

Math 220

Differential Equations

Contact Information

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Meeting times

This course meets MWF 3:00-3:50 in Noyce 2517.

Office Hours

1:00-3:00 Monday, Wednesday, Thursday,
or by appointment,
or drop in if my office door is open.

Text

Elementary Differential Equations, 9th or 10th Edition; Boyce and DiPrima

Introduction, course aims and objectives: Differential equations is where physics and mathematics meet. Most physical phenomena that we can study are studied using differential equations: the vibration of a spring, the propagation of heat or waves through a medium, planetary motion, and the list goes on.

A course in Mechanics (PHY 234) is a good place to learn how differential equations describe the physical world. Our task in this class is more about the mathematics behind differential equations. We aim

1. to learn methods for solving certain differential equations explicitly (*some* of these equations may never come up in your physics classes, but getting a broad understanding of the subject comes from not restricting our attention only to “useful” problems);
2. to learn ways to understand the qualitative behavior of solutions of those differential equations which cannot be solved explicitly (in fact, this is by far the more common situation. We must not restrict our attention only to problems with “nice” solutions);
3. to become familiar with power series and Fourier series as mathematical tools that can be used to aid in the above two tasks;
4. to learn or reinforce some techniques from linear algebra to better understand the qualitative behavior of solutions of systems of differential equations.

Mathematica Some of the computations in differential equations can get tedious. Therefore, I want you to learn to use a computer algebra system, so that you won't need to waste time doing routine calculations that are not illuminating. Since I know *Mathematica* best, I will ask that you learn to use that. This may also be a useful tool for you in other courses or in computational research projects.

Many students wonder when it is okay to use Mathematica for a problem. In general, if there is a calculation which you are confident that you could do, but which you also know would not serve any learning purpose, feel free to use Mathematica. On exams, you will only be allowed to use a simple scientific calculator, so it is important to be sure you *could* do a given problem if that was required.

If there is a picture of a mouse next to a problem in the text, that is an indication that a part of the problem will require a computer, typically to generate a graph.

Exams There will be three 50-minute exams, on September 27, November 1, and November 29. The final exam is scheduled for Friday, December 15, from 2:00 PM until 5:00 PM. **Do not make flight arrangements or other plans that would require you to take an alternate exam.** I will deduct a letter grade from the final exam of anyone who makes flight arrangements or other plans requiring an alternate final exam. If you have another final exam scheduled at the same time as the final exam for this course, please let me know as soon as you can so that we can make alternate arrangements.

Only scientific calculators (without graphing capabilities) are permitted on exams. I will bring some permissible calculators to each exam for anyone who wants to borrow one.

Homework Homework will be due at the beginning of class. A grader for the course will grade a portion of each homework assignment. I will drop a total of two homework assignments, but late homework will typically not be accepted or graded. Homework assignments can be found in the Assignments section on Pioneerweb.

When doing homework, be sure to staple your work before class; I generally will not have a stapler available in class. Also, begin each problem at the left side of the page – do not put more than one solution side by side. Please leave two or three lines of space between each problem and the next.

If part of a problem involves producing a graph, you can print out the graph and include it as an appendix to your work – be sure to indicate where the grader can find the graph. Every graph should be accompanied by at least one sentence describing what the graph shows or what we learn from it.

Preparation and participation You will learn more from this class if we can devote more class time to having you think about problems, rather than just copying down notes from a lecture. Therefore, I will occasionally post some notes on a section that you should read before class. Such preparation will allow us to use class time more effectively.

You will learn more from this class by working with others than trying to do everything on your own. Therefore, I encourage collaboration on homework assignments (but acknowledge the

help – see the section on academic honesty below). Also, I will ask you to work on problems in class with a randomly selected partner. You should speak to your partner about your own ideas, and listen to your partner's ideas; don't just work on the problem separately!

But also, you will learn more from this class by working on some problems on your own, rather than just listening to me give the "correct answer." I will also occasionally give unannounced, low-stakes quizzes in class. Writing your name and an attempt at an answer will be worth full credit on such quizzes. The purpose of such quizzes is to have you think and learn, not to assess your learning.

Academic Honesty Standard academic honesty policies of the college apply to this course; such policies are described in the *Student Handbook*. In this class, you do *not* need to acknowledge ideas that you receive directly from me, or ideas that you get from the textbook. However, ideas that you get from others in the class, other faculty, or any other outside sources beyond the textbook must be acknowledged. If you work with others on an entire problem set, it is required that you list the names of those you work with at the top of your problem set. If you get an idea from someone on a particular problem, you must make a note of that next to the problem. For example, if Simeon helped you on a particular problem, you could write, "help from Simeon" next to the problem. If you referred to a website to understand material for a problem, provide me with the URL of the website at the end of the problem. If you referred to a book, provide me with the author and title.

Grading If your exam average is better than your final exam grade:

- Homework: 15%
- Exam average: 55%
- Final exam: 20%
- Preparation and participation: 10%

If your final exam grade is better than your exam average:

- Homework: 15%
- Exam average: 35%
- Final exam: 40%
- Preparation and participation: 10%

Excessive absence/tardiness can have a negative impact on your grade. If you are sick and let me know before class that you cannot make it, I will not count that against you.

Time commitment Plan to spend around 10 hours a week outside of class on this course. This number may need to be adjusted upward or downward, as the amount of time you will need to spend to do well will vary according to your mathematical background.

Accommodations I encourage students with documented disabilities, including invisible disabilities such as chronic illness, learning disabilities, and psychiatric disabilities, to discuss appropriate accommodations with me. You will also need to have a conversation about and provide documentation of your disability to the Coordinator for Disability Resources, John Hirschman, located on the 3rd floor of the Rosenfield Center (x3089).

If your accommodations require that you have extra time on an exam, or that you take an exam in a separate room, you will need to reserve a room provided by Academic Advising. Be sure to make arrangements with Stacey Turley or John Hirschman (x3089) at least a week prior to the exam.

Religious Observances If a religious observation conflicts with your ability to participate in some aspect of my course, please be sure to let me know so that we can make suitable arrangements.

Athletic Events Please be sure to let me know ahead of time when you will need to miss class for athletic events, so we can make suitable arrangements for any missed material.

Finally, a little advertisement from the Math SEPC:

Peer Advising Do you want to know more about what its like to be a math major and what upper-level math classes are like? Do you lack upper-year math majors in your life to ask these questions to? Would you like to get to know more math majors? If you answered yes to any of these questions, our Peer Advisor Program may be a valuable resource to you! This program matches students interested in the math major with upper-year math majors who will act as peer advisors, giving advice and answering questions about being a math major at Grinnell. This program is a great way to get involved, build community, and find support in the department. We strongly encourage all students interested in declaring a math major to participate. If you are interested in participating, please email mathsepc@grinnell.edu!