EMORY UNIVERSITY

College of Arts and Sciences
Department of Mathematics

MATH 212 – Ordinary Differential Equations (Fall 2025)

(as of April 25, 2025)

Land Acknowledgement

Emory University acknowledges the Muscogee (Creek) people who lived, worked, produced knowledge on, and nurtured the land where Emory's Oxford and Atlanta campuses are now located. In 1821, fifteen years before Emory's founding, the Muscogee were forced to relinquish this land. We recognize the sustained oppression, land dispossession, and involuntary removals of the Muscogee and Cherokee peoples from Georgia and the Southeast. Emory seeks to honor the Muscogee Nation and other Indigenous caretakers of this land by humbly seeking knowledge of their histories and committing to respectful stewardship of the land.

Instructor: Dr. Manuela Girotti

Office: Math & Science Center, room E416

Email: `manuela.girotti@emory.edu`

Please put "MATH 212" in the subject line, use the *plain text format*, and make sure that you are clearly identified (first and last names). I do not answer anonymous email. I make every effort to answer by the first business day after receiving an email.

Lectures:

Tuesday and Thursday 1:00pm–2:15pm
Math&Science Center, room N302

Office hours: – *Ask-Me-Anything* hours –

(tentatively)
Tuesday and Thursday 2:30pm–4:30pm
or by appointment

Prerequisites: Calculus II (MATH 112, or equivalent).

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Overview: This course is a first exploration into the world of Ordinary Differential Equations, that were already introduced in Calculus II (MATH 112).
The main topics will be the following:

- First-order differential equations (separable, exact, linear; integrating factors).
- Second-order (and higher-order) differential equations (homogeneous linear, constant coefficients, non-homogeneous; undetermined coefficients; variation of parameters; models of forced oscillations and resonance; electric circuits).
- System of linear ODEs (eigenvalue problem, phase portrait); predator-prey model and SIR model.

A diary of the lectures will be regularly kept on the Canvas calendar with the material covered in each class. Please, refer to that when preparing for the final exam or in case of missed class, because that will be the official and ultimate syllabus for the class.

Textbook: W. E. Boyce, R.C. DiPrima, *Elementary Differential Equations*, 11th Edition.

Evaluations: The course mark will be calculated as follows:

25% biweekly quizzes,
15% class participation,
15% 1st midterm exam,
15% 2nd midterm exam,
30% final exam.

Final letter grades are assigned according to the ECAS Catalog:

Grade	F	D	D+	C-	C	C+	B-	B	B+	A-	A
Mark	0-62.99	63-66.99	67-69.99	70-72.99	73-76.99	77-79.99	80-82.99	83-86.99	87-89.99	90-92.99	93-100

Learning outcomes:

At the end of the semester students will be able to

- identify and classify different types of differential equations using standard criteria.
- develop and interpret slope fields to visualize solutions for first-order differential equations.
- determine general and particular solutions of first-order differential equations using methods such as separation of variables, homogeneous equations, exact equations, and integrating factors.
- evaluate the existence and uniqueness of solutions by applying appropriate theorems.
- create and solve differential equations that model physical problems using suitable methods.
- solve second-order linear differential equations using methods such as reduction of order, undetermined coefficients, and variation of parameters.
- solve systems of first-order linear equations using matrix methods, including finding eigenvalues and eigenvectors, and interpret the solutions of linear systems.
- analyze and solve nonlinear systems of differential equations, including models such as predator-prey, competition, and SIR models.

Quizzes:

There will be a total of 5 quizzes. Each quiz will cover the material from the previous quiz or exam. Quizzes will be administered online, and you will have 24 hours to complete each one.

Class participation:

Journals, interviews, and/or questionnaires are to be completed at the end of each week of class.

Exams:

There will be two Midterm Exams and the Final Exam.

The midterm exams will cover material from the previous exam onward. Exams will be taken in class, during scheduled times.
Date for the final exam will be scheduled by the university registrar. The final exam is comprehensive and cumulative.

Notes, books, or electronic devices may not be used when taking the exams.

