Extra Credit Assignment for Math 081 -- Chapter 8 **Name: ________________________**
Moore - Spring 2012

Due: April 26th at the start of class

You will be taking notes using the template from my website while watching the videos that go along with Chapter 8 in MML. These videos have different examples than we have gone over in class.

On my website: http://www.sccollege.edu/faculty/kmoore
On the lower left corner – Math 081 information – choose Notes from Chapter 8 and print these out.

In MyMathLab or Course Compass, log in as usual.
Open the eBook, Go to Chapter 8, Choose Section 8.1, then click on 8.1 Video Lecture
While watching the video lecture – fill out the notes, writing all the steps to each example.

Repeat this process for all 5 sections.

This counts as your 9th lab activity to fulfill the requirements for the Math 081 class.

Video Length	Section
15:28	8.1
14:26	8.2
16:05	8.3
15:25	8.4
17:03	8.5

CHAPTER 8. EXPONENTIAL & LOGARITHMIC FUNCTIONS

8.1. COMPOSITE FUNCTIONS & INVERSE FUNCTIONS

Composite Functions

We say $(f \circ g)(x) = f(g(x))$ as the function f is composed with g, i.e, we substitute every x in f with the function g(x).

In general, $(f \circ g)(x) = f(g(x))$
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$(g \circ g)(x) = g(g(x))$

Example. Let $f(x) = x^2$ and $g(x) = x – 3$. Then find:

a) $(f \circ g)(x)$ b) $(g \circ f)(x)$ c) $(f \circ f)(x)$ d) $(g \circ g)(x)$

* Is it always true that $(f \circ g)(x) = (g \circ f)(x)$? ________

One-to-one Functions

Definition. A function is one-to-one if any two different inputs in the domain correspond to any two different outputs in the range, i.e., $f(x_1) = f(x_2)$ for any x_1 and x_2. Another way of determining one-to-one is: each y value must pair with only one x value.

Example. Determine if the following function is one-to-one.

{(−3,4), (−2,6), (−1, 8), (0, 10), (1, 12)}

Horizontal Line Test

If every horizontal line intersects the graph of a function f in at most one point, then f is one-to-one.

Try. Graph an example of a functions that is not one-to-one. Graph an example that is one-to-one.

Definition. If f(x) is an invertible function with ordered pairs (a, b), then **the inverse function**, $f^{-1}(x)$, is the set of ordered pairs (b, a), i.e., y–coordinates and x–coordinates switch.

Example. Find the inverse of the function {(0, 3), (1, 4), (2, 5), (3, 6)}.

*State the domain and range of the inverse function.

Example. Draw the function and then draw the inverse function f^{-1}.

Steps to Algebraically Finding the Inverse:

Step 1. Replace f(x) with y.
Step 2. Switch x and y.
Step 3. Solve for y.
Step 4. Replace y with $f^{-1}(x)$.
Step 5. Check your work with $f(f^{-1}(x))= x$ or $f^{-1}(f(x))= x$.

Example. Find the inverse of the one-to-one function $g(x) = x^3 + 3$.

8.2 Exponential Functions

Graphing Exponential Functions

An exponential function is a function of the form $f(x) = a^x$, where $a > 0$ and $a \neq 1$.

Example. Plot $f(x) = 5^x$ by plotting points. From the graph, state the domain and the range of the function.

Example. Graph the function $f(x) = (1/5)^x$. From the graph, determine the domain and the range of the function.

Properties of a^x

1. D: {x| all real numbers } and R: {y| y # 0}
2. There are no x–intercepts; the y intercept is at (0, 1).
3. If $a > 1$, then the function is an increasing (or __________) function.
   If $0 < a < 1$, then the function is a decreasing (or _________) function.

Solving Exponential Functions

To solve exponential equations, we use the fact if $a^m = a^n$, then $m = n$.

Example. Solve.

a) $3^{-x} = 81$ b) $3^{x^2-4} = 27^x$

Exponential Models

Example. Does the Number of Compounding Periods Matter? Suppose that you deposit $2000 into an account that pays 3% annual interest.

Compound Interest Formula:

How much will you have after 5 years, if interest is compounded:

a) annually? b) quarterly? c) monthly? d) daily?

e) Based on the results (a) through (d) what impact does the number of compound periods have on the future value, all other things equal?

