BE - PRECALC MONDAY 11-30-09

① LIST THE 3 logarithmic RULES (based on the MR, DR, PPR for EXPONENTS).

- EXAM 2 FRIDAY

Ch. 11-5 Common Logarithms

$\log x$ means $\log_{10} x$ ⇒ "Common" logarithm

Since: $10^0 = 1$ $\quad\quad$ $\log 1 = 0$

$10^1 = 10$ $\quad\quad$ $\log 10 = 1$

$10^2 = 100$ $\quad\quad$ $\log 100 = 2$

$10^3 = 1000$ $\quad\quad$ $\log 1000 = 3$

⋮ $\quad\quad$ ⋮

Also: $10^{-1} = 0.1 = \frac{1}{10}$ $\quad\quad$ $\log(.1) = -1$

$10^{-2} = 0.01 = \frac{1}{100}$ $\quad\quad$ $\log(.01) = -2$

$10^{-3} = 0.001 = \frac{1}{1000}$ $\quad\quad$ $\log(.001) = -3.$

Recall: $\log ab = \log a + \log b$

Ex 1 Pg 726 (A) $\log 7{,}000{,}000 = ?$

$= \log 7 + \log 1000000$

$= 0.8451 + 6 = \boxed{6.8451}$

MANTISSA $\quad$ CHARACTERISTIC

(B) $\log .0007$

$= \log 7 + \log 10^{-4}$

$= .8451 + -4 = \boxed{-3.1549}$

MANTISSA $\quad$ CHARACTERISTIC

Chemistry Note: H^+ = hydrogen ion

$H_2O \rightleftharpoons H^+ + OH^-$

Hydrogen ion — Hydroxide ion

$\sim 10^{-7} \frac{m}{\ell}$ $\quad \sim 10^{-7} \frac{m}{\ell}$

DEFINITION OF pH

$pH = -\log[H^+]$ or $\log \frac{1}{[H^+]}$ $\quad \therefore$ pH WATER = 7

$7 \rightarrow 14 \Rightarrow$ more and more basic $\Rightarrow$ less H^+; more OH^-

$7 \rightarrow 0 \Rightarrow$ more and more Acidic $\Rightarrow$ more H^+, less OH^-

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Ex 2 PG 727 FIND pH if $[H^+] = 7.94 \times 10^{-9} \frac{\text{moles}}{\ell}$

