Math 2030 Section 001: Ordinary Differential Equations

Summer A 2021

Instructor:	Samuel DeHority	**Time:**	M-Th 10:45am – 12:20pm
Email:	samdehority@math.columbia.edu	**Zoom:**	see online
TA:	Andrew Sullivan	**TA Email:**	ags2198@columbia.edu

Course Pages

- https://math.columbia.edu/~samdehority/teaching/2021-Summer-ODEs

Office Hours: Monday and Wednesday 2pm – 3pm, or by appointment.

Recitation section: There will be a weekly recitation section with the TA. The date and time will be determined in one of the first few class sessions.

Textbook:

- W. Boyce, and R. DiPrima *Elementary Differential Equations and Boundary Value Problems*. Any edition.

Other useful references:

- V. Arnold, *Ordinary Differential Equations*, The MIT Press

Prerequisites: The formal prerequisites for this course are MATH UN1102 and MATH UN1201 on the calculus sequence, corresponding to integral and differential calculus of one variable, and knowledge of vectors and of partial derivatives. Informal but extremely helpful prerequisites include complex numbers and the rudiments of linear algebra, namely matrices, determinants, eigenvectors, and eigenvalues. These additional topics will be reviewed in class.

Grading Policy: There are two options for the grade for the course.

A The final grade is based on the following factors: Homework (30%), Midterm (30%), Final (40%).

B The student completes a final project in the form of a 5-8 page final paper, on an agreed upon topic. In this option the makeup is: Homework (30%), Midterm (30%), Final (36%), Project (4%).

If you opt to do the final project your final grade will be the highest of the scores from the two options.

Course Policies:

- On a typical week there will be two homework assignments due per week. These are to be submitted online before 10pm (NYC time) on Monday and Thursday.
- Homework submissions are expect to be **complete documents** and demonstrate organization and coherence appropriate for a University-level course. At a minimum, they should restate the problem statement and clearly separate scratch work from the solution. You are encouraged, but by no means required, to submit solutions typeset using LaTeX.
- Students are strongly encouraged to work together on the homework assignments, but resulting submissions must authored and written up individually. Please also note collaborators on the document.

- The lowest homework grade will be dropped.
- There will be no makeup exams and late homework will not be accepted without documentation from a doctor, dean or university official.
- There is no collaboration on the midterm or final exams.

Exam Dates: There will be a midterm exam and a final exam.

- The **midterm** will be a take home exam, released after the lecture on **May 20** to be completed within 48 hours.
- The **final exam** format is not yet determined but the Summer A reading days/exam period is June 15-18.

Course Schedule: The course will mostly cover the topics in the Boyce and DiPrima text although in a slightly different order. Here is an approxmiate schedule for the course, which lists key topics covered in the course.

Date	Topic	Textbook sections
May 3	Introduction, graphical methods	1.1 - 1.3
May 4	ODE terminology/classification, separable equations, linear/nonlinear	2.1, 2.2, 2.4
May 5	Existence and uniqueness theorem, autonomous systems	2.5, 2.8
May 6	Integrating factors	2.6
May 10	2nd order homogeneous ODE, characteristic equation	3.1-3.4
May 11	Nonhomogeneous ODEs, Method of undetermined coefficients	3.5
May 12	Linear systems, intro to linear algebra	7.1 - 7.3
May 13	Homogeneous systems with constant coefficients	7.5-7.6
May 17	Solution with matrix exponential, repeated eigenvalues	7.6-7.8
May 18	Nonhomogeneous linear systems	7.9, 4.3-4.4
May 19	Phase plane, critical points of non-linear autonomous systems	9.1-9.3
May 20	Midterm review	
May 24	Power series review	5.1
May 25	Power series solutions at ordinary points	5.2-5.3
May 26	Solutions at regular singular points	5.4 - 5.6
May 27	Irregular singular points, Bessel functions	5.7
June 1	Laplace transform	6.1-6.2
June 2	Laplace transform and initial value problems	6.2
June 3	Distributions, Dirac delta, discontinuous forcing functions	6.3 - 6.5
June 7	Convolution	6.6
June 8	Operators, Green's function, impulse response	
June 9	Boundary value problems	10.1
June 10	Additional topics	
June 14	Final review	

Academic Honesty: Students are expected to abide by the highest standards of academic integrity, only submit work of which they are the author, and not participate in plagiarism or cheating of any kind.