

Syllabus — MATH 2331 Linear Algebra (Section 7, CRN 18975, Fall 2021)

Instructor: Ben Knudsen
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Class time and location: MWR 1:35—2:40 Hastings 202
Office hours: TBA
Teaching assistant: Oleksii Sorokin Office hours: TBA

This syllabus is subject to reasonable changes at the discretion of the instructor. Check Canvas for the updated version.

Textbook: Linear Algebra with Applications, 5th Edition, by Otto Bretscher (It is **NOT** required that you purchase a printed textbook).

We will cover Chapters 1-3 and 5-8 from the text. Topics include matrices, linear systems, Gauss-Jordan elimination, determinants, vector spaces, eigenvalues and eigenvectors, and orthogonal and symmetric matrices.

Homework: Homework is an essential component of the course and makes up 15% of the course grade. It will be assigned weekly on Thursday and due at the beginning of class the following Thursday. The grade will be based on completeness (4 points) and 6 graded problems (1 point each). Students are encouraged to work together on homework, but writing should be separate and reflect individual understanding. Late homework will not be accepted. The lowest homework score will be dropped. **To earn full credit, answer the questions in order, label the section and question number, write the answer clearly, show work and circle the final result.**

Exams: There will be **three 65-minute exams** in class (15% each). *Tentatively*, these exams will be held on **October 6, November 3, and December 1**. There will also be one 2 hour cumulative final exam (*exam day to be scheduled*).

In the rare event that a student misses a test or exam due to a university sanctioned absence or religious observance, the student will be given a makeup test. Otherwise, makeup tests will be given only at the instructor's discretion. Check for final exam schedule conflicts as soon as possible. *The last day to file a Final Exam Conflict Form with the Registrar is Friday, October 1.*

Course grade:

15%	Weekly homework
45%	Three in class exams
40%	Common final exam

Letter grades: Letter grades are determined from numerical grades as follows:

A: 93-100	A-: 90-92	B+: 87-89	B: 83-86	B-: 80-82	C+: 77-79
C: 73-76	C-: 70-72	D+: 67-69	D: 63-66	D-: 60-62	F: 0-59

Incomplete: Per departmental policy, the I grade (incomplete) will be given only rarely. It is intended to cover real emergency situations in which a student who is doing reasonably well (C- or better) is unable, due to circumstances beyond the student's control, to complete all course requirements (e.g., is unable to take the final exam due to hospitalization). This grade may not be used to rescue a failing grade or to postpone the final.

Calculators and computers: Use of calculators and computers capable of performing matrix operations or solving linear systems is not permitted during tests. Use of ordinary scientific calculators for help with arithmetic is permitted, but answers not accompanied by sufficiently detailed justification will NOT receive credit, even if the final answer is correct.

Classroom recording: Parts of this course may be recorded by the instructor for educational purposes. Such recordings would be made available only to enrolled students, TAs and instructors, and other department or administrative personnel for training, oversight, or evaluation purposes. If you have any concerns, please contact the instructor.

Only students who have arranged an accommodation with the Disability Resource Center (DRC) may use mechanical or electronic transcribing, recording, or communication devices in the classroom. Students with disabilities who believe they may need such an accommodation may contact the DRC.

Issues with the course/instructor: If you have issues with this course or instructor which you are not able to resolve through conversation with your instructor, you may contact the course coordinator, Evan Dummit at e.dummit@northeastern.edu. For matters that remain unresolved, you may contact the Teaching Director, Prof. Alexander Martsinkovsky, at a.martinskovsky@northeastern.edu

Additional resources: The Mathematics Department Tutoring Center is expected to run in-person in Fall 2021, likely also with options for online appointments. The free tutoring center is expected to start soon after the semester begins. Signup is through MyNortheastern (<https://undergraduate.northeastern.edu/peer-tutoring/>).

Official holidays: There will be no class on the following days: Labor Day (M 9/6), Indigenous Peoples' Day (M 10/11), Veterans Day (R 11/11), and Thanksgiving Recess (W 11/24 and R 11/25) (see the calendar at <https://registrar.northeastern.edu/app/uploads/2021-2022-UG-Expanded-Calendar-List.pdf>)

Important dates:

The last day to **drop a course without a W** grade is Tuesday, September 28th.

The last day to **submit a Final Exam conflict form** is Friday, October 1st.

The last day to **drop a course with a W** grade is Thursday, December 9th.

Academic integrity: Cheating will not be tolerated. All incidents of cheating will be reported. From the Academic Integrity Policy (see <http://www.northeastern.edu/osccr/academic-integrity-policy/>):

“A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues.”

Title IX: The University strictly prohibits sex or gender discrimination in all university programs and activities. Information on how to report an incident of such discrimination (including sexual harassment and sexual assault) is located at <http://www.northeastern.edu/titleix>. As a responsible employee, your instructor is required to report all allegations of sex- or gender-based discrimination to the Title IX Coordinator.

