Primer Assignment for Mathematics 1b
Problem Set # 0

Prereading guide: *This problem set is due Monday, September 27 or Tuesday, September 28 depending upon whether you are in a MWF or a TTH class. Because it is a pre-class assignment it will be graded on a binary system, with credit based on effort, not on correctness. It must be turned in on the first day of class for credit. The expectation is that Part I. will be done correctly, as it is review. Part II. requires some synthesis. There is also a reading assignment due the first day of class. See the course website under 'News' for details.*

Part I. Primer for Integration

The first third of this course deals with integration and its applications. This part of the problem set is designed to be a primer. You are expected to know the integrals in problem 1. If you don't, review section 5.3 in Stewart to learn them.

1. Evaluate the following:
   (a) $\int u^n \, du, \quad n \neq -1.$
   (b) $\int \frac{1}{u} \, du$
   (c) $\int \sin u \, du$
   (d) $\int \cos u \, du$
   (e) $\int \sec^2 u \, du$
   (f) $\int e^u \, du$
   (g) $\int b^u \, du$
   (h) $\int \frac{1}{1+u^2} \, du$
   (i) $\int \frac{1}{\sqrt{1-u^2}} \, du$

2. Knowing the integrals from problem 1, do the integrals below by substitution. (If you need review, look at section 5.5 in Stewart.)
   (a) i) $\int (2x+1)^3 \, dx$ ii) $\int \frac{1}{(2x+1)^3} \, dx$ iii) $\int \frac{1}{2x+1} \, dx$
   (b) i) $\int x\sqrt{x^2+5} \, dx$ ii) $\int \sqrt{\cos x} \sin x \, dx$ iii) $\int t^2 \sin(t^3) \, dt$
   (c) i) $\int \frac{\ln x}{x} \, dx$ ii) $\int \frac{e^x}{e^{-x}} \, dx$ iii) $\int \frac{x}{e^{x^2}} \, dx$

3. To prime yourself for applications, read Stewart section 5.2 and do §5.2 #1, 7, 30c and on page 438 from the Concept Check do # 2 and 5.

Part II. Graphing Primer

Learning Goal: There are many different ways to look at mathematical problems; often a graphical approach is fruitful. In order to use this approach successfully, you need familiarilty with the graphs of some basic functions. For example, in addition to being able to graph lines and parabolas, you should have some expectations about what the graphs of higher order polynomials can look like. (This will be important for understanding Taylor and MacLaurin series.) You should be able to draw the graphs of trigonometric functions such as $\sin x$, $\cos x$ and $\tan x$, of exponential functions (such as e^x and e^{-x}), and of the logarithmic function. This is by no means an exhaustive list of all the functions you may run into in your studies, but it is a beginning. Some of you may have become accustomed to leaning very heavily on a graphing calculators for anything having to do with graphing. The exercises that follow are meant to prime your graphing skills. You should use a graphing calculator (or the graphing capacity of a computer) to *check* your work but not to do it.

1. How are the graphs of $y = f(x)$ and $y = f(x-2)$ related? If the zeros (roots) of $f(x)$ are at $x = 3, 7$, and 10, what are the zeros of $f(x-2)$?

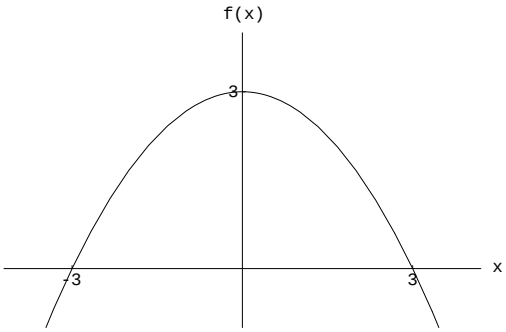
2. What are characteristics of polynomials that distinguish them from exponential, trigonometric, and logarithmic functions.

3. Look at the graphs on the bottom of the next page. Write a possible formula for each function. (There may be more than one correct answer to some of these problems.) Check your answer with a graphing calculator or a computer.

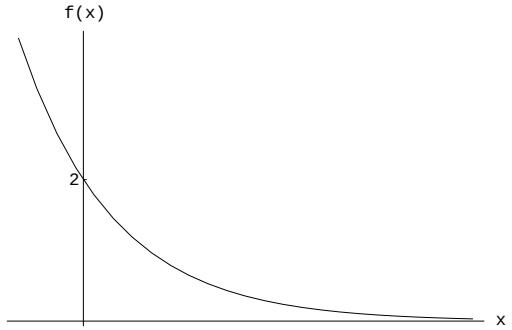
   The domain of the function in graph III is $\{x : x \geq -1\}$; all other functions have the domain $(-\infty, \infty)$. The functions graphed in IV and V are periodic. The function graphed in VII has infinitely many zeros. The zeros in VII are evenly spaced.

   Hints: Two of the functions are basically trigonometric, two are basically exponential functions, one is a polynomial, one is a logarithmic funtion and one requires multiplication of different varieties of functions. The answers to some of these problems are not unique.

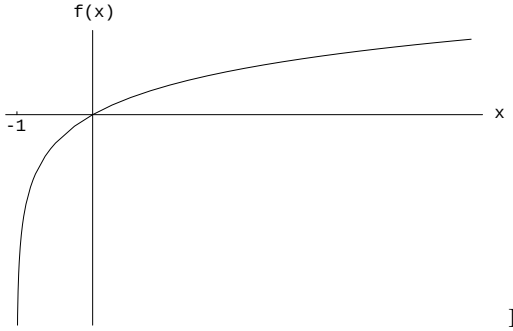
I.



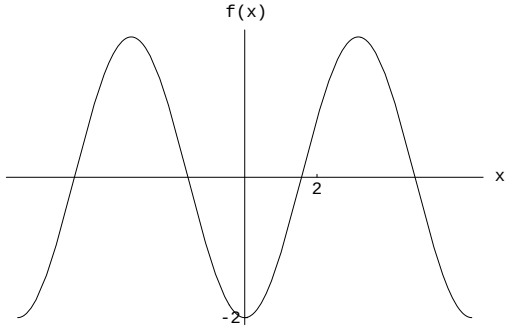
II.



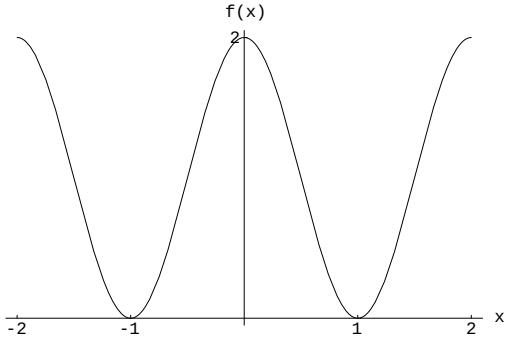
III.



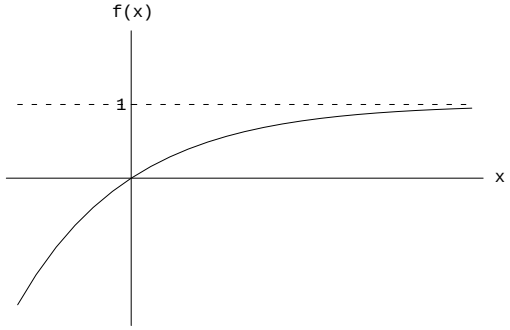
IV.



V.



VI.



VII.