

**LESSON #3: GRAPHS OF LOGS**

Do Now:

1. The graph of the function  $f(x) = x^3$  will be shifted down 2 units and to the right 3 units.

Which is the function that corresponds to the resulting graph?

- a)  $g(x) = (x + 3)^3 + 2$       c)  $g(x) = (x + 3)^3 - 2$   
 b)  $g(x) = (x - 3)^3 + 2$       **d)  $g(x) = (x - 3)^3 - 2$**

→ what it should be!

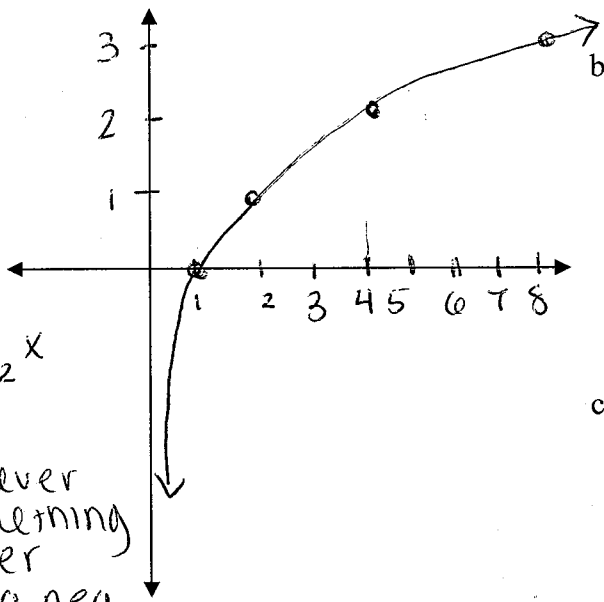
↳ opposite what you think!

2. a. Sketch the graph of  $y = \log_2 x$  after completing the table of values shown.

Calculator Key for Logs! **PRESS.....**  
**MATH** then scroll up **logBASE(**

x	y
-1	ER
0	ER
1	0
2	1
4	2
8	3

why?!  
 $y = \log_2 x$   
 $2^y = x$   
 you can never raise something to a power and get a neg. or zero!



b. Two critical points that appear on a logarithmic graph in the form

$y = \log_b x$  are ...  
 $(1, 0)$  and  $(b, 1)$   
 ex)  $(2, 1)$

c. State the domain and range.

$(0, \infty) = \text{Domain}$   
 $(-\infty, \infty) = \text{Range}$

**Standard form of a logarithmic function:**

$y = a \log_b (x \pm h) \pm k$   
 ↑ dilation      ↓ horizontal shift      ↗ vertical shift

$a$  = dilation  
 $a > 1$  : stretched vertically  
 $0 < a < 1$  : compressed horizontally  
 $b$  = base ( $b > 0$ )  
 $h$  = horizontal shift  
 $k$  = vertical shift

For parts d – g, describe the transformation on  $y = \log_2 x$

d.  $y = \log_2 x - 2$       down 2

e.  $y = \log_2 (x + 1)$       left 1

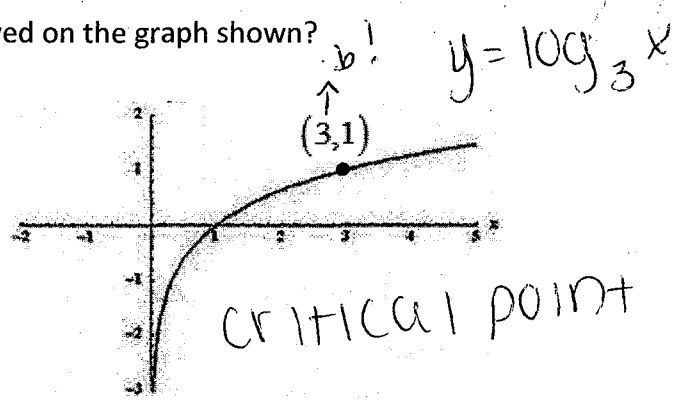
f.  $y = \log_2 (x - 3) + 2$       right 3, up 2

g.  $y = 3 + 2 \log_2 (x - 2)$       up 3, right 2, stretch vertically by 2

The domain of a log graph only changes with horizontal shifts.

1) Which of the following logarithmic equations is displayed on the graph shown?

- a)  $y = \log(x)$
- b)  $y = \log_2(x)$
- c)  $y = \log_3(x)$
- d)  $y = \log_5(x)$



2) Which of the following is true about the function  $y = \log_4(x+16) - 1$ ?

- a) It has an x-intercept of 4 and a y-intercept of -1.
- b) It has an x-intercept of -12 and a y-intercept of 1.
- c) It has an x-intercept of -16 and a y-intercept of 1.
- d) It has an x-intercept of -16 and a y-intercept of -1.

