Math 325, Spring 2000

Tips for Studying for the Final

The final is Wednesday, May 9, 4:15-6:15. It includes an a take-home part, which will be handed out in class on Monday, May 1, and due at the start of the in-class part. The final will cover everything we have done, so Sections 4.1-4.3, 8.1-8.2, 8.4, 8.6, Chapter 7, Sections 9.1-9.3, Sections 10.1-10.6, and Chapter 6 in Boyce and DiPrima and Chapters 5, 7, 8, and 11-13 of *Differential Equations with Maple*. You may bring a summary (both sides of an $8\frac{1}{2}'' \times 11''$ sheet of paper, with notes in your writing) to the final.

Since you are allowed to bring in notes, I am not testing your ability to memorize formulas, algorithms, rules, etc. As you know by now, it is easy to get a computer to solve many ODE and systems of ODE, often explicitly, and almost always numerically. That means that the ability to do computations by hand is much less important. An understanding of the theory, an ability to tell whether computer output is reasonable, and the ability to interpret the output is very important.

I also assume that you learned techniques of integration in second semester calculus, got good at doing them when you did multiple integrals in third semester calculus (if you weren't already good at them), and refreshed your ability to do them on homework problems in this course, so I don't need to test your ability to carry out a skill you learned long ago. I will provide you with a copy of the table of Laplace transforms from page 300 of Boyce and DiPrima and also a table of Fourier transforms of some standard functions.

What should you expect the in-class part of the exam to look like? It will have 6 problems, some with several parts, each worth 15-20 points. (There will also be a 10 point bonus problem.) Almost $\frac{2}{3}$ of the points will be on material not included on the midterm—nonlinear systems, Fourier series, the heat equation, the wave equation, and the Laplace transform. As I mentioned several times in class, there wouldn't be much point to doing the Laplace transform just to give you another way of solving the kinds of problems you solved in Chapters 3 and 4. Because of my mathematical interests, I have a particular fondness for the heat equation.

Some of the problems will involve computing solutions. What kind of problems have you learned how to compute solutions for this semester? Constant coefficient linear equations (higher order and using the Laplace transform), first order constant coefficient systems, the heat equation and the wave equation. I won't ask you to compute a numerical solution—that is best done by computer.

Since the take-home exam tests your ability to write Maple code, I won't ask you to write any during the in-class exam.

How can I test your ability to tell whether computer output is reasonable and if so, to interpret it? I will guarantee at least one problem (and at most two) in which you are shown a Maple worksheet which has the Maple input and output but no comments. The worksheet will have some relationship to problems you have done. You will be asked various questions connected with the worksheet. Since you can't find explicit solutions for nonlinear systems, but you can get a lot of information about solutions from plots of various kinds, nonlinear systems are good candidates for Maple problems. How can you study for such problems? Although the Maple problems on the midterm were on linear systems and numerical solutions, start by making sure you understand those. Then make sure you understand things we've done with computers and nonlinear systems, such as some of the problems in Problem Set F and Project 1.

While some of the problems on the exam will require an understanding of theory, or be a lot easier if you do understand some theory, I won't test that understanding very directly. By that, I mean there will be no problems of the type that often cause you the most trouble in homework—none involving reading abstract mathematical statements or doing proofs. However, you can count on at least one problem which will require you to use ideas from the course in a new way.