Section 3.3 Logarithmic Functions and their Graphs

Disclaimer: ONLINE HW is easier than the notes BUT QUIZ & TEST covers NOTES, CLASSWORK AND HW. REVIEW ALL

Without a calculator, approximate the solution of the following equations

a) $2^x = 10$ $2^3 = 8$ $2^4 = 16$

x is between 3 & 4, closer to 3

b) $3^x = 10$ $3^2 = 9$ $3^3 = 27$

x is between 2 & 3, closer to 2

For $x > 0, a > o, a \neq 1,$

$y = \log_a x$ if and only if $x = a^y$

The function $f(x) = \log_a x$ is called a **logarithmic function with base *a*.**

* A log is an exponent producing function. (The answer to a log is an exponent)
* Can't take log of a neg. ## Base ^exp = Positive

1) Rewrite each of the following equations in logarithmic form (if possible). If not possible, say why.

a. $4^x = 64$

$\log_4 64 = x$

$x = 3$

b. $5^x = \frac{1}{125}$

$\log_5 \frac{1}{125} = x$

$x = -3$

c. $2^x = -32$

Not possible 2^x no value of x will produce a negative output

2) Use the definition of a logarithmic function to evaluate each logarithm at the indicated value of x.
No calculator

a. $f(x) = \log_4 x, x = 16$

$f(16) = \log_4 16$

$= 2$

Since $4^2 = 16$

b. $f(x) = \log_2 x, x = 64$

$f(64) = \log_2 64$

$= 6$

Since $2^6 = 64$

c. $f(x) = \log_3 x, x = \frac{1}{81}$

$f(\frac{1}{81}) = \log_3 \frac{1}{81}$

$= -4$

Since $3^{-4} = \frac{1}{81}$

d. $f(x) = \log_5 x, x = 1$

$f(1) = \log_5 1$

$= 0$

Since $5^0 = 1$

3) Use a calculator to evaluate the function given by $f(x) = \log x$

Round 4 dec.

no BASE means BASE = 10

a. x=100

$\log_{10} 100$

$= 2$

b. $x = \frac{1}{5}$

$\log_{10}(\frac{1}{5})$

$10^? = \frac{1}{5}$

-0.6990

c. x=3.25

$\log(3.25)$

0.5119

d. x= -4

$\log(-4)$

not possible

4) Simplify No calculator

a. $\log_5 1 = x$

$5^x = 1$

$x = 0$

b. $\log_{\sqrt{11}} \sqrt{11}$

$\sqrt{11}^x = \sqrt{11}$

$x = 1$

c. $8^{\log_8 30} = x$

$\log_8 x = \log_8 30$

$x = 30$

d. $\log \sqrt[5]{10}$

$10^x = 10^{1/5}$

$x = \frac{1}{5}$

e. $\log_5 \sqrt[3]{5^7}$

$5^x = 5^{7/3}$

$x = \frac{7}{3}$

f. $\log_{81} 9$

$81^x = 9$

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

$\sqrt{81} = 9$

$81^{1/2} = 9$

g. $\log \frac{1}{1000}$

$10^x = \frac{1}{1000}$

$x = -3$

5) Solve No calculator

Check answers - Plug in to make sure not taking log (-)

a. $\log_5 y = \log_5 16$

$y = 16$

b. $\log(4-3x) = \log(x+2)$

$4 - 3x = x + 2$

$2 = 4x$

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

c. $\log_3(x^2+4) = \log_3 29$

$x^2 + 4 = 29$

$x^2 = 25$

$x = \pm 5$

Section 3.3 Logarithmic Functions and their Graphs

To sketch the graph of $y = \log_a x$, use the fact that the graphs of inverse functions are reflections of each other in the line y=x (the x and y variables are interchanged). $y = \log_a x$ and $y = a^x$ are inverses of each other.

6) On the same coordinate plane, sketch the graph of each function

a) $f(x) = 4^x$

- Construct a table of values for f(x) No calculator

x	-3	-2	-1	0	1	2
f(x)	$\frac{1}{64}$	$\frac{1}{16}$	$\frac{1}{4}$	1	4	16

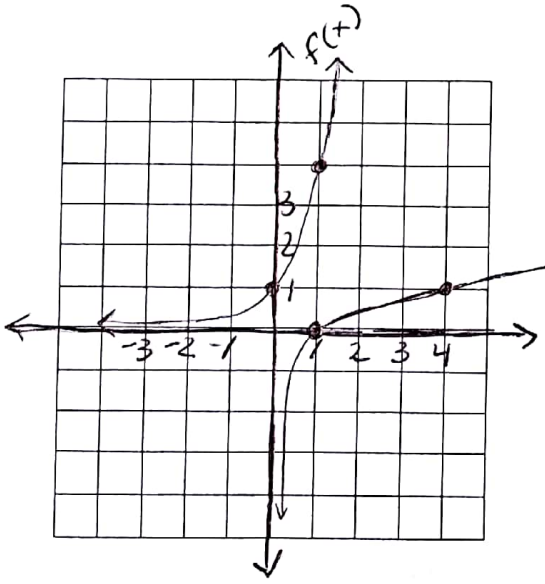
$f(x) = 4^x$ D $(-\infty, \infty)$
R $(0, \infty)$
HA $y = 0$

b) $g(x) = \log_4 x$

x	g(x)
1/64	-3
1/16	-2
1/4	-1
1	0
4	1
16	2

- Since $g(x) = \log_4 x$ is the inverse of $f(x) = 4^x$ the graph of $g(x) = \log_4 x$ is obtained by interchanging the x and y variables of $f(x) = 4^x$. In other words, plot the points $(f(x), x)$

$f(x) = 4^x$
D $(-\infty, \infty)$
R $(0, \infty)$
H.A. $y = 0$



$g(x) = \log_4 x$
D $(0, \infty)$
R $(-\infty, \infty)$
V.A. $x = 0$