Math. 301-01
Fall, 1999
R. B. Kearfott

First Examination

Monday, September 13, 1999

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is open book, open notes, and computer-on. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 20 points.

1. Sketch a graph of a possible antiderivative $F(x)$, if $F'(x) = f(x)$ and $F(0) = 1$, where the function $f(x)$ is given in Figure 1. Be sure to label the points A, B, C, D, E, F, and G on your graph of the antiderivative.

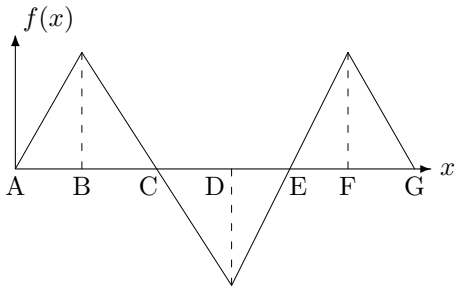

Figure 1: The derivative f for Problem 1

2. If an antiderivative of f is shown in Figure 2, then write down $\int_1^3 f(x)dx$.

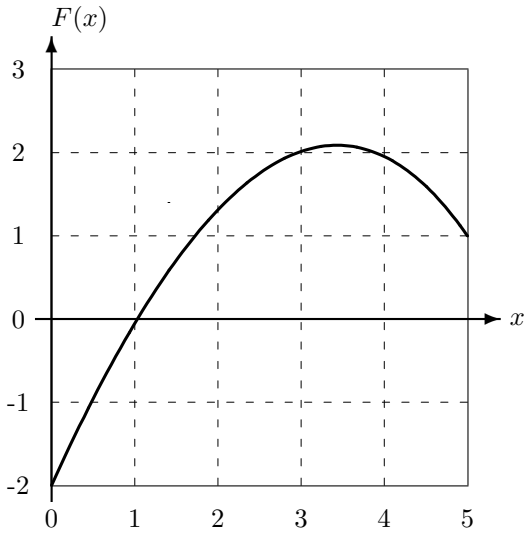

Figure 2: The antiderivative for Problem 2

3. Find each of the following. In the case of the definite integrals, give an exact numerical answer, except you may leave transcendental numbers such as $\log(5)$. Although you may use the computer as an aid, you must write down the set of steps you would take to do the problem by hand.

   (a) $\int_0^1 \frac{2000x^{1999}}{1+x^{2000}}dx$ (b) $\int \frac{x}{1+x}dx$

   (c) $\int x^2 \sin(3x)dx$ (d) $\int_{-1}^1 x^2 \sin(x^3) - x\cos(x)dx$

4. The acceleration of gravity on the moon is about 5ft/sec^2. Suppose someone throws a ball with an initial velocity of 125ft/sec up from the surface of the moon.
   (a) Derive an equation for the height of the ball $s(t)$ above the moon's surface, as a function of time t.
   (b) How high above the surface does the ball go?
   (c) When does the ball return to the surface?

5. Find the solution to the differential equation $y' = x^2 \sin(3x)$, $y(0) = 1$.