Pre-calc: Math 3 Unit 2 Name:

Lesson 5 Common Sense

1. Solve for the missing x values in the following tables of functions. Try to use different tools and methods to solve different problems. Work with your group to collect different methods. Be ready to present your work.

x	$y = 10^x$
-2	$\frac{1}{100}$
1	10
1.7	50
2	100
3	1000

x	$y = 3(10^x)$
-1	0.3
0	3
1.5	94.87
2	300
2.7	1503.56

x	$y = 10^{-x}$
-2	100
-1.6	40
-1	10
1	0.1
4	0.0001

$50 = 10^x$

$\updownarrow$

$\log_{10} 50 = x$

$100 = 10^x$

$\log_{10} 100 = x$

$\frac{0.3}{3} = \frac{3(10^x)}{3}$

$0.1 = 10^x$

$\updownarrow$

$\log_{10} 0.1 = x$

$\frac{94.87}{3} = \frac{3(10^x)}{3}$

$31.62 = 10^x$

$\updownarrow$

$\log_{10} 31.62 = x$

$100 = 10^{-x}$

$\log_{10} 100 = -x$

$2 = -x$

$-2 = x$

2. Solve the equation $2^{x-1} = 30$ using two different methods:
   a. Using a base 2 logarithm.
   b. Using a base 10 logarithm. (Start by taking the $\log_{10}$ of both sides.)

a. $2^{x-1} = 30$

$\updownarrow$

$\log_2 30 = x-1$

$+1 \quad +1$

$\log_2 30 + 1 = x$

$5.9 = x$

b. $\log_{10} 2^{x-1} = \log_{10} 30$

$\frac{(x-1)\log_{10} 2}{\log_{10} 2} = \frac{\log_{10} 30}{\log_{10} 2}$

$x-1 = \frac{\log_{10} 30}{\log_{10} 2}$

$x = \frac{\log_{10} 30}{\log_{10} 2} + 1$

$x = 5.9$

notice: $\log_2 30 = \frac{\log_{10} 30}{\log_{10} 2}$

Practice

Solve each equation or system of equations.

3. $10^x = 10000$

$\log_{10} 10000 = x$

$4 = x$

4. $125 = 10^x$

$\log_{10} 125 = x$

$2.1 = x$

5. $10^{x+2} = 347$

$\log 347 = x+2$

$-2 \quad -2$

$\log 347 - 2 = x$

$0.54 = x$

6. $\frac{5(10^{x+2})}{5} = \frac{0.25}{5}$

$10^{x+2} = 0.05$

$\log 0.05 = x+2$

$-2 \quad -2$

$\log 0.05 - 2 = x$

$-3.3 = x$

note: log means $\log_{10}$

7. $10^{-x-1} = \frac{1}{36}$

$\log\left(\frac{1}{36}\right) = -x-1$

$+1 \quad +1$

$\log\left(\frac{1}{36}\right)+1 = -x$

$-0.56 = -x$

$0.56 = x$

8. $-(10^{x+2}) = 16$

$\cdot -1 \quad \cdot -1$

$10^{x+2} = -16$

$\log(-16) = x+2$

↑ can't take the log of a negative number

undefined or no solution

9. $\begin{cases} y = 10^x \\ y = 100 \end{cases}$

$10^x = 100$

$x = 2$

$y = 100$

10. $\begin{cases} y = 10^x - 50 \\ y = 25 \end{cases}$

$25 = 10^x - 50$

$+50 \quad +50$

$75 = 10^x$

$\log 75 = x$

$x = 1.9$

$y = 25$

11. $\begin{cases} y = 10^{-x} \\ y = x + 5 \end{cases}$

$10^{-x} = x+5$

graph both functions, find the intersection at $(-0.64, 4.36)$

$x = -0.64$

$y = 4.36$

12. $\begin{cases} y = 4^{3x} \\ y = 2^{2x-8} \end{cases}$

$4^{3x} = 2^{2x-8}$

$(2^2)^{3x} = 2^{2x-8}$

$2^{6x} = 2^{2x-8}$

$6x = 2x-8$

$-2x \quad -2x$

$\frac{4x}{4} = \frac{-8}{4}$

$x = -2$

$y = 4^{3\cdot -2}$

$y = 4^{-6}$

$y = \frac{1}{4096}$