Introduction to Logarithms

Use What You've Learned

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. $\log_3 (\frac{1}{3})$

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

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?

   $t = \log_3(p)$ (t = time in hours, p = population)

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