Missed tests and late submissions:

Late submissions without prior agreement will be lowered by 1% of the total grade for each day beyond the deadline.

If you know you will have to miss an exam in advance, due to illness or a university-sanctioned commitment, you must contact the course instructor before the exam. Excuses such as travel for other reasons, non-Emory exams, etc., are not valid reasons for missing exams. If an assignment is not submitted or an exam is not taken, they will result in a 0 grade.

Extra help:

Do not hesitate to come to my office during office hours or by appointment to discuss a homework problem or any aspect of the course.

You may also want to check the Academic Success Program for resources to succeed in the course!

Accommodation:

Emory University is committed to providing reasonable accommodations for all persons with disabilities. Students with disabilities who need accommodations shall contact the Department of Accessibility Services to learn more about the registration process and steps for requesting accommodations.

Students who have accommodations in place are encouraged to coordinate with the instructor during the first week of the semester to communicate your specific needs for the course.

Academic Integrity:

This course will adhere to the Emory University Academic Honor Code
http://catalog.college.emory.edu/policies/honor-code.html

Students are expected to do their own work during tests and exams. The following activities, although not exhaustive, are examples of activities that are prohibited:

- Copying from another student;
- Allowing another student to copy from you;
- Using unauthorized aids, including: sheets, cell phones and calculators, during test or exam;
- Getting aid from or giving aid to another student during tests and exams;
- Having another student write for you or writing for another student.

Offenders will be subject to discipline. In particular, cheating may be reported to both the student's college and the Honor Council.

An incident of academic dishonesty can have extremely negative consequences: it could delay or bar a student from graduating or even affect job opportunities.

This course is a precious opportunity for you to learn something new and valuable. It's an investment on your future. Failing to acquire it will sadly be your loss.

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(Tentative) course calendar: TO ADJUST TO FALL SEMESTER

Week	Topic	Graded Assignments
1 (Aug 27th)	Introduction. Motivations and first definitions.	Pre-course survey. Prerequisite Quiz.
2 (Sep 1st)	Elementary Mechanics Problems. Initial Value Problems (IVP). Method of integrating factors and variation of parameters for linear ODEs.	Pre and post weekly surveys
3 (Sep 8th)	Linear and non-linear differential equations. Existence and uniqueness of the solution. Method of separation of variables.	Pre and post weekly surveys. QUIZ #1 (online, available Friday)
4 (Sep 15th)	Exact equations. Integrating factors.	Pre and post weekly surveys.
5 (Sep 22nd)	Autonomous equations and population dynamics. Overall classification of first order ODEs.	Pre and post weekly surveys. QUIZ #2 (online, available Friday)
6 (Sep 29th)	Vibrating springs and intro to second order ODEs.	Pre and post weekly surveys.
7 (Oct 6th)	Non-homogeneouos second order ODEs. Method of undetermined coefficients.	Pre and post weekly surveys. EXAM # (in-class, on Thursday)
8 (Oct 13th)	Method of reduction of order. Method of variation of parameters.	Pre and post weekly surveys. QUIZ #3 (online, available Friday)
9 (Oct 20th)		Pre and post weekly surveys.
10 (Oct 27th)	RLC circuits. Course review.	Pre and post weekly surveys.
11 (Nov 3rd)	Linear systems of algebraic equations. The eigenvalue problem. Introduction to linear systems of ODEs.	Pre and post weekly surveys. EXAM #2 (in-class, on Thursday)
12 (Nov 10th)	Solutions of linear systems of first order ODEs.	Pre and post weekly surveys.
13 (Nov 17th)	Geometric Properties of the solutions. 2D phase portrait.	Pre and post weekly surveys. QUIZ #4 (online, available Friday)
14 (Nov 24th)	Autonomous Systems of ODEs. Predator-prey and competition.	Pre and post weekly surveys.
15 (Dec 1st)	The SIR model and the spread of diseases. Phase plane analysis.	Pre and post weekly surveys. QUIZ #5 (online, available Friday)
16 (Dec 8th)	Review & Conclusions.	Post course survey.