8.3 Logarithmic Functions

Logarithmic Function

The logarithmic function is denoted by $y = \log_a x$ which is equivalent to $x = a^y$,
where $a > 0$ and $a \neq 1$. The value a is the base, y is the exponent, and x is the value.
The equation $y = \log_a x$ is called the logarithm form and $x = a^y$ is called the exponential form.

Writing in Logarithmic & Exponential Form

Example. Rewrite each exponential form to its equivalent logarithmic form. $64 = 4^3$

Example. Rewrite each logarithmic form to its equivalent exponential form. $\log_5 a = -3$

Evaluating Logarithms

Example. Find the exact value of $\log_4 \frac{1}{16}$

Domain of Logarithmic Functions

The domain of the logarithmic function is $\{x|x > 0\}$ and the range is $\{y|$ all real numbers $\}$

Example. Find the domain of $f(x) = \log_7(2x + 1)$.

Graphing Logarithmic Functions

Example. Graph the function $f(x) = \log_5 x$. State the domain and the range of the function.

Properties of $f(x) = \log_a x$

1. D : $\{x|x > 0\}$ and R : $\{y|$ all real numbers $\}$
2. There is an x–intercept at (1, 0); there are no y–intercepts.

Example. Graph $f(x) = \log_{1/3} x$ by plotting points. Determine the domain and the range of the function.

8.3 Logarithmic Functions (continued)

Natural & Common Logarithms

1. The natural logarithm is given by $y = \log_e x = \ln x$ if and only if $x = e^y$
2. The common logarithm is given by $y = \log_{10} x = \log x$ if and only if $x = 10^y$

Solving Logarithmic Functions

Example. Solve. $\log_3(2x + 1) = 2$

Application

Example. A whisper has an intensity level of 10^{-10} watt per square meter. How many decibels is a whisper?

8.4 Properties of Logarithms

Understanding Properties of Logarithms

Properties of Logarithms

$\log_a 1 = 0$	Exponent of Zero
$\log_a a = 1$	Exponent of One
$\log_a a^r = r$	
$\log_a(MN) = \log_a M + \log_a N$	Product Rule
$\log_a(M/N) = \log_a M - \log_a N$	Quotient Rule
$\log_a M^r = r \log_a M$	Power Rule
$a^{\log_a M} = M$	
$\log_e a = \ln a$	Definition of Natural Log
$\log_{10} a = \log a$	Definition of Common Log

Example. Use the properties of logarithms to find the exact value. Do not use a calculator.

a) $\ln e^{-7} =$ b) $3^{\log_3 5} =$ c) $\log_{10} 2 + \log_{10} 5 =$

Example. Suppose that $\ln 2 = a$ and $\ln 3 = b$. Use the properties of logarithms to write the logarithm in terms of a and b: $\ln 9$

Expanding and Contracting Logarithms

Example. Expand the logarithm by rewriting as a sum or difference of logarithms with exponents as factors.

a) $\log_2 (xy^2)$ b) $\log\left(\frac{x^4}{\sqrt[3]{(x-1)}}\right)$

8.4 Properties of Logarithms (continued)

Example. Write the expression as a single logarithm: $\frac{1}{2}\log_3 x + 3\log_3(x-1)$

Change of Base Formula

If a ≠ 1, b ≠ 1, and M are positive real numbers, then

$$logaM = \frac{\log_b M}{\log_b a}$$

Example. Use the change of base formula and a calculator to evaluate the logarithm: $\log_8 3$ =

8.5 Exponential & Logarithms Equations

Solving Logarithmic & Exponential Equations

One-to-One Property of Logarithms

If $\log_a M = \log_a N$, then M = N where M, N, and a are positive real numbers with a ≠ 1.

Example. Solve. Express irrational solutions in exact form and as a decimal rounded to three decimal places.

a) ½ ln x = 2 ln 3

b) $\log_2 (x + 3) + \log_2 x = 2$

c) $2^x = 10$

d) $-3e^x = -18$

Solving Equations Involving Exponential Models

Example. Time is Money. Suppose that you deposit \$5000 into a Certificate of Deposit (CD) today. If the deposit earns 6% interest compounded monthly, how long will it be before the account is worth –

a) \$7000?

b) \$10,000?