Syllabus for Math 307: Linear Algebra and Differential Equations

Fall 2025 (August 25 - December 19)

Instructor: Max Hill (max6hawaii.edu)
My office: Physical Sciences Building 304
Office Hours: TBD

Section 1 Class
Times: MWF 8:30 - 9:20am
Location: Watanabe 112

Section 2 Class
Times: MWF 9:30 - 10:20am
Location: Keller 303

Textbook: *Linear Algebra and Differential Equations* by Peterson and Sochacki. 2002.

Course prerequistes: Pre: 242 or 252A, or consent. If you don't meet the prerequisites, you'll need to get approval from the math department office.

Course objectives: This is primarily a linear algebra course, but contains some application to certain differential equations at the end of the semester. My hope is that you obtain an understanding of the basic concepts of linear algebra, be able to compute examples, understand the elements of spectral theory, be able to solve systems of linear differential equations, and gain a sense of the broad applications of linear algebra.

Grading: Homework (30%), Midterm (35%), Final (35%). The following grade cutoffs will be used at the end of the semester to determine final grades:

D	D+	C-	C	C+	B-	B	B+	A-	A	A+
60%	67%	70%	73%	77%	80%	83%	87%	90%	93%	97%

Homework: Homework will be due approximately weekly.

- You have one free 'no questions asked' homework extension.
- Your lowest homework score will be dropped at the end of the semester.
- You may collaborate with classmates on the homeworks. But if you do so, you must (1) make an effort write up your solutions on your own, using your own words, and (2) list the names of the people who you worked with.
- You are encouraged to use online resources to maximize your learning of the material, with the understanding that those resources will not be availabe on the exams. Therefore, you are free to use any online resources when working on your homeworks, provided that you identify the resources you use (i.e., cite any resources you use, like chatgpt, desmos, math stack exchange, whatever.)

Exams: There will be a midterm and a final exam, both held in the classroom.

- **Midterm exam:** The midterm will be held around week 12, after we cover linear transformations and spectral theory (see tentative course outline).
- **Final exam:** The final will be cumulative, but will emphasize material after the midterm. Both exams will include both problems and questions which ask you to state definitions, so you'll need to memorize definitions. The final exam dates are as follows:

  Section 1 final exam ..... Monday, December 15, at 7:30-9:30am
  Section 2 final exam ..... Friday, December 19, at 9:45-11:45am

  If you do better on the final than the midterm, then your grade on the final will replace your midterm grade.

Tentative course outline:

- **Weeks 1-3: Matrices and determinants.** Systems of linear equations, matrices, matrix operations, inverse matrices, special matrices and their properties, and determinants.
- **Weeks 4-6: Vector spaces.** Vector spaces, subspaces, spanning sets, linear independence, bases, dimension, null space, row and column spaces, Wronskian.
- **Weeks 7-11: Linear transformations, spectral theory.** Linear transformation, eigenvalues and eigenvectors, algebra of linear transformations, matrices for linear transformations, eigenvalues and eigenvectors, similar matrices, diagonalization, Jordan normal form.
- **Weeks 12-14: Systems of differential equations.** theory of systems of linear differential equations, homogeneous systems with constant coefficients, the diagonalizable case, nondiagonalizable case, nonhomogeneous linear systems, applications to 2×2 and 3×3 systems of nonlinear differential equations.
- **Weeks 14-16: Other stuff if time allows.** converting differential equations to first order systems, linearization of 2×2 nonlinear systems, stability, instability, predator- prey equations.

Make-up policy: Make-up exams are allowed only in three types of circumstances: (1) in accordance with university policies, such as conflict with a religious observation, (2) conflicts with another university-related event, or (3) exceptional circumstances, such as a last-minute medical or family emergency with verification. In the first two cases, notice must be given to the instructor two weeks in advance.

Accommodations: Any student who feels s/he may need an accommodation based on the impact of a disability is invited to contact me privately. I would be happy to work with you, and the KOKUA Program (Office for Students with Disabilities) to ensure reasonable accommodations in my course. KOKUA can be reached at (808) 956-7511 or (808) 956-7612 (voice/text) in Room 013 of the Queen Lili‘uokalani Center for Student Services.

Attendance: Students who are enrolled in this course, but never attend will be flagged by the course instructor for non-participation before the last day to add/drop (for 100% tuition refund) deadline. Flagged students will be administratively dropped by the Office of the Registrar. Any changes to a student's enrollment status may affect financial aid eligibility and can result in the return of some of all of federal student financial aid.

Math advisors and chairs: If you have questions or concerns, please come talk to me first—if it's something bigger or if you have advising questions, you can contact the chairs or advisors listed here:

- Department Chair: Malik Younsi (`myounsi@hawaii.edu`)
- Associate Chair and Advisor: Sarah Widiasih Post (`spost@hawaii.edu`)
- Chair of Graduate studies: Elizabeth Gross (`egross@hawaii.edu`)
- Undergraduate Director and Advisor: Mirjana Jovovic (`undergrad-dir@math.hawaii.edu`)