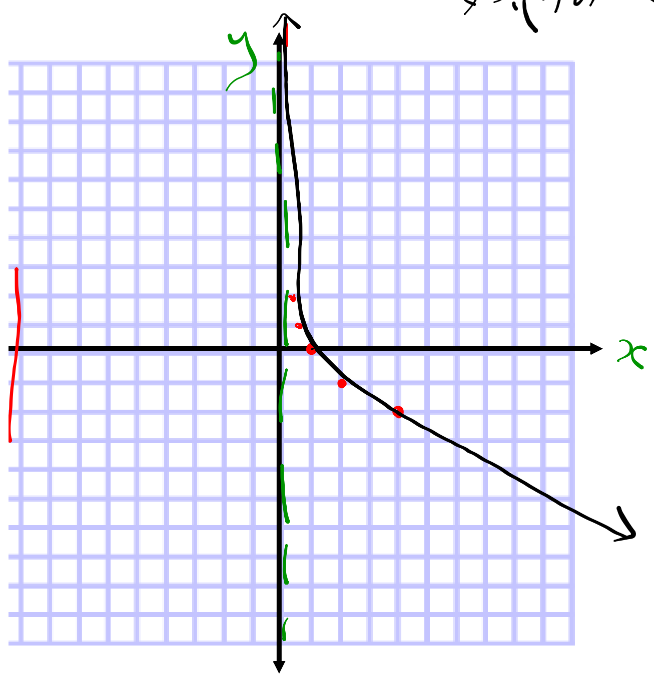
x	y	
$4 = (1/2)^{-2}$	-2	Jason
$2 = (1/2)^{-1}$	-1	Sanjit
$1 = (1/2)^0$	0	Jidh
$1/2 = (1/2)^1$	1	Rohail
$1/4 = (1/2)^2$	2	Ron

Step ①:
Consider the parameters.

Step ②:
Convert equation into exp form.

Step ③:
Construct Table of value and ~~pick y value.~~

x	y
	$k-2$
	$k-1$
	k
	$k+1$
	$k+2$



Step ④: Plot points and asymptotes and draw curves.

$(\log_9 1)$

Domain $]0, \infty$

Range: $\mathbb{R}$

$9^0 = 1$

$\frac{\log 1}{\log 9}$ $\log_9 1 = 0$

graph

$y = a^x \longleftrightarrow \log_a y = x$

$f(x) = -2\log_3 2(x-2) + 1$

$f(x) = a\log_c b(x-h) + k$

convert

$a = -2$
$b = 2$
$h = 2$
$k = 1$

$c = 3$

$y \overset{-1}{=} \underline{-2\log_3 2(x-2)} + 1 \quad {}^{-1}$

you must isolate the log term before converting

$\dfrac{y-1}{-2} = \dfrac{-\cancel{2}\log_3 2(x-2)}{-\cancel{2}}$

B E D M A S

$y = a^x$

$\updownarrow$

$\log_a y = x$

$\dfrac{y-1}{-2} = \log_3 2(x-2)$

Additional step

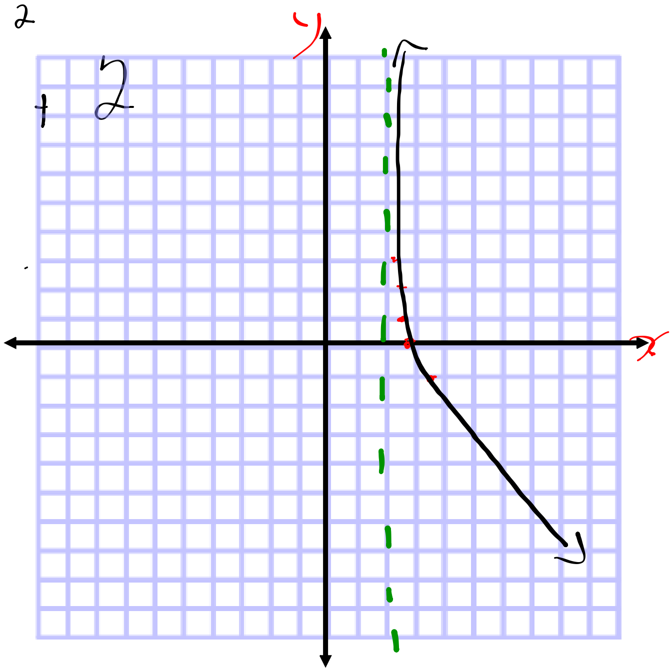
isolate x and the constant term w y values

