Math 1111 Journal Entries **Name ______________________**
Units IV& V (Sections 6.1-6.7, 12.1)

Respond to each item, giving sufficient detail. You may handwrite your responses with neat penmanship. *Your portfolio should be a collection of your best work and should also be very helpful to you as you prepare for exams.*

1. Make up 2 functions, f and g, and then show how to find the **composition** of these functions $(f \circ g)(x)$. Use no more than one linear function.

   $f(x) = 2x + 1$ $\qquad$ $g(x) = x^2 - 3$

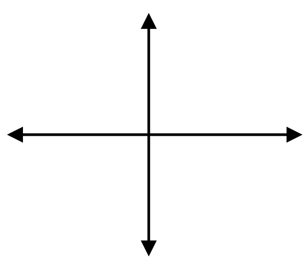
   $(f \circ g)(x) = f(g(x)) = f(x^2 - 3) =$ ______________________________

   A function is **one-to-one** if each x value in the domain is paired with one value in the range (function definition) and each y value in the range is paired with __________ value in the domain (one-to-one).

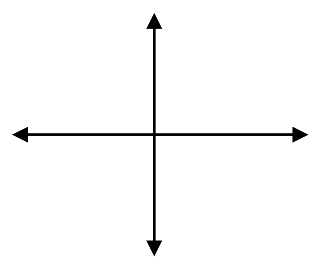
   If every _______________ (horizontal or vertical) line intersects the graph of a function f in at most one point, then the function f is one-to-one.

   Sketch 2 graphs, one which is a function but isn't one-to-one and one which is a one-to-one function.

   (1) Not one-to-one

   (2) One-to-one function

2. Complete the 3 main steps for finding the **inverse** of a function, $y = f(x)$. Also, complete the example in the box, and use this function and its inverse for the graphs (next page).

   (1) From $y = f(x)$ form, the main idea is to ______________________________ .

   (2) Then, if possible, solve for y in terms of x.

   (3) Then write $y = f^{-1}(x)$.

   You can check your result by showing that

   ______________________________ .

   Let $y = f(x) = \sqrt{x - 4}$

   $x = \sqrt{y - 4}$

   _____ $= y - 4$

   $y =$ __________

   $f^{-1}(x) = x^2 + 4$

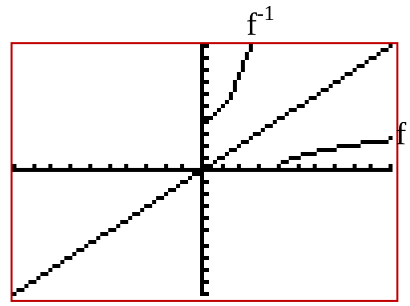
Show the graphs and tables for the specific function, f, and its inverse, f^{-1} .

$f(x) = \sqrt{x-4}$

x	y
4	0
5	1
8	2
13	3

f^{-1}

x	y
0	4
1	5
2	8
3	13



Also give the domains and ranges of these 2 one-to-one functions. Use interval notation.

Domain of f: $[4, \infty)$ Range of f: $[0, \infty)$

Domain of f^{-1}: ___________ Range of f^{-1}: ___________

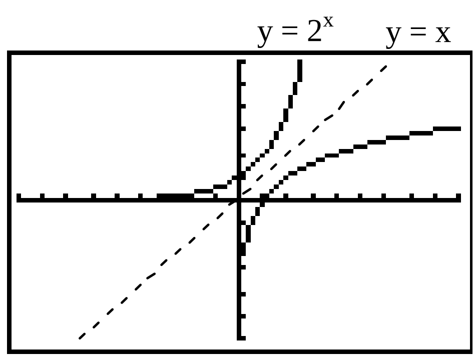
3. The general form for an exponential function is ___________ with a > 0 and a ≠ 1.

The general form for a logarithmic function is ___________ with a > 0 and a ≠ 1.

The other form of a logarithm is ___________ .

Label the following graphs with the following 3 equations:

$y = 2^x$, $y = x$, $y = \log_2 x$



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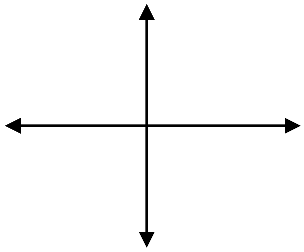
What is the relationship between the exponential function $y = 2^x$ and the logarithmic function $y = \log_2 x$?

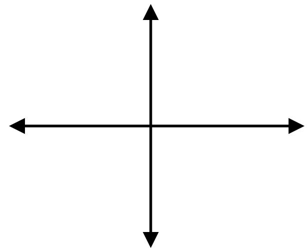
____

4. Draw rough sketches of the graphs of 2 exponential functions of the form $y = a^x$ under the following conditions. Include any asymptotes and intercepts on your graphs. You may choose a specific value for the base, a.

(a) $a > 1$



(b) $0 < a < 1$



Both graphs have y-intercept ___________and horizontal asymptote ___________.

