Differential equations projects Math 309 Wiseman Fall 2005

During the last four days of classes, you will turn in a differential equations project. The project consists of a paper and an in-class presentation. The paper is due at the beginning of class on Monday, 12/2; the exact time of your presentation will be determined later.

To complete your project you can use any resources you want. Depending on your project you may want to consult textbooks, books from the library, journal articles, the internet, etc. You are required to use at least two sources in addition to the handout that you are given (websites and your textbook don't count toward this minimum). Here are some concrete suggestions.

- The best place to find journal articles about mathematics is Math-SciNet. You can find it on the web at http://www.ams.org/mathscinet/.
- There are many excellent java applets on the web. See if you can find one that illustrates your examples.

Due by **3:00, Friday, November 4** : send me an email with the a list of the top 4 projects that you'd like to present. List them in order with your favorite first and your least favorite last.

The presentation: Each presentation should last 30 minutes. Your presentation can be as high- or low-tech as you'd like. Feel free to use the chalkboard, the overhead projector, the internet, Powerpoint, Maple, Winplot, the CD that came with your textbook, physical demonstrations, etc. You have a lot of freedom. Be sure to practice before you give your talk; you may find it more difficult than you expect!

Your presentation will be graded on the following criteria:

- (1) *Overview:* What is the context of the problem? Was the background of the topic explained? What assumptions are you making?
- (2) *Mathematics:* Have you clearly explained how the methods of this course help answer the question? You won't have time to do every detail, but you should at least outline the development of the necessary mathematical theory.
- (3) *Clarity:* Is all new terminology and notation defined?
- (4) *Style and organization:* Is the talk polished? Does it look like you have practiced it? Is the talk well organized and well planned?

Hint #1: It's a very, very, very good idea to visit the Speaking Center while you're planning your presentation.

Hint #2: One of the most common mistakes that students make in presentations is rushing through the introduction. Make sure to spend plenty of time setting up the problem. Remember, the audience won't care about the answers you're giving if they don't understand the questions.

The paper: There is no page limit (maximum or minimum) for your writeup. It should be typed. For many of you the write-up will include more information than you will be able to present (those 30 minutes will fly by!). The paper should be written in complete sentences, with correct grammar and punctuation. It should read like a research paper, not like a homework assignment. Although I will list tasks for you (a, b, c, etc.) you shouldn't write your papers in that way. You are free to use any word processing software that you like, but Microsoft Word has an equation editor that may help with the writing. Lastly, it is very important to cite any outside sources and to include a bibliography. Be aware of Agnes Scott's strict policy on plagiarism!

Your paper will be graded on the following criteria:

- (1) Do you address all of the issues in the assignment?
- (2) Can the paper stand on its own? That is, can the paper be understood by someone who didn't see the presentation?
- (3) Is the paper well written (including punctuation and grammar)?
- (4) Did you use at least two outside sources? (Remember, websites and your textbook don't count toward this minimum.) Are all outside sources cited appropriately? Is there a bibliography?

Timeline:

- (1) Friday, November 4 submit project requests by 3:00
- (2) Monday, December 5 through Monday, December 12 project presentations in class
- (3) Monday, December 12 papers due at beginning of class

List of possible projects

- (1) Proof of the existence and uniqueness theorem (Picard's theorem) using the Banach contraction theorem
- (2) Series solutions to differential equations
- (3) Difference equations
- (4) Calculus of variations
- (5) Chaotic dynamics in the plane: ω -limit sets and the Poincare-Bendixson theorem
- (6) Dirac delta function
- (7) Three-body problem
- (8) Modeling epidemics
- (9) How does Maple solve ODEs?
- (10) Comparing different ODE textbooks
- (11) Other. If you don't see anything that you like here, I encourage you to come up with your own topic. Differential equations are everywhere, so you should be able to find some application that interests you. By November 4, turn in a project description like the ones that I've given for the projects listed above.