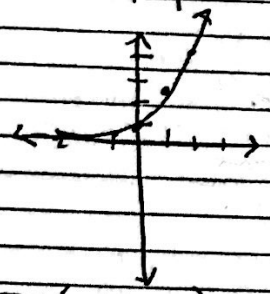
Day 3 - Logarithms

I. Logarithms: exponents (Richter Scale - show); log

Consider $y = 2^x$

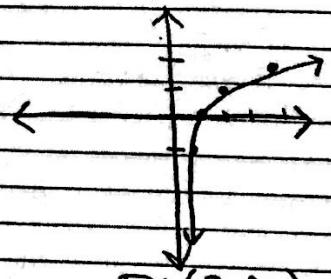
x	y
-1	1/2
0	1
1	2
2	4



D: $(-\infty, \infty)$ *why?
R: $(0, \infty)$

$x = 2^y$

x	y
1/2	-1
1	0
2	1
4	2



D: $(0, \infty)$ *why?
R: $(-\infty, \infty)$

* inverses
* symmetry

$x = 2^y$ is actually $y = \log_2 x$; notice y is the exponent! the answer

$$x = 2^y \iff y = \log_2 x \quad \text{"log base 2 of x"}$$

Ex:	Exponential	Logarithmic
1.	$5^2 = 25$	$\log_5 25 = 2$
2.	$10^3 = 1000$	$\log_{10} 1000 = 3$
3.	$8^0 = 1$	$\log_8 1 = 0$
4.	$2^{-4} = 1/16$	$\log_2 1/16 = -4$
5.	$9^{1/2} = 3$	$\log_9 3 = 1/2$

* The log always equals the exponent!

I. Evaluate

1. $\log_7 49 = \boxed{2}$
2. $\log_3 27 = \boxed{3}$
3. $\log_4 \frac{1}{64} = \boxed{-3}$
4. $\log_6 1 = \boxed{0}$
5. $\log_{10}(-100)$ $\boxed{\text{undefined}}$ *graph!
6. $\log_3 3^5 = \boxed{5}$
7. $\log_4 4^9 = \boxed{9}$
8. $\log_4 2 = \boxed{\frac{1}{2}}$

9. $\log_8 16$

$8^x = 16$
$2^{3x} = 2^4$
$3x = 4$
$\boxed{x = \frac{4}{3}}$

10. $\log_4 32$

$4^x = 32$
$2^{2x} = 2^5$
$2x = 5$
$x = \boxed{\frac{5}{2}}$

II. Properties of Logs

1. $\log_b xy = \log_b x + \log_b y$

Ex: $\log_5 pq = \log_5 p + \log_5 q$

$\log_6 6x = \log_6 6 + \log_6 x = 1 + \log_6 x$

2. $\log_b \frac{x}{y} = \log_b x - \log_b y$

Ex. $\log_{12} \frac{p}{q} = \log_{12} p - \log_{12} q$

$\log_7 \frac{z}{49} = \log_7 z - \log_7 49 = \log_7 z - 2$

3. $\log_b x^y = y \log_b x$

Ex. $\log_2 y^6 = 6 \log_2 y$

$\log_7 x^2 = 2 \log_7 x$

Scanned by CamScanner

Ex: Expand.

1. $\log_7 a^3b^4 = \log_7 a^3 + \log_7 b^4 = \boxed{3\log_7 a + 4\log_7 b}$

2. $\log_{12} \frac{x^2}{y} = \log_{12} x^2 - \log_{12} y = \boxed{2\log_{12} x - \log_{12} y}$

3. $\log\left(\frac{y}{3}\right)^2 = 2\log\left(\frac{y}{3}\right) = \boxed{2\log y - 2\log 3}$

4. $\log_4 \sqrt{x}(y+3)^2 = \log_4 \sqrt{x} + \log_4 (y+3)^2$

$= \boxed{\frac{1}{2}\log_4 x + 2\log_4 (y+3)}$

Ex: Condense.

1. $4\log_{10} x + 2\log_{10} y = \log_{10} x^4 + \log_{10} y^2 = \boxed{\log_{10} x^4 y^2}$

2. $\log_{25} 20 - \log_{25} 4 = \log_{25} \frac{20}{4} = \log_{25} 5 = \boxed{\frac{1}{2}}$

3. $\frac{1}{2}\log_3 81 + \frac{1}{3}\log_3 27 = \log_3 81^{1/2} + \log_3 27^{1/3}$

$= \log_3 \sqrt{81} + \log_3 \sqrt[3]{27}$

$= \log_3 9 + \log_3 3$

$= 2 + 1 = \boxed{3}$

4. $\log_6 252 - \log_6 7 = \log_6 \frac{252}{7} = \log_6 36 = \boxed{2}$

*Review graphs

* Review meaning

* Review Properties

CW - make up problems (if time)