Ordinary Differential Equations

MATH-UA.0262-007

Spring 2026

Course Topics

- First-order equations: separable equations, linear and nonlinear examples, Euler's method, Picard iteration, Duhamel formula.
- Second-order linear equations: general solution of equations with constant coefficients, variation of parameters, inhomogeneous equations.
- Series solutions: power series method, singular points, Frobenius method.
- Systems of linear equations: matrix method, eigenvalues and eigenvectors, complex and repeated eigenvalues.
- Systems of nonlinear equations: phase plane, stability, predator–prey models.
- Self-adjoint operators, eigenfunctions, Fourier series, separable partial differential equations.
- Delta functions and Green's functions.

Instructional Staff

- Instructor: Yi Zhang (y.zhang@nyu.edu)
- Recitation Instructor: Mingxin Li (ml6223@nyu.edu)
- Grader: Zichu Wang (zw3409@nyu.edu)

Logistics

- **Class Time:** Monday and Wednesday, 12:30–13:45 PM (194 Mercer St, Room 304)
- **Office Hours:** Monday, 3:30–5:30 PM (WWH 909)
- **Recitation:** Friday, 8:00–9:15 AM (Tisch Hall LC1)

Textbook

Martin Braun, *Differential Equations and Their Applications*, 4th Edition, Springer, 1993.
Available for free under NYU network at: `https://link.springer.com/book/10.1007/978-1-4612-4360-1`.

Grading Policy

- Homework (roughly weekly): 20%
  - Due on Brightspace each Friday starting from Week 2.
  - Two lowest homework scores will be dropped
  - No late homework accepted to ensure fairness
- Midterm Exam: 30%
- Final Exam: 50%

  Exam rules: A strict no-electronics policy applies to all exams. Any form of cheating will result in disciplinary procedures per university guidelines. Please avoid any actions that may appear dishonest. As the Chinese saying goes, "Do not adjust your shoes in a melon field or your hat under a plum tree" (瓜田不纳履，李下不正冠).

Lecture Schedule

Week	Dates	Topics / Notes	Readings
1	1/21	Introduction, classification of ODE's	1.1, 1.2
2	1/26, 1/28	First-order ODEs, separation of variables	1.2, 1.4
3	2/2, 2/4	Population models, exact solutions	1.5, 1.9
4	2/9, 2/11	Existence and uniqueness, Euler method	1.10, 1.13, 1.16
5	2/17, 2/18	Lipschitz continuity, second-order ODEs, Wronskian	2.2
6	2/23, 2/25	Abel's theorem, inhomogeneous equations, oscillators	2.1
7	3/2, 3/4	Series solutions	2.5, 2.6
8	3/9, 3/11	Singular points; **Midterm**	2.8
9	3/16-20	Spring break	
10	3/23, 3/25	Linear systems, eigenvalues	3.1, 3.8–3.10
11	3/30, 4/1	Predator prey, phase portrait, nonlinear oscillator	4.1–4.3
12	4/6, 4/8	Nonlinear systems, stability	4.3–4.7
13	4/13, 4/15	Boundary value problems, Fourier series	5.1, 5.4, 6.2, 6.4
14	4/20, 4/22	PDEs, delta functions	5.3–5.7, 2.12
15	4/27, 4/29	Green's functions; **Review**	2.12
16	5/4	No class	