Inclusion and diversity: I value all students regardless of their background, country of origin, race, religion, gender, sexual orientation, ethnicity, or disability status, and am committed to providing a climate of excellence and inclusiveness within all aspects of the course. If there are aspects of your culture or identity that you would like to share with me as they relate to your success in this class, I would be happy to meet to discuss. If you have any concerns in this area or are facing any special issues or challenges, I encourage you to discuss the matter with me as you feel comfortable, with assurance of full confidentiality, except for matters related to academic integrity and Title IX.

Students with disabilities: Students with disabilities who wish to receive academic services and accommodations should follow the standard Disabilities Resource Center (DRC) procedures (see <http://www.northeastern.edu/drc/getting-started-with-the-drc/>).

College of Science policies: The current College of Science Academic Course Policies are available at <https://cos.northeastern.edu/wp-content/uploads/2012/10/COS-teaching-policies-April-2017.pdf>.

TRACE: Every student is expected to complete the online TRACE survey at the end of the semester.

MATH2331 PACING GUIDE (ROUGH GUIDE SUBJECT TO CHANGE)

Week 1 (Sep. 6-10)

(Classes start Wed Sep 8th)

- 1.1 Introduction to Linear systems (Homework: 1, 7, 10, 21, 24, 25, 36)
- 1.2 Matrices, Vectors, and Gauss-Jordan Elimination (Homework: 2, 4, 5, 7, 18, 21-24, 31-33, 36, 37)

Week 2 (Sep. 13-17)

- 1.3 On The Solution of Linear Systems (Homework: 1-8, 11-15, 21-31, 34, 36, 47, 55)
- 2.3 Matrix Products (Homework: 3, 5, 11, 13, 16-23, 25, 29, 47)

Week 3 (Sep. 20-24)

- 2.1 Intro. to Linear Transformations and Their Inverses (Homework: 1-3, 5, 6)
- 2.2 Linear Transformations in Geometry (Homework: 1, 4, 6, 7, 8, 10, 19, 21, 26abc, 53)
- 2.4 The Inverse of a Linear Transformation (Homework: 1-3, 5, 6, 17, 19, 35-41 (odd))

Week 4 (Sep. 27- Oct 1)

- 3.1 Image and Kernel of a Linear Transformation (Homework: 1, 3, 5, 7, 12, 15, 16, 23, 25, 33, 35)
- 3.2 Subspaces of \mathbb{R}^n ; Bases and Linear Independence (Homework: 1, 3, 11-33(odd), 26, 37, 39, 46, 49, 52)

Week 5 (Oct. 4-8)

- 3.3 The Dimension of a Subspace of \mathbb{R}^n (Homework: 1, 3, 5, 7, 11, 13, 17, 21, 23, 27, 37, 39)
- Test 1 (Thu Oct 7)**

Week 6 (Oct. 11-15)

(Mon Oct 11, Indigenous Peoples Day, no classes)

- 5.1 Orthogonal Projections and Orthonormal Bases (Homework: 1, 3, 5, 15, 17, 27, 35)

Week 7 (Oct. 18-22)

- 5.2 Gram-Schmidt Process and QR Factorization (Homework: 5, 7, 19, 21, 33, 35)
- 5.3 Orthogonal Transformations and Orthogonal Matrices (Homework: 5-8, 13-17, 27, 29, 37)

Week 8 (Oct. 25-28)

- 5.4 Least Squares and Data Fitting (Homework: 1, 5, 7, 17-25 (odd), 31-33)
- 6.1 Introduction to Determinants (Homework: 1-11(odd) , 17, 27, 29-32)

Week 9 (Nov. 1-5)

6.2 Properties of Determinants (Homework: 1, 5, 6, 11, 13, 15, 30, 37-42.)

7.1 Diagonalization (Homework: 1-7, 9, 15-21 (odd), 34)

Test 2 (Thu Nov 4)

Week 10 (Nov. 8-12)

7.2 Finding the Eigenvalues of a Matrix (Homework: 1-13(odd), 16)

7.3 Finding the Eigenvectors of a Matrix (Homework: 1-13(odd) , 21)

(Thu Nov 11, Veterans Day, no classes)

Week 11 (Nov. 15-19)

7.4 Dynamical Systems (Homework: 1-7 (odd), 11, 17, 21, 25)

8.1 Symmetric Matrices (Homework: 1, 3, 7, 9, 11 22)

Week 12 (Nov. 22-26)

8.2 Quadratic Forms (Homework 1—11, 27, 28, 37) (depending on time)

(Nov 24-28, Thanksgiving Break, no classes)

Week 13 (Nov. 29- Dec. 3)

8.3 Singular Value Decomposition (Homework: 1, 2, 4, 6, 12, 13, 14) (depending on time)

Test 3 (Wed Dec 1)

Week 14 (Dec. 6-9)

Review

(Classes end Wed Dec 8th)

(Thu Dec 9, Reading Day, no classes)

(Dec 10-17, Final Exam Period)

Final Exam Day: (To be announced.)