

1. The definition of logarithm is if  $a^x = y$ , then  $\log_a y = x$ , and if  $\log_a y = x$ , then  $a^x = y$ .
  - a. Complete the tables for an exponential function base 10 and a logarithmic function base 10.

x	$10^x$
0	$10^0 = 1$
1	
2	
3	$10^3 = 1000$
4	
5	
6	$10^6 = 1000000$
7	
8	
9	
10	

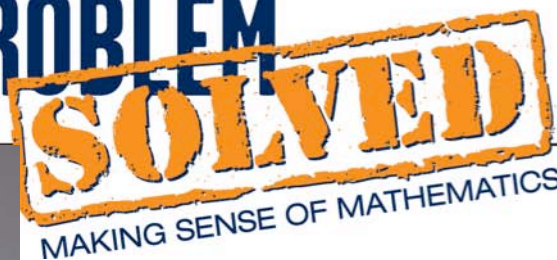
y	$\log_{10} y$
1	0
10	
100	
1000	
10000	
$10^5$	
$10^6$	
$10^7$	
$10^8$	
$10^9$	
$10^{10}$	

- b. Ten raised to what power is 1,000,000?
- c. How can the definition of logarithms help you find  $\log_{10} 1000000$  ?
- d. Using the table, estimate  $\log_{10} 99,932$  to the nearest whole number.
- e. Using the table, estimate  $10^{3.1}$ .

2. Complete the tables below. The base is **three** in both tables.

x	$3^x$
0	1
1	3
2	
3	27
4	
5	

y	$\log_3 y$
1	0
3	1
9	
27	3
81	
243	



a. Without using a calculator, compute the following base **three** logarithms.

i.  $\log_3(81)$

ii.  $\log_3(243)$

iii.  $\log_3(1)$

iv.  $\log_3\left(\frac{1}{3}\right)$

v.  $\log_3\left(\frac{1}{9}\right)$

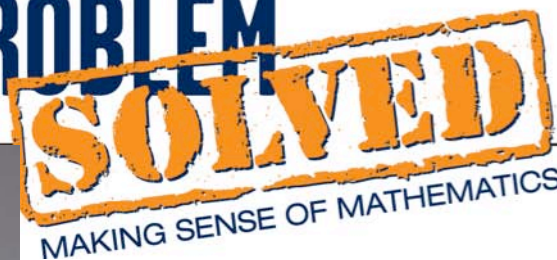
3. Moore's Law states, informally, that the computing power of a chip doubles every two years.

a. Make a table showing how the computing power of a chip increases, where  $n$  is the number of doubling periods.

$n$	$2^n$
0	
1	
2	
3	
4	
5	
6	

b. According to Moore's Law, how long will it take the computing power of a chip to increase by a factor of 64?

c. According to Moore's Law, by what factor will the computing power of the chip increase in 16 years?



4. Assume the population ( $p$ ) of a virus in a human body triples every hour.
- a. If we start with 1 virus in a body, how many will there be in three hours?

t	$3^t$
0	
1	
2	
3	
4	
5	
6	

- b. How long will it take for the population of viruses to be 243?
- c. How many viruses will there be in one day?
- d. Is the equation below a valid representation for the number of viruses in a human body? Why or why not?

$$t = \log_3(p) \quad (t = \text{time in hours}, p = \text{population})$$

5. The following is a graph of  $y = 4^x$ . Use the graph to estimate  $\log_4(8000)$ .