$x \text{ int} \rightarrow y = 0$   
 $y \text{ int} \rightarrow x = 0$

x	y
0	1
-12	0

y int  
 x int

3) Which of the following values of x is not in the domain of  $f(x) = \log_5(10 - 2x)$ ?

- a) -3 ✓
- b) 5
- c) 0 ✓
- d) 4 ✓

why?!  $\log_5(10 - 2(5)) = y$   
 $\log_5(0) = y$   
 $5^y = 0$  ? NOT POSSIBLE!

$\rightarrow$  has an ERR

**PARTNER PRACTICE:**

4)  $G(x)$  is the image of  $F(x)$  after a shift of four units up followed by a vertical stretch of 3.

If  $F(x) = \log_3(x)$ , which of the following gives the equation of  $G(x)$ ? (from the June 2016 Regents)

- a)  $G(x) = 3 \log_3(x+4)$
- b)  $G(x) = 3 \log_3 x + 12$
- c)  $G(x) = 3 \log_3 x + 4$
- d)  $G(x) = 3 \log_3 \frac{1}{3} x + 4$

5) Which value of x is not in the domain of  $y = \log_4(x+4)$ ?

- a) 4
  - b) 0
  - c) -2
  - d) -6
- why?!  $\log_4(-6+4) = y$   
 $\log_4(-2) = y$   
 $4^y = -2$  ? NOT POSSIBLE!

$\rightarrow$  what makes this zero?  
 $x+4=0$   
 $x=-4$

6) Which statement about the graph of  $c(x) = \log_6(x)$  is false?

- a) The asymptote has an equation of  $y=0$ . NO! y axis = asymptote
- b) The graph has no y-intercept. x axis
- c) The domain is the set of positive real numbers.  $(0, \infty)$
- d) The range is the set of all real numbers  $(-\infty, \infty)$

7) What is the y-intercept of the function  $y = \log_2(32-x) - 1$ ?

or use table!  $x=0$   
 $y = \log_2(32-0) - 1$   
 $y = \log_2(32) - 1$   
4

$$\begin{aligned} \log_2(32) &= y+1 \\ 2^{y+1} &= 32 \\ 2^{y+1} &= 2^5 \\ y+1 &= 5 \\ \boxed{y=4} \end{aligned}$$

8) In which quadrants does the graph of  $y = \log_8 x$  lie?

use graphing calc  
 I & IV

9) The graphs of the equations  $y = \log_3 x$  and  $y = 1$  will intersect at which coordinate?

2nd calc intersect

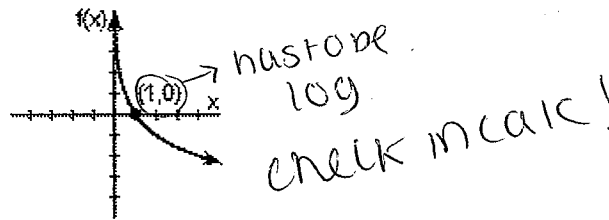
$(b,1) = \boxed{(3,1)}$

$$\begin{aligned} \log_3 x &= 1 \\ 3^1 &= x \end{aligned}$$

$$\begin{aligned} y &= \log_3(3) \\ 3^y &= 3 \\ y &= 1 \end{aligned}$$

10) Which of the following equations could be represented by the graph below?  $x=3$

- a.  $y = \log_2 x$
- b.  $y = -\log_2 x$
- c.  $y = 2^x$
- d.  $y = 2^{-x}$



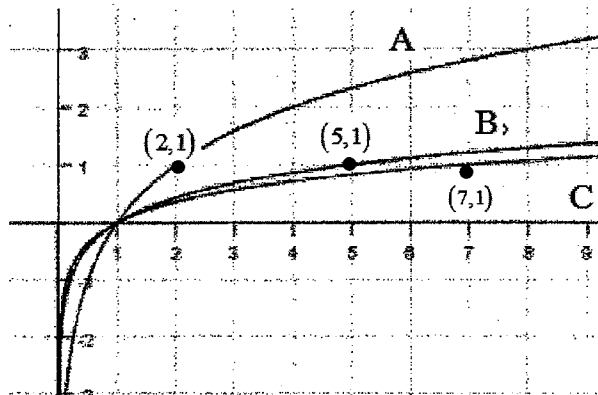
$\boxed{(3,1)}$

11) Match the equations shown below with the appropriate graph.

$y = \log_7 x$  C

$y = \log_2 x$  A

$y = \log_5 x$  B



SUMMARY:

$\log_b(x) = y$  where  $x > 0$  ( $b,1$ ) = critical point!  
 ( $x$  cannot be 0 or negative!)

