FINAL PROJECT

Due Date: See Sections Below
100 Points

In many ways, differential equations are the backbone of applied mathematics. We spend a lot of time in class learning techniques to solve them, but that does little to show their importance. The final project for this course is designed to let you explore some of the significance of differential equations outside of the classroom.

This project consists of three parts:

- Proposal

- Write Up

- Presentation

Each of these components are explained in detail below. For the final project, you may work in groups of 1-4 students. If you choose to work in a group, know that you are committing to treat the other members with respect and to do your fair share of the project. I reserve the right to separate individuals from a group at any time should other members of that group feel disrespected in any way or it does not appear that an individual is adequately contributing to the project. Groups need only submit one proposal and one write up that includes the names of all group members. All members of the group need to be a part of the presentation.

Goals

By the end of this project, you should...

- appreciate differential equations in a larger context.

- be capable of thinking about a topic outside of the classroom setting.

- have demonstrated your ability to communicate ideas through good academic writing and public speaking.

- be glad its over.

- have had a lot of fun.

Choosing a Topic

Finding a suitable topic is perhaps the most difficult part of this project. You may choose any topic that has to deal with ordinary differential equations, and I have provided some ideas on Blackboard in the Final Project folder. When you're looking for a project idea, try to draw from your own interests; it will be much easier to motivate yourself if you have some enthusiasm for the project.

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Your project may be expository or original. An expository project is a detailed analysis of something that is already well-known. Our in-class examination of spring displacement is a good example of this. Other examples are the two/three body problem, RLC series circuits, the Lorenz system, or predator-prey dynamics. If you choose to work on an expository topic, be aware that I will expect very thorough and well-formulated results from you. An original project is one that comes from your own idea. By their very nature, its difficult to give examples of them; however, you might choose to extend some well-known idea.

Finally, good projects will be of an appropriate scope. It is very easy to choose a project that is too simple, and it is equally difficult to choose a project that is unrealistic to accomplish in one semester. If you need help finding an appropriate balance, please do not hesitate to contact me. I will do my best to add to uncomplicated ideas and pick through the cumbersome ones. It would be best to run your idea by me before you submit your proposal, but part of the reason I'm requiring the proposal is to catch ideas that may prove to be problematic in the future.

Proposal

Due Date: 29 Oct 2015 (Thurs)
15 Points

In short, your proposal should summarize the game plan for this project. It should be 1-2 pages typed and include a brief overview of your chosen topic. If you have a differential equation (or a system of differential equations) already formulated, then you should include this as well.

Your proposal should indicate specific questions you plan to answer with your project. These are not set in stone. So feel free to change them, but the proposal should point you in a direction. This is especially important if you're working in a group because it should get all of the group members on the same page.

At the end, please list some references (2-3+). Be aware that I will look up your references so that I can understand your perspective on this project; so make sure they're worthwhile. (I should note: in my opinion, Wikipedia is a worthwhile initial source. They do a decent job of summarizing topics, but it should not be your only reference.)

Write Up

Due Date: 10 Dec 2015 (Thurs)
70 Points

The bulk of the final project is a typed write up detailing all of the work you've done on your topic. There is no page minimum or limit, but you should be sure to give a thorough examination. 5 pages is probably not enough to fully explain the topic – especially if you're incorporating equations, diagrams, and figures. A good project probably has 12-20 pages. Good write ups are also understandable to an individual who has limited knowledge of the topic; so be sure to fully explain yourself.

There is no specific required format, but in general your write up should include:

Introduction A section setting up the problem and discussing why you chose to look at it.

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Motivation Language that describes the mathematical formulation of the project. In other words, why the equations look the way they do.

Analysis & Results Your work on the topic. This might include solving the differential equation(s), a discussion of model simulations, parameter analysis, a section detailing strengths and weaknesses of the model, etc.

Graphs & Diagrams Figures that help to support your analysis and results.

Bibliography A list of references you used when working on the problems. Be sure to properly cite them throughout the write-up when needed. (There is no required format for doing so; just make it consistent.)

Python Code Any Python codes/programs that you used to complete this project. Please include this as a separate document or an appendix; do not include it as part of the main body of your write up.

Just a note: Be careful about plagiarism. If you are confused as to what qualifies as plagiarism, then please consult the Academic Integrity Policy or talk to me.

Presentation

Due Date: 8/10 Dec 2015 (Tues/Thurs)
15 Points

In addition to the written portion, you will be required to give a short in-class presentation on your findings. Each group will be given 10-15 minutes to discuss the motivation of their project, highlight the project details, and summarize their analysis and results. You should be prepared to answer questions after your presentation.

Presentations will be given on Dec 8 (Tues) and Dec 10 (Thurs). A sign-up sheet will be made available closer to those dates. Depending on how many presentations we will have, this schedule (including the presentation length) might change.