5. The compound interest formula for the accumulated amount of an investment is given by the formula, $A = P\left(1 + \frac{r}{n}\right)^{n \cdot t}$, where P is the principal, r is the ______________________ , and t is the ______________________ .

Common numbers of compoundings (n) for a year include 1 for annually, 2 for semiannually, 4 for quarterly, 12 for _______________ , 52 for weekly, and 360 for daily.

If interest is compounded “continuously”, we use a new formula, ________________ , where P is the principal, r is the annual interest rate, and t is the time in years.

The number e is (like π) a transcendental number and is approximately
__________________ .

The number e is defined to be what the expression $\left(1+\frac{1}{n}\right)^n$ approaches as n approaches infinity (∞).

This formula is part of the general exponential growth (or decay) category of applications.

6. There are several exponential and logarithmic equation solving principles. Complete the following statements.

(a) If $\log_a u = v$, then ________________ .

(b) If $a^u = a^v$, then ________________ .

(c) If $\log_a u = \log_a v$, then ________________ .

Show the proper use of two of these principles in the problems below.

$\log_2(x^2 - 1) = 3$ $\qquad\qquad$ $\log_2(x^2 - 1) = \log_2 3$

7. Complete the following chart of logarithm rules, with their rationale.

1. $\log_a a = 1$ because ___________ . For example, log 10 = _____ and ln e = 1.	6. $\log_a \frac{M}{N} = \log_a M - \log_a N$ since $\frac{a^M}{a^N}$ = ___________ .
2. ___________ because $a^0 = 1$. For example, log 1 = 0 and ln 1 = _____ .	7. $\log_a M^r = r \cdot$ ___________ .
3. $\log_a a^r$ = ___________ .	8. $\log_a M$ = ___________ . This is the "Change-of-Base Formula".
4. $a^{\log_a M}$ = ___________ .	
5. $\log_a MN = \log_a M + \log_a N$ since $a^M \cdot a^N$ = ___________ .	

8. The common logarithm is base 10, and the inverse of y = log x is ________________ .

The natural logarithm is base e, and the inverse of y = ln x is ________________ .

These are the two typical calculator keys (log and ln).

Perform the following computations. Round to 4 decimal places.

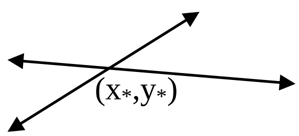
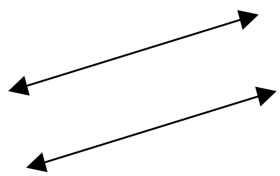
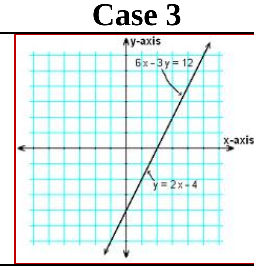
(a) log 23 ≈ 1.3617 (b) ln 100 $\approx$ _____________ (c) log 10 + ln e = _____________

Describe 2 practical applications of exponential functions or logarithmic functions. Include the specific formula related to the application.

(1) __U.S Population Growth (Census Years, 1900-Present)__ $y = 81.2253 \cdot 1.0126^x$

(2) __the pH scale__________________________________ pH = ______________

9. Complete the chart below involving the 3 cases for systems of 2 linear equations.

	Case1	**Case 2**	**Case 3**
Drawing:			
Geometric relationship:		Parallel lines	Coinciding lines
Solution Set:	$\{(x_*, y_*)\}$		{(x, y) | either equation}

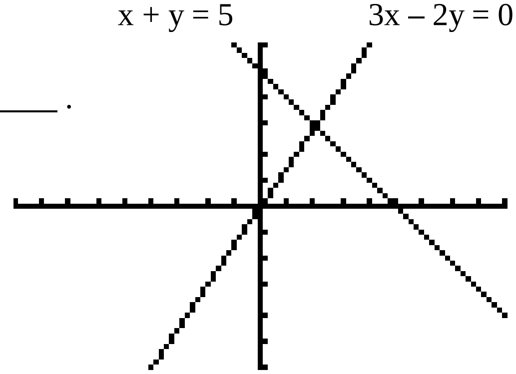
Show your work for each method of solving linear systems.

(a) Graphing (Write each linear equation near the corresponding line on your graph.)

$$\begin{cases} x + y = 5 \\ 3x - 2y = 0 \end{cases}$$

The solution appears to be __________ .

x + y = 5 3x – 2y = 0



9. (b) Substitution

$y = 5 - x$

$3x - 2(5 - x) = 0$

(c) Elimination or Addition

$2(x + y) = 2(5)$

$2x + 2y = 10$

$\underline{3x - 2y = 0}$

10. Write a few sentences describing something you learned that was new for you in class this unit. You may include a favorite activity, an interesting application, a teaching and learning technique, or a specific concept that you better understand as a result of this unit.

Do your best! Live and learn! Rise to the challenge!