

MATH 322: ORDINARY DIFFERENTIAL EQUATIONS COURSE INFORMATION

SPRING 2022

Location:	Library 204, MWF 11:10–12:00
Instructor:	David Perkinson (he/his) (davidp@reed.edu)
Course homepage:	https://people.reed.edu/~davidp/322/
Moodle:	https://moodle.reed.edu/course/view.php?id=4200
Text:	<i>Differential equations and dynamical systems</i> , Lawrence Perko, edition 3
Office hours:	TBD

Course description. This is a course in ordinary differential equations for advanced undergraduates.

Learning outcomes. After taking this course, you will understand the basic theory of ODEs and its applications to analyzing systems of equations. The topics will include:

- » Systems of linear ordinary differential equations with constant coefficients.
- » Local theory of non-linear systems: fundamental local existence-uniqueness theorem, the stable manifold theorem, the Hartman-Grobman theorem on linearization of a nonlinear autonomous system near a hyperbolic equilibrium point, stability and Lyapunov functions, and critical points of planar systems of nonlinear differential equations. Outlines of center manifold theory and normal form theory.
- » Global theory: index theory, critical points at infinity, global phase portraits, resolution of singularities.

At the end of the semester, you will give oral presentation on an independent topic of your choosing. The course should improve your ability to communicate mathematical ideas both verbally and in writing.

Distribution requirements. This course can be used towards your Group III, “Natural, Mathematical, and Psychological Science,” requirement. It accomplishes the following goals for the group:

- » Use and evaluate quantitative data or modeling, or use logical/mathematical reasoning to evaluate, test, or prove statements.
- » Given a problem or question, formulate a hypothesis or conjecture, and design an experiment, collect data or use mathematical reasoning to test or validate it.

This course **does not** satisfy the “primary data collection and analysis” requirement.

Class attendance and participation. This is an in-person class. Therefore, when your health allows, you are expected to be present and engaged. At the same time, each community member has an individual responsibility to help prevent the spread of the coronavirus and other diseases. If you need to miss a class, or series of classes, due to illness, self-isolation, and/or quarantine, you are responsible for emailing me to let me know as soon as possible.

While in class, I expect you to actively engage in conversations by asking questions and participate in classroom discussions and activities. You are expected to do the assigned reading in advance of class, and doing so will help you to participate more effectively.

People have a tendency in math classes to think that their question is trivial or uninteresting. However, in fact, if you are confused about something—even if it feels like something that should be simple—count on at least half of your fellow students being confused on the same point. Asking that question is likely to come as a relief to several of your classmates. Your questions will then encourage others to participate, and they will help me adjust the pace of the class.

Text. The third edition of *Differential equations and dynamical systems* by Lawrence Perko is required for the course. It is possible to use an earlier edition, but the assigned reading will reference the third edition. So if you use an earlier edition, make sure that you are reading the correct material.

Homework. Homework assignments will be posted on our course homepage and will be due via Gradescope.¹ Excellent solutions take many forms, but they all have the following characteristics:

- » they use complete sentences, even when formulas or symbols are involved;
- » they are written as explanations for other students in the course; in particular, they fully explain all of their reasoning and do not assume that the reader will fill in details;
- » when graphical reasoning is called for, they include large, carefully drawn and labeled diagrams;
- » they are neatly typeset using the L^AT_EX document preparation system. A guide to L^AT_EX resources is available on the course homepage.

I reserve the right to not accept late homework. If health or family matters might impede the timely completion of your homework, please contact me as early as possible.

Feedback. You will receive timely feedback from me on your homework via Gradescope. Most homework problems will be graded on a five-point scale (5 = perfect; 4 = minor mistake; 3 = major mistake, right idea; 2 = significant idea; 1 = attempted, 0 = none of the above). *The quality of your writing will be taken into account.* If your answer is incorrect, this will be reflected in the score, and there will also be a comment indicating where things went wrong with your solution. You are strongly encouraged to engage with this comment, understand your error, and try to come up with a correct solution. You are welcome to post questions about homework problems (old and new) to our Moodle forum and talk about them with me in office hours (see the Help section).

