Math 229, Fall 2014
Differential Equations

“A solution is a function.” – K. Constantine

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Office hours: DC: Wed 3-4p, Thurs 2-3p
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Problem session: TBA, ESC TBA

Meeting times: MW 1:10-2:30 am, ESC 137

Text: Differential Equations, Blanchard, Devaney & Hall.

Mathematica: We will use Mathematica a fair amount this semester. If you do not already have it installed on your computer, you should get your copy from WesFiles via the directory path Software → [Mac, PC, or Linux]Soft → All → Mathematica for Students. The .txt file there will explain activation of your copy of the software.

Course overview: Differential equations model change – change with respect to time, location, or a host of other factors. They are ubiquitous in the physical and social sciences, and the study of differential equations is key to many areas of applied math. In addition, the study of differential equations itself is a deep and interesting field of pure math, with connections to many areas of real and complex analysis, geometry, and dynamical systems.

As you will discover, there is no central, overarching theory for our subject matter, in contrast to the way that vector spaces and linear transformations
are the central theory of a linear algebra class, or that group theory is the central focus of a first abstract algebra course. Instead, mastery of differential equations involves cultivating a wide tool kit for solving problems, as well as skill in using differential equations for modeling, evaluating the strengths and weaknesses of those models, and interpreting the solutions we obtain from our models.

In this course, we will develop the theory of linear ordinary differential equations, and linear systems of ODEs. We will also develop numerical methods for solving DEs that are not solvable in other ways, and will develop methods for qualitative analysis of DEs, with a particular focus on non-linear DEs. As time permits, we will cover Laplace transforms and series solutions.

**Course goals:** As noted above, our goals involve a wide range of skills and habits of thought. This course has been specifically designed to help you learn to apply deep mathematical understanding to the many situations (pure and applied) where DEs show up. Our course goals are:

- To be able to produce DE models to understand (new and unfamiliar) systems involving change.
- To be able to understand and critique the strengths and weaknesses of DE models.
- To be able to obtain qualitative information about solutions to DEs, especially those for which standard solution routines are not available.
- To develop understanding of and facility with various numerical methods for producing approximate solutions to DEs.
- To bring deep mathematical understanding and rigor to the work with DEs which you will do in other classes.
- To develop skills working collaboratively on open-ended mathematical problems.

**About our text:** Our text takes a ‘modeling-heavy’ approach to DEs, emphasizing the process of constructing models before moving into solving various types of DEs. We will mimic this structure in our class. The text (and the class) also places a premium on qualitative analysis of DEs and addresses numerical methods early.
The text is an excellent reference for the material we will learn. We will sometimes follow its presentation, but at other times we will work on our own in class to develop methods.

Explorations and projects:
This semester we will undertake several exploratory investigations in class which will motivate material, and during which we will develop methods together for solving and analyzing DEs. These are a crucial part of the class and of building some of the skill sets mentioned above – as such, class attendance and participation is essential and will be tracked.

You will also complete three projects which involve deeper investigation of specific DE models. You may work on these individually, or in groups of up to 3 students of your choosing. More detail on what is expected from write-ups will be handed out later. During weeks when projects are due, there will be no problem set.

See dconstantine.web.wesleyan.edu/teaching/DE_projects for a list and brief descriptions of potential projects. If you have ideas of your own for projects, please bring them to me.

Logistics: We will have problem sets most weeks, one midterm exam and one final exam, and three written projects.

Problem sets: 20%
Projects: 10% each
Midterm exam: 20%
Final exam: 25%
Class Participation: 5%

Problem sets should be neat, clear, and STAPLED. You are welcome/encouraged to collaborate with others on the problem sets but you must sit down by yourself to produce an independent write-up of your solutions. Identical or nearly identical solutions may be cause for loss of credit or further disciplinary action. Please indicate your collaborators on your write-up. The lowest-scoring problem set will be dropped. Late homework is not accepted.

Important dates:
Midterm exam: Thursday, October 16, 7-9pm
Final exam: Thursday, December 11, 9am-12noon
Project due dates: Friday Oct 10, Friday Nov 7, and Friday Dec 5

Students with Disabilities:
Wesleyan University is committed to ensuring that all qualified students with disabilities are afforded an equal opportunity to participate in and benefit from its programs and services. To receive accommodations, a student must have a documented disability as defined by Section 504 of the Rehabilitation Act of 1973 and the ADA Amendments Act of 2008, and provide documentation of the disability. Since accommodations may require early planning and generally are not provided retroactively, please contact Disability Resources as soon as possible.

If you believe that you need accommodations for a disability, please contact Dean Patey in Disability Resources, located in North College, Room 021, or call 860-685-5581 for an appointment to discuss your needs and the process for requesting accommodations.

Please note:
I very rarely give an incomplete or any sort of make-up exam, and do so only for very serious circumstances. Under all circumstances, there is a much better chance I can do something for you if you let me know what is going on ahead of time.

It is your responsibility to be familiar with and abide by University policy on cheating and plagiarism, and to conform to the Honor Code. Ask me if you have questions, and note the homework collaboration policy above.