

MATH 314 – Section 005
Spring Semester 2020
MWF 11:30 am–12:20 pm, Avery Hall 019

1 Instructor

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Office Hours: TR 8:30 am – 9:30 am (or by email appointment)

Grader: TBA

2 Textbook

Linear Algebra and Its Applications, by David C. Lay, Steven R. Lay, and Judi J. McDonald, 5th Edition.

3 ACE Outcome 3

This course satisfies ACE Outcome 3: “Use mathematical, computational, statistical, or formal reasoning (including reasoning based on principles of logic) to solve problems, draw inferences, and determine reasonableness.” Your instructor will provide examples, you will discuss them in class, and you will practice with numerous homework problems. The exams will test how well you’ve mastered the material. The final exam will be the primary means of assessing your achievement of ACE Outcome 3.

4 Contacting me

The best way to contact with me is by email, xperez@unl.edu. Please put “[MATH 314]” at the beginning of the title and make sure to include your whole name in your email. Using your official UNL email to contact me is strongly recommended. My office is Avery Hall 333. My office hours are TR 8:30 am – 9:30 am. If you want to meet at another time, please email me in advance, and we will try to schedule a time to meet.

5 Course Description

One can say that Linear Algebra is a mathematical branch studying system of linear equations, for example

$$\begin{cases} 4x + 5y + 6z = 7 \\ 2x + 6y + z = 2 \\ x + y + z = 4 \end{cases}$$

Linear Algebra has many applications to diverse scientific areas, and even has powerful uses in computer graphics, linguistics, audio engineering, artificial intelligence, humanitarian aide, and legal studies etc.

This course is a transition course from computational courses, like calculus, to more theoretical ones. You will need to understand definitions and theorems, be able to apply them, and sometimes, prove theorems. *The material in the course will tend to be more mathematically subtle than that encountered in your previous math courses, and will consequently require a significant effort on your part to master.*

The course covers sections from Chapters 1 to 7 of the text: systems of linear equations, matrix algebra, determinants, vector spaces, eigenvalues and eigenvectors, orthogonality, and inner product spaces, and quadratic forms.

6 Homework and quizzes

Homework is designed to help students understand the materials and to prepare them for exams. We would have homework almost every week. Pop quizzes will be given if needed. There are **no make-up quizzes**.

Collaboration is encouraged in this course. However, copying someone else's work and submitting it as your own is unacceptable. This act of academic dishonesty will be prosecuted in accordance with university policy.

Besides homework and quizzes, you are expected to read the appropriate sections of the text before coming to the class. You are also expected to work through the indicated exercises after the corresponding material is presented in class, and **before** the next class meeting.

7 Calculators and Electronics

You are **not** allowed to have on your person during exams or quizzes any devices that can access the internet or communicate in any way. Cell phones, Apple watches, etc. should be put away in backpacks/purses. Calculators, laptops, tablets, cell phones, and other non-medical electronic devices are not permitted during exams unless otherwise stated. During class, cell phones should be set on vibrate or off. If you need to take a call, send a text message, etc., please quietly leave the classroom to do so, so that you do not distract other students. You are welcome to return to class quietly when you are finished. If you wish to take notes using an electronic device, you must first demonstrate to me that you can type or write fast enough to do so properly, and that you can do it without distracting others, before the privilege to use such devices may be granted. If you are found to be abusing this privilege, you risk forfeiting it.

8 Grading

Your minimal course grade will be computed as follows.

| | |
|-------------------|--------------------------|
| Homework+Quizzes: | 30% |
| Midterms: | $2 \times 17.5\% = 35\%$ |
| Final Exam: | 35% |
| — | — |
| Total: | 100% |

| | | | | | | | | | | | |
|----|--------|---|--------|----|--------|---|--------|----|--------|---|--------|
| A+ | 95.00% | – | 100% | B- | 76.66% | – | 79.99% | D | 60.00% | – | 63.32% |
| A | 90.00% | – | 94.99% | C+ | 73.33% | – | 76.65% | D- | 56.66% | – | 59.99% |
| A- | 86.66% | – | 89.99% | C | 70.00% | – | 73.32% | F | 0% | – | 56.65% |
| B+ | 83.33% | – | 86.65% | C- | 66.66% | – | 69.99% | | | | |
| B | 80.00% | – | 83.32% | D+ | 63.33% | – | 66.65% | | | | |

