Exam 1 Review

Date: Wednesday, Feb 7.
Time: 6pm - 7:30pm (starts promptly at 6 so be there before this time).
Location: 182 Dennison.
Note card: You may have half of a 3x5 note card.
Calculator: Bring it, and make sure you have and can use the INTEGRAL program.

Material: The exam will cover 6.1-7.8, as well as some little information from section 3 and section 4.6 (section 3 we did the first day as a review of the integral, and section 4.6 reminds us how to take the derivative of the $\text{arctan}(x)$ and $\text{arcsin}(x)$ ... you should be aware of these functions and their derivatives, but do no need to know how to produce the derivative).

Key to studying: Practice doing problems; review as you practice. For instance, suppose you come across a question which tells you the rate at which fish were reproducing in the Huron river from 1970 to 1975, and asks you to 1) sketch a graph of the rate at which fish are reproducing (for $t$ between 70 to 75), 2) sketch a graph of the total number of fish born in the river at time $t$ (for $t$ between 70 to 75), and 3) say how many fish will be born in the river from 1970 onward. The first thing you should do is solve the problem (you might have to do some reviewing to complete this step). It is a good idea to practice writing the answers down to some of the problems you practice, else you might find on the exam that you don’t understand it well enough to actually explain it. Next, ask yourself some questions to see if you understand the problem, like: what is the relationship between this problem and an integral, what does a integral measure, what is the derivative of a function defined by an integral (the answer to part 2 above would involve a function defined by an integral), what questions like this one were asked about in the group hw, or what concepts like this one were considered in the group homework, etc. Some problems like the group homework will very likely appear (not so hard, perhaps, but the same sorts of problems). The idea as you practice is not to attempt a problem so that you can say “Here is how you solve that particular problem,” (because that particular problem probably won’t be on the test) but to be able to say “I understand integrals, so here is how you solve this kind of problem.” In the end, you must make your own decisions, of course, and everyone studies a little differently. These are just my thoughts on the matter.

You can get problems from:
1. Old exams (from other semesters) (GOOD IDEA)
2. Group homework problems (KNOW HOW TO DO THESE TYPES OF PROBLEMS)
3. Class exercises
4. Individual homework questions
5. The book in general

Checklist of topics and my musings: recall that I do not write the exams, so you should use this to help you study, not as an authoritative guide. If you find something I missed, please let me know right away.

1. Chapter 6
   (a) Definite integrals.
      (i) Integrals computing area. (What does this area represent, what are the various ways to calculate it).
(ii) Given the graph of $f'$ what can you say about $f$, especially about the graph of $f$?

(iii) First Fundamental Theorem of Calculus (esp. using it to label graphs).

(b) Indefinite integrals.

(c) Differential equations. Using anti-differentiation to solve real world problems.

(d) Second Fundamental Theorem of Calculus.
   (i) Constructing antiderivatives.
   (ii) Differentiating integrals.

2. Chapter 7
   (a) Integrating by U-substitution, by parts, with tables, completing the square, using long division, and using partial fractions.
      (i) Know the derivative of $\arctan x$ and $\arcsin x$, so that you could use them if necessary.
   (b) Approximating definite integrals.
      (i) Left, Right, Mid, and Trap sums (esp using calculator).
      (ii) Under what circumstances do you get over and under estimates.
      (iii) What is the error in these approximations (how to you get a certain number of decimal places of accuracy).
      (iv) Approximate a given integral with error less than a certain bound.
      (v) About how long should it take to approximate some integral with error less than some bound (say to 10 decimal places) if you knew how long it took to approximate it a certain accuracy (say to 1 decimal place).
   (vi) You do not need to know Simpson’s Rule.
   (c) Improper integrals
      (i) What does it mean to converge or diverge?
      (ii) What are the several ways that integrals can be improper and how do you deal with them?
      (iii) Comparison test.
      (iv) Be able to chug one out, of course.

Some things I think are fairly certain: I think that you will see a problem from section 6.3. You will see an improper integral (probably will have to evaluate it during the course of a problem). You will be asked to give the physical meaning of the area under some curve (they will ask the total number of fish born, for instance, after they have given you a function for the rate of births). You will also be asked to estimate some integral to a certain number of decimal places or with error less than some bound. This means you will need the program INTEGRAL on your calculator. They may ask you to do a Riemann sum calculation by hand (calculate TRAP(2) for some function and draw a picture, for instance). You might be asked to write a Riemann sum. I do know that there will be one page on the exam for which NO explanations need be given. On the rest of the test, however, explain everything you do.