MA 180 CHAPTER 4: Exponential and LOGARITHMIC FUNCTIONS
SECTION 4.4: LOGARITHMIC FUNCTIONS

WHAT IS A LOGARITHM?

1. Solve the following equations for x:

   A. $2^x = 4$ B. $2^x = 16$

   C. $3^x = 9$ D. $3^x = 81$

2. Note the above problems could have been written using logarithmic notation.

   A. $x = \log_2 4$ B. $x = \log_2 16$

   C. $x = \log_3 9$ D. $x = \log_3 81$

3. DEFINITION: For $b > 0$, $b \neq 1$, and $a > 0$

   $\log_b a = k$ where k is the number such that $b^k = a$.

   Note: 1. $\log_{10}$ is often written as log.
   2. When you evaluate a log – you are finding a number that will be used as an exponent.

4. Evaluate each of the following. You can always check your answer using an exponential expression.

   A. $\log_6 (36) =$ _____ B. $\log_4 (64) =$ _____

   C. $\log_5 (125) =$ _____ D. $\log_{10} (100{,}000) =$ _____

   E. $\log_2 \left(\frac{1}{2}\right) =$ _____ F. $\log_3 \left(\frac{1}{9}\right) =$ _____

G. $\log_7(\sqrt{7}) =$ _____ H. $\log_4 8 =$ _____

PROPERTIES OF LOGARITHMS:

5. A. $\log_3(3) =$

B. $\log_7(7) =$

C. $\log_{12}(12) =$

D. Use your answers above to guess the rule for $\log_b(b)$.

6. A. $\log_5 1 =$

B. $\log_6 1 =$

C. $\log_{14} 1 =$

D. Use your answers above to guess the rule for $\log_b 1$

7. PROPERTIES OF LOGARITHMIC FUNCTIONS: page 214

For $b > 0$, and $b \neq 1$,

$\log_b(b) = 1$
$\log_b(1) = 0$

8. RELATIONSHIP BETWEEN LOGARITHM & EXPONENTIAL FUNCTIONS: page 215

For the exponential function $f(x) = b^x$, $f^{-1}(x) = \log_b(x)$.

For the logarithmic function $g(x) = \log_b(x)$, $g^{-1}(x) = b^x$.

$f(x) = b^x$ and $g(x) = \log_b(x)$ are inverse functions of each other.

9. For the functions listed below, find a formula for the inverse function.

A. $f(x) = 7^x$ B. $g(x) = \log x$

10. $h(x) = 3^x$

A. Find $h^{-1}(1)$ B. Find $h^{-1}(3)$

11. THE GRAPH OF A LOGARITHMIC FUNCTION:

Fill in the table and plot points to graph f and g.

x	$f(x) = \log_4 x$	$g(x) = \log_{(1/4)} x$
-2		
-1		
0