9 Attendance

Daily attendance for class lectures is expected and is **extremely important**. While attendance is not recorded, missing even one class will put you behind. Note that there is a strong correlation between class absences and poor grades. You are responsible for all material and announcements in class regardless of whether or not you attended. **You are also responsible for making arrangements with another classmate to find out what you missed. You should not ask me to go over material you missed (due to tardiness or absences) during office hours or over email.**

10 Exams

There are three exams: two midterms and a final. Students are expected to arrange their personal and work schedule to allow them to take the final exam at the scheduled time. No student will be permitted to take the final exam early.

Make-up exams will only be given with written evidence of an official university excused absence.

11 Incompletes

A grade of “Incomplete” may be considered if all but a small portion of the class has been successfully completed, but the student in question is prevented from completing the course by a severe, unexpected, and documented event. Students who are simply behind in their work should consider dropping the course.

12 ADA Statement

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

13 Grade Questions

Any questions regarding grading/scoring of homework, exams, or projects must be made **within two class days** from when they were handed back, or no change in grade will be made.

Because of privacy rights, **I cannot discuss grades over email or telephone. Please do not email or call me asking about your grade. I will not be able to give you any information.** Of course, I am happy to discuss grades in my office.

14 Special Dates

- January 24, 2020 (Friday): Last day to withdraw from this course and not have it appear on your transcript.
- March 6, 2020 (Friday): Last day to change your grade option to or from Pass/No Pass.
- April 3, 2020 (Friday): Last day to drop this course and receive a grade of W. (No permission required.) After this date, you cannot drop.

15 Departmental Grading Appeals Policy

Students who believe their academic evaluation has been prejudiced or capricious have recourse for appeals to (in order) the instructor, the departmental chair, the departmental appeals committee, and the college appeals committee.

16 Course Evaluation

The Department of Mathematics Course Evaluation Form will be available during the last two weeks of class. You will get an email when the form becomes available. Evaluations are anonymous and instructors do not see any of the responses until after final grades have been submitted. Evaluations are important—the department uses evaluations to improve instruction. Please complete the evaluation and take the time to do so thoughtfully.

17 Tentative schedule:

The following table shows the material expected to be covered for each week of the semester. The exercises listed here are only recommended problems, they are *not* your official assignments. Note that what is shown here is approximate; your instructor may change the dates for each assignment and/or exam. It is your responsibility to keep track of the course details and schedule for your section.

