

MAT 2550: Introduction to Linear Algebra

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1. TEXT & REFERENCES

1.1. **Course text:** *Introduction to Linear Algebra, with Applications*, by Jim DeFranza & Daniel Gagliardi.

1.2. **Supplementary texts:** The following texts, available free on-line, provide you with resources you can use indefinitely and from any location. I will refer to them in my coverage of several topics and sometimes assign problems from them. In addition, they will allow you to study linear algebra beyond the minimum requirements of this course, to whatever level suits you. If you read any parts of these, I would be interested to know what you think of them.

Linear Algebra, by E. Kowalski, ETH Zurich. This text is more theoretical, progresses more quickly to an advanced level, and assumes more mathematical sophistication than our course text. It covers some topics additional to those we will cover, but spends very little time on solving systems of linear equations.

Linear Algebra Done Wrong, by Sergei Triel. This text introduces vector spaces and linear maps before discussing the solution of systems of linear equations, whereas our course text does the opposite. I will try to blend the two topics in an integrated fashion. Although it is somewhat more advanced than our course text, it does not really require any more background sophistication, so you may find reading it to be valuable and only moderately challenging. The discussion of determinants is very nice, and I will follow it. The discussion of rank and row reduction, not so much. (About the title, don't ask – long story!)

Linear Algebra, by Jim Hefferon. Written at a similar level of sophistication to our course text, and following a similar organization of topics, this text is well-designed for self-study, with helpful suggestions for the student. This text also includes some nice applications, such as voting paradoxes.

2. COURSE CONTENT

The fundamentals of linear algebra: vector spaces and linear maps, matrix operations, systems of linear equations, determinants, eigenvalues and eigenvectors. As time permits, inner products, linear functionals, and dual spaces will also be discussed. These topics will be approached from both a computational and theoretical perspective.

3. OBJECTIVES

It is fashionable, unfortunately, to list so-called *measurable objectives*, but I will refrain from doing so, because the most important things to gain from the study of any subject, such as depth of understanding and the ability to think in a way that is natural for the discipline, are not particularly definable or quantifiable. My object is to expose you to a rich set of concepts and exercises in linear algebra, presented in a discursive manner, with the objective that you will make these ideas your own and develop facility in working with them.

Note that you will be expected to understand and write simple proofs, in addition to performing computations correctly. I do not expect this to pose serious difficulty, because we will be very clear about definitions and assumptions.

4. REQUIREMENTS, EXPECTATIONS, & GRADING

4.1. Homework. Homework will regularly be assigned, and questions about the homework problems will be answered in class. When appropriate, such as for problems that are more conceptual or theoretical, assignments will be collected and graded, with comments and suggestions. *Do not fool yourself into thinking you can succeed in this course without doing all the homework exercises, whether or not they are collected.*

I encourage you to work in groups and discuss the homework problems with your classmates. Cooperation is far more effective than slogging it out on your own. Also, the experience of explaining things to other people and finding their mistakes will improve your own understanding. *I strongly advise forming a study group of 2-4 people that meets regularly to work on this course. Gobs of research shows that students who belong to a regular study group do better than those who don't. (It stands to reason, doesn't it?)*

You may hand in joint papers, but I strongly suggest you use this privilege very judiciously, in order to make sure you get sufficient practice writing out solutions on your own. Obviously, all of those submitting a joint assignment will receive the same grade and comments.

4.2. Quizzes. There will be occasional quizzes, the main purpose of which is to help you prepare for the exams.

4.3. Exams. There will be *two exams during the term* (in addition to the final exam), one near the middle of the term (the *mid-term exam*) and one near the end of the term (the *end-of-term exam*). The mid-term exam will cover all of the material since the beginning of the course; the end-of-term exam will cover all material since the midterm exam.

There will be a *comprehensive final exam*, covering all the material of the course, at the scheduled time during exam period.

Make-up exams will be given only under extraordinary circumstances or in case of serious emergency; prior permission to miss an exam must be obtained from the professor if at all possible.

4.4. General expectations on written work. You are expected to write solutions (aside from simple computational exercises) in clear, grammatical, and logical sentences, organized logically into paragraphs if necessary, using proper English and mathematical notation. The steps in a proof or substantive computation must be clearly justified. The grading of homework, quizzes, and exams will reflect these expectations. I am VERY STINGY with partial credit. (However, I am forgiving about small careless errors.)