$$-\log(7.94 \times 10^{-9})$$

$$= -[\log 7.94 + \log 10^{-9}]$$

$$= -[.8998 + -9]$$

$$= -[-8.1002]$$

$$\cong \boxed{+8.1} \Rightarrow \text{BASIC SOLUTION}$$

Operations with logarithms ⇒

Use the 3 logarithm rules: (MR) $\log ab = \log a + \log b$

(DR) $\log \frac{a}{b} = \log a - \log b$

(PR) $\log a^b = b \log a$

Ex 3 Pg 727 (a) $\log 5(2)^3$

$= \log 5 + \log (2)^3$

$= \log 5 + 3 \log 2$

$= .6990 + 3(.3010) = \boxed{1.6021}$

OR $10^{1.6021} = 40$

(b) $\log \frac{19^2}{6}$

$= \log 19^2 - \log 6$

$= 2 \log 19 - \log 6$

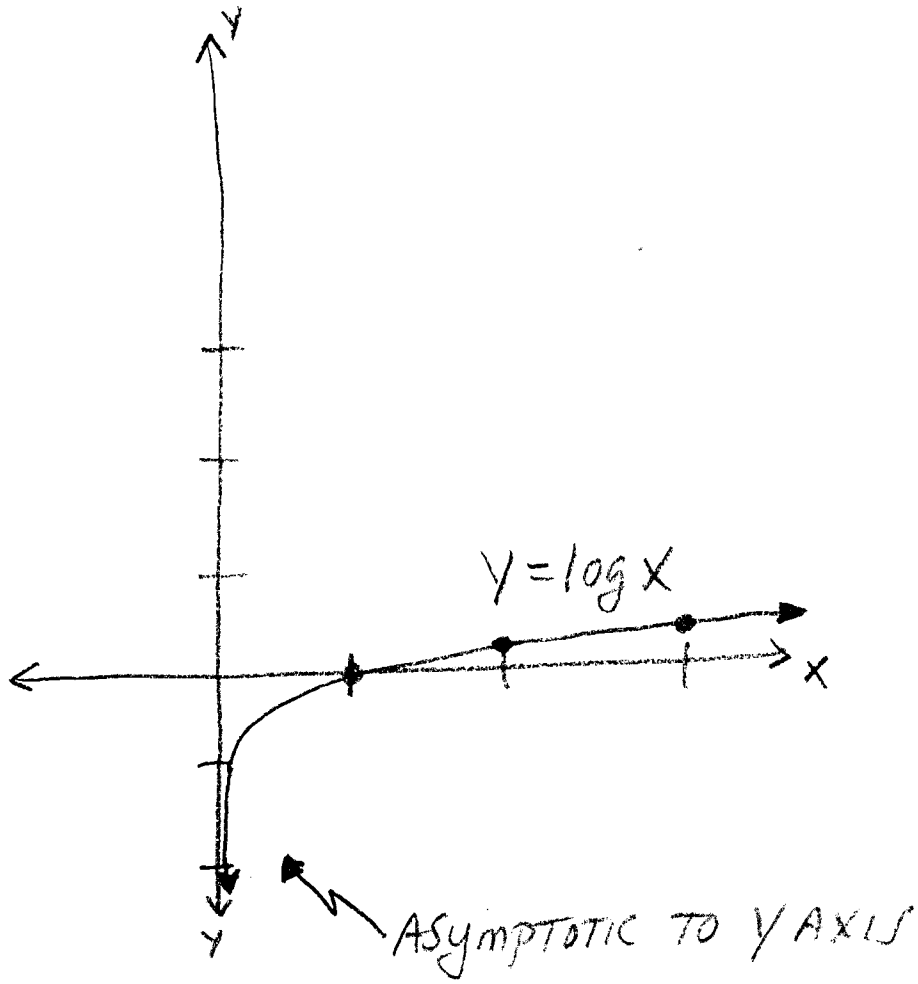
$= 2(1.2789) - .7782$

$\approx \boxed{1.7794}$

WHAT does the graph of $y = \log x$ look like?

NOTE: A ⊕ exponent gives a big number
A ⊖ exponent gives a small number
The EXPONENT does NOT AFFECT THE SIGN ∴ X CANNOT be NEGATIVE.

X	$Y = \log X$
0	? X MUST BE > 0
1	0
10	1
100	2
⋮	⋮
2	.3
3	.4
5	.7
8	.9
.1	-1
.01	-2



(See TOP OF Pg 728.)

Change of base formula:

Since Common Logarithms are built into your calculators, the change of base formula is a useful tool for evaluating logarithms that are not base 10

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a, b, N are positive, and $a, b \neq 1$

$$\log_a N = \frac{\log_b N}{\log_b a}$$

(EX)

$$\log_3 12 = \frac{\log 12}{\log 3} = \frac{1.0792}{.4771} = \boxed{2.2620}$$

CK $3^x = 12$ $\quad 3^{2.260} \approx 11.98$ ✓

Ex 5 PG 728

$\log_9 1043 = ?$

$$\log_9 1043 = \frac{\log 1043}{\log 9} = \frac{3.0183}{.9542}$$

$$= \boxed{3.1632}$$

SOLVING EXPONENTIAL EQUATIONS WITH different bases: $6^{3x} = 6^2$ ⇒ same base

$\therefore 3x = 2 \quad x = \frac{2}{3}$

→ Ex 7 Pg 729 $6^{3x} = 81$ take log of both sides

$\log 6^{3x} = \log 81$

$3x \log 6 = \log 81$

$3x = \frac{\log 81}{\log 6} = \frac{1.9085}{.7782.} = 2.4525$

$x = \frac{2.4525}{3} = \boxed{0.8175 = x}$

NOTE: ANTILOG $X = 10^X$ (Ex) ANTILOG $3.2 = 10^{3.2} = 1584.9$

HOMEWORK: Pg 730

5-7, 8, 9, 11-14.