| Week of | Section | Recommended (but not necessarily mandatory) Exercises |
|-------------|---|--|
| January 13 | 1.1 Systems of Linear Equations | 1, 3, 5, 9, 10, 11, 15, 18, 19, 20, 23, 24, 25, 31 |
| | 1.2 Row Reduction and Echelon Forms | 1, 3, 7, 11, 13, 15, 17, 19, 21, 22, 23, 24, 25, 26 |
| | 1.3 Vector Equations | 1, 3, 5, 7, 9, 11, 13, 14, 15, 17, 18, 19, 23, 24, 25, 28 |
| January 20 | Martin Luther King Day | |
| | 1.4 The Matrix Equation $Ax = b$ | 1, 3, 7, 9, 11, 13, 14, 15, 17–24 |
| | 1.5 Solution Sets of Linear Systems | 2, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 20, 23, 24, 25, 40 |
| January 27 | 1.6 Applications | 3(a,b), 7, 14 |
| | 1.7 Linear Independence | 1, 3, 5, 7, 8, 9, 13, 14, 15, 17, 19, 21, 22, 23, 24, 28, 30 |
| | 1.8 Introduction to Linear Transformations | 1, 2, 3, 5, 7, 9, 11, 13–16, 19, 21, 22, 32, 33, 34 |
| February 3 | 1.9 The Matrix of a Linear Transformation | 1, 5, 7, 8, 13, 15, 17, 22–25, 38 |
| | 2.1 Matrix Operations | 1, 3, 5, 7–11, 15, 16, 19, 22, 24 |
| | 2.2 The Inverse of a Matrix | 1, 3, 5, 7, 8, 9, 10, 13, 20, 21, 23, 24, 29, 31, 32, 33 |
| February 10 | 2.3 Characterization of Invertible Matrices | 1–7(odd), 11, 12, 13, 16, 17, 19, 22, 33, 37 |
| | 2.5 Matrix Factorizations | 3, 5, 9, 11, 19 |
| | Catch Up and Review | |
| February 17 | Midterm Exam I | |
| | 3.1 Introduction to Determinants | 1–13 (odd), 39, 40 |
| | 3.2 Properties of Determinants | 1–8, 11, 15, 18, 19, 25, 27, 28, 31 |
| February 24 | 4.1 Vector Spaces and Subspaces | 1–15, 17, 19, 20, 21, 23, 24, 25, 27 |
| | 4.2 Null Spaces, Column spaces | 1, 2, 3, 5, 7, 11, 12, 15, 17, 19, 20, 21, 25–28, 30, 35, 37 |
| | 4.3 Linearly Independent Sets; Bases | 1–19 (odd), 21–25, 31, 32 |
| March 2 | 4.4 Coordinate Systems | 1, 3, 5, 7, 8, 11, 13, 15, 16, 27, 28, 29 |
| | 4.5 The Dimension of a Vector Space | 1–5, 7–17 (odd), 19, 20, 21, 29, 30, 31 |
| | 4.6 Rank | 1, 3, 4, 5–15 (odd), 17, 18, 19, 21, 25, 27–29 |
| March 9 | 4.7 Change of Basis | 1–9 (odd), 11, 12, 13, 15 |
| | 4.9 Applications/Catch Up | 1, 3, 5, 9, 11 |
| | 5.1 Eigenvectors and Eigenvalues | 1–15 (odd), 19, 21, 22, 23, 24, 25, 27, 31, 33 |
| March 16 | Classes cancelled | |
| March 23 | Spring vacation | |
| March 30 | 5.2 The Characteristic Equation | 1, 3, 7, 9, 11, 13, 17, 21, 22, 23, 24 |
| | 5.3 Diagonalization | 1, 3, 5, 7, 11, 15, 16, 19, 21, 22, 23, 24, 25, 27, 29 |
| | 5.4 Eigenvectors and Linear Transformations | 1, 3, 5, 8, 9, 11, 13, 19, 23, 27 |
| April 6 | 5.5 Complex Eigenvalues | 1, 5, 9, 13, 16 |
| | 6.1 Inner Product, Length and Orthogonality | 1–19 (odd), 20, 25–31 |
| | 6.2 Orthogonal Sets | 1, 5, 9, 11, 13, 15, 17, 23, 24, 27–29 |
| April 13 | Midterm Exam II | |
| | 6.3 Orthogonal Projections | 1, 5, 7, 9, 11, 13, 15, 17, 21, 22, 23, 24 |
| | 6.4 The Gram-Schmidt Process | 1, 5, 9, 11, 15, 17, 18, 19, 22 |
| April 20 | 6.5 Least-Squares Problems | 1, 3, 5, 7, 11, 15, 17, 18, 19, 21 |
| | 6.6 Applications | 1, 3, 7a, 9 |
| | 7.1 Diagonalization of Symmetric Matrices | 1–19 (odd), 23, 25, 26, 28, 29, 36 |
| April 27 | 7.2 Quadratic Forms | 1–13 (odd), 21, 22, 23, 24 |
| | 7.4 Singular Value Decomposition | 1, 3, 5, 7, 9, 11, 12, 13, 17, 18, 23 |
| | Catch Up and Review | |
| May 4 | Final Exam Week | |

The Final Exam is on Monday, May 4, 10:00 am – 12:00 pm