$\dfrac{\cancel{2}(x-2)}{2} = \dfrac{3^{\frac{y-1}{-2}}}{2}$

$x - 2 \overset{+2}{=} \dfrac{3^{\frac{y-1}{-2}}}{2} + 2$

$x = \dfrac{3^{\frac{y-1}{-2}}}{2} + 2$

x	y	
$3.5 = \dfrac{3^{\left(\frac{-1-1}{-2}\right)}}{2} + 2$	-1	K
$2.866 = \dfrac{3^{\frac{0-1}{-2}}}{2} + 2$	0	D
$2.5 = \dfrac{3^{\frac{1-1}{-2}}}{2} + 2$	1	Kevin
2.3	2	Gary
2.167	3	Jida



graph

$f(x) = \log_4(-3x + 2) + 5$

$f(x) = a\log_c b(x - h) + k$

$y = \log_2\left(\frac{-2x}{-2} + \frac{4}{-2}\right)$

$y = \log_2 -2(x - 2)$

$y = \log_2(-2x + 4)$

Unit 5: Finding the Rule of a log function

(in the form $y = \log_{c} \pm (x-h)$)

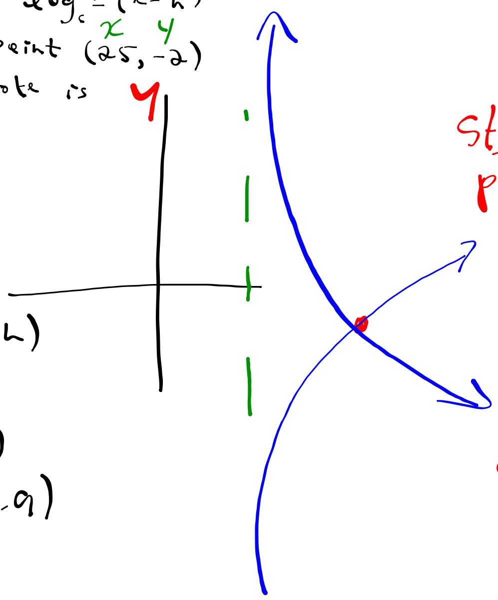
ex. Find the log function in the form $f(x) = \log_c \pm(x-h)$ that goes through point $(25, -2)$ and whose asymptote is equal to $x = 9$.

$x = h$

$a = 1$ $b = \pm 1$

$k = 0$

Step ① Identify the parameters and draw a sketch



Step ② Determine the sign of b by looking at the sketch.

Step ③ To find last missing parameter, sub in a temp. point (x, y) and solve for c.

$y = \log_c \pm (x-h)$

$y = \log_c (x-9)$

$-2 = \log_c (25-9)$

$-2 = \log_c 16$

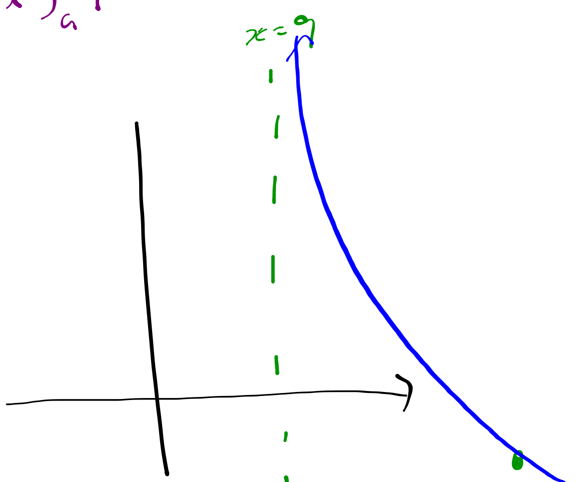
convert!

$y = a^x \leftrightarrow \log_a y = x$

$\sqrt[-2]{16} = \sqrt[-2]{c^{-2}}$

$c = 0.25$

$$\boxed{f(x) = \log_{\frac{1}{4}}(x-9)}$$



Determine the equation of the log function in the form $y = \log_c \pm (x - h)$ that goes through $(-9, 4)$ and has asymptote $x = -7$.