In order to be accepted, your homework must be neatly written and assembled. Multiple pages must be stapled, not folded together, and edges must be straight, not torn out of a spiral notebook. I expect you to turn in the final draft, not the rough draft! Late homework will not generally be accepted, although exceptions can be made when extenuating circumstances warrant them.

4.5. Academic Integrity. Complete honesty on assignments and exams is expected of all students. All sources must be appropriately cited and acknowledged. Please refer to the EIU Student Code of Conduct for further details.

4.6. Attention to communications. It is the student's responsibility to be informed about any communication from the instructor made in class, posted on the course Web site, or sent to the student's EIU email address.

4.7. **Grading.** I do not grade on a “curve”. Under no circumstances will your grade directly depend on how your fellow students do. If you do a good job of learning the material, you will receive a good grade, regardless of how well the other members of the class perform. Don’t forget that the reverse is also true: if you do a poor job of learning the material, you will receive a poor grade, regardless of how poorly everyone else does.

Some problems on assignments and exams will require proofs or other essay responses. For such problems I will often assign letter (rather than numerical) grades, based on specified objectives and standards. These letter grades will be converted to the standard 0 – 4 scale, as will numerical scores ($100\% \equiv 4.5, 90\% \equiv 3.5, \dots, 60\% \equiv 1.5, \leq 55\% \equiv 0$), and a weighted average will then be used to compute your final grade for the course.

Letter grades correspond to my judgement of quality as follows:

- A Excellent. The work exhibits mastery of nearly all important ideas, including those which are subtle or difficult, much insight and originality, highly coherent organization and fine expository style. Errors and omissions, if any, are minor.
- B Good. The work exhibits substantial understanding of most important ideas, including some which are subtle or difficult, some insight and originality, coherent organization and correct usage, grammar and spelling. There are some substantive errors or omissions.
- C Fair. The work exhibits basic understanding of many fundamental ideas, although not those which are subtle or difficult, and demonstrates some coherence. The presentation is readable, with at most minor errors of usage, grammar or spelling. There are many substantive errors or omissions.
- D Poor. The work exhibits some understanding of a few fundamental ideas, but not those which are subtle or difficult, and it fails to demonstrate coherence. Usage, grammar and spelling are mostly correct. There are a great many substantive errors or omissions.
- F No credit. The work exhibits too few of the positive qualities noted above to be worthy of credit.

Each requirement will count toward your final grade as follows:

Homework & Quizzes: 25% Exams (mid-term & end-of-term) : $2 \times 25\% = 50\%$ Final Exam: 25%

The instructor reserves the right to make changes in course policy.

5. HOW TO PARTICIPATE IN CLASS: SOME SUGGESTIONS

Class time will involve a combination of lecture, discussion, examples, and opportunities to ask questions and to work on problems in small groups. Come to class prepared to concentrate and work hard! *Read any relevant material in advance. And, if I may restate the obvious, in order to get something out of class participation, you have to come to class.*

Do not let note-taking distract you from also *thinking* about the material being presented. If you have read the relevant material in advance, you will know what to emphasize in your notes, freeing up your mind to think. In taking down an example, do not struggle to write down every algebraic step: at this point, you should know how to do algebra, so just leave room to fill in any missed steps later.

Always go over your notes as soon after class as possible, before the following class, filling in any missing details, adding marginal notes, and making sure you understand what you have written. If you have questions, come to office hours or ask them at the beginning of the following class. Be neat, organized, and thorough - it really helps a lot!

Finally, *never hesitate to ask a question in class. Every question is important, no matter how elementary you may think it is!*

6. DISABILITY SERVICES

If you have a documented disability and are in need of accommodation, please contact the Office of Student Disability Services (OSDS), Ninth Street Hall, Room 2006, (217) 581-6583. All accommodations must be approved through OSDS.

7. STUDENT SUCCESS CENTER

Students who are having difficulty achieving their academic goals are encouraged to contact the Student Success Center, Ninth Street Hall, Room 1302, (217) 581-6696, for assistance with time management, test-taking, note-taking, avoiding procrastination, setting goals, and other skills to support academic achievement. The Student Success Center provides individual consultations.