Collaboration. You are permitted and encouraged to work with your peers on homework problems. It is best practice to cite those with whom you worked, and you must write up solutions independently. **Duplicated solutions will not be accepted and constitute a violation of the Honor Principle.**

In-class presentations. During the last week of class, each of you will give a 8–10 minute presentation on an differential equations topic of your choice (within or outside of mathematics). You will need to turn in a proposal for your presentation on Monday, April 11.

¹Gradescope is an online homework submission and evaluation platform. You are likely to already be enrolled in our Gradescope class. If not, you will be able to enroll using a link+code provided on our Moodle page.

Grades: Your grade will be based on your performance on the homework, your in-class presentation, and your class participation.

Academic honesty: As noted above, for homework you should write your own solutions and disclose your collaborators. The internet is a great source of information about mathematics; you are welcome to search for information about the material of the course online, but you should not search for solutions to specific problems in the homework. You should not consult solutions to homework from previous versions of this class. **Copying solutions from fellows students or from the Internet is an Honor Principle violation and will result in an academic misconduct report.**

Joint expectations. As members of a communal learning environment, we should all expect consideration, fairness, patience, and curiosity from each other. Our aim is to all learn more through cooperation and genuine listening and sharing, not to compete or show off. I expect diligence and academic and intellectual honesty from each of you. You should expect that I will do my best to focus the course on interesting, pertinent topics, and that I will provide feedback and guidance which will help you excel as a student.

Help. There are a number of resources you can access for help with this course's content. Everyone is welcome and encouraged to attend my **office hours**. They are an opportunity to clarify difficult material and also delve deeper into topics that interest you. Further, every Reed student is entitled to one hour of free **individual tutoring** per week. Use the tutoring app in IRIS to arrange to work with a student tutor.

Technology: The use of electronic devices (computers, cell phones, tablets, etc.) is not allowed in the classroom without my authorization. Browsing the internet, answering your email, and texting during class is rude—it disrupts learning. It distracts your classmates and your instructor. Talk to me if you have a specific reason for needing to use technology (for example, note-taking).

Academic accommodations. If you have a documented disability requiring academic accommodation, please have Disability & Accessibility Resources (DAR) provide a letter during the first week of classes. We can then discuss your accommodations. I cannot provide accommodations after an assignment has been turned in or within 24 hours of an exam. If you believe you have an undocumented disability and that accommodations would ensure equal access to your Reed education, I would be happy to help you contact DAR.

Learning in the time of COVID:. We are all hoping that this semester will be as “normal” as possible, but it might not be. We still need to watch out for symptoms, and possibly isolate/quarantine. The following recommendations should guide your decision about coming to class:

- » Self-isolation is the recommended course of action for anyone experiencing flu-like symptoms, whether due to possible coronavirus or to other illnesses. Please stay at home if you feel sick, and contact the Health and Counseling Center (HCC) or your healthcare provider to discuss. This is especially important if you think you may have an infectious disease.
- » You should not attend class if you have tested positive for COVID-19 in the last 10 days, or if you have received notification or advice from the college or a health professional (including HCC staff) to quarantine or self-isolate.
- » The CDC suggests that people with the any of the following symptoms may have COVID: fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, diarrhea. As always, please consult a medical professional (members of the HCC or otherwise) if you have any questions about your health or health safety.

- » If you suspect or know you have been exposed to a case of COVID-19, contact the HCC right away to discuss your next steps.

For more information, visit the CDC's [webpage on isolation and quarantine](#).

It is also possible that we may have bigger disruptions due to COVID. We will navigate the situation together, and I promise to maintain an open communication so that we all know what is going on. Potential changes that might happen depending on the situation include:

- » Moving to a hybrid format, where some students are in the classroom and other students are remote.
- » Moving to a fully remote version, with lectures being online.
- » Changing the access to office hours to be fully remote.
- » Instead of doing an in-class presentation, you will produce a video.

A final remark: Learning and understanding mathematics requires engaging with the material several times. You might not get what is happening on the first try. Struggling with the material is normal and, maybe, even expected. By actively participating in class, spending time working on the homework, reviewing the material, talking to classmates and talking to me, you will increase your understanding. Use the resources available!