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Math 341 Elementary Linear Algebra

Class meets: MUWF 10:00-11:00, **Anstett 195**.
Office Hours: M 1:00-2:00, U 12:00-1:00, W 2:00-3:00 Fenton 319.
Book: Linear Algebra and its applications by D. Lay, 4th edition
               (required but I do not insist you bring it to class).
Syllabus: Roughly chapters 1–4.
Calculator: Any basic calculator will be sufficient.
               You all probably want one that does things with matrices,
               but honestly it is far better to learn to calculate
               by hand first!
Grading: Homework 25%, midterms 35%, final 40%.
Test dates: First midterm: 10:00-10:50 U October 21, Anstett 195.
               Second midterm: 10:00-10:50 U November 11, Anstett 195.
               Final: 10:15-12.05 U December 9, Anstett 195.
In the midterm and the final, you must bring photo ID!
Other dates: Last day to drop class with W: S November 16.
               Last day to add class: W October 8.
               Thanksgiving: H/F November 27/28 – no classes.

General policies:

- Homework will be assigned every Wednesday, due the following Wednesday (first homework due W October 8). You will find it on the Blackboard site for this class. Also there I will put practice midterms and finals, solutions, and so on.

- I do not accept late homework.

- I will usually devote our Tuesday classes to going over the homework that is due the following day. Exceptions to this rule are first week, last week, and the two Tuesdays when there are midterms.

- Homework will be graded by the grader (though usually only a subset of the questions set will be graded) and I will grade the midterms, and the final.

- Please remember that if you miss a class, it is your responsibility to find out what happened in that class.

- If your grade is borderline between one grade and another, then class attendance and participation will be taken into account.

- Please make use of my office hours and ask questions in class (if you're lost you can be sure that others will appreciate your question too!).

- If you cannot make the office hours, then arrange another appointment with me (preferably by e-mail). I will not be available on Thursdays.

Syllabus for Math 341:

Math 341 is a practical class. The main goal is to teach you some techniques for manipulating vectors and matrices, especially solving systems of linear equations, and calculating bases for and dimensions of subspaces. The heart of the course really is about linear transformations, which are certain very important functions defined by matrices. You should be able to visualize simple linear transformations in low dimensions, and learn how in general to