Mathematics 134 – Intensive Calculus for Science 2
Exam 2 – Things To Know
March 17, 2006

General Information

As announced in the course syllabus, the second full-period midterm exam of the semester will be given in class on Friday, March 24. The format will be similar to that of the first midterm exam, and the midterms last semester. The exam will cover the material since the first exam (Quizzes 4,5,6), including the following material from Chapter 7, sections 2,3,4,5,6, and Chapter 8, sections 1,2,3,7,8:

1) Integrals by parts: Selecting appropriate u and dv, computing du and v, using the parts formula $\int u\,dv = uv - \int v\,du$, then finishing the integral on the right. Recall that this might involve using parts again, or another method such as substitution.
2) Integrals by partial fractions: Division to get degree of numerator less than the degree of the denominator, factorization of the denominator, setting up partial fractions, solving for coefficients, integration of resulting simpler rational functions.
3) Integrals by the table: Recognizing the appropriate entry, using reduction formulas repeatedly if necessary. Be aware that a preliminary substitution might be necessary to take an integral to one of the forms in the table.
4) Left-hand sum, Midpoint sum, Right-hand sum, Trapezoidal rules for approximate numerical integration – I might ask you to compute an approximate value with one or more of these methods, but only for simple functions and small n. I might also ask "qualitative" questions about which methods give over- or under-estimates in particular situations.
5) Applications of integrals:
   a) Areas and volumes by integration – know how to set up an integral formula by slicing, approximating the area or volume of the slice, summing, then taking a limit to get an integral. You may need to use any one of the methods we know to evaluate one of these. Important special case – volumes of solids of revolution. Know how to distinguish between the cases of disk or ring ("washer") cross-sections, and how to set up the integrals in each case.
   b) Total mass and center of mass of an object of specified shape and given density function.
   c) Arc length of curves
   d) Probability density functions, cumulative distribution functions, probabilities, means.

There will be a review for the exam in class on Wednesday, March 22. Rosie will also be available for "last minute" questions Thursday evening at the usual time.

Sample Exam Questions

Note: The actual exam will only have 7 or 8 "parts;" this list is somewhat longer than the actual exam will be.

I. Compute each of the integrals below using integration by parts or partial fractions:

A) $\int x^2 e^{-2x}\ dx$

B) $\int \frac{x+1}{x^3-4x}\ dx$

II. Compute each of the following integrals using an entry or entries from the table of integrals. Say which entry or entries you are using.

A) $\int \sqrt{x^2-9}\ dx$

B) $\int \cos^4(6x)\ dx$

III. Which of the methods LEFT, RIGHT, MID, TRAP is guaranteed to give an overestimate for $\int_0^4 f(x)\ dx$ for all numbers n, where the graph $y = f(x)$ is the following?

(There may be more than one!)

IV. Let R be the region bounded by $y = x^{3/2} + 1$, $y = 0$, $x = 0$ and $x = 4$.

A) Sketch the region.
B) Find the volume of the solid obtained if R is rotated about the x-axis.
C) Set up the integral to compute volume of the solid obtained if R is rotated about the line $y = 10$.
D) What is the length of the top boundary curve of the region R?

V. A thin metal plate has the shape of the region in the plane bounded by $y = \sin(x)$, $y = 0$, $x = 0$, and $x = \pi/2$. The density of the material of the plate at x is $\rho(x) = x + 1$ grams per unit area.

A) Compute the total mass of the plate.
B) Set up (but do not evaluate) the formula to compute the x-coordinate of the center of mass.

VI.

A) For which value c is $p(x)$ above a valid probability density function (pdf).
B) A random value is selected with distribution described by $p(x)$. What is the probability that $1 < x < 2$?

Also see Problem Sets 4,5,6, the last three quizzes, and the Review Problems from the ends of Chapters 7,8 in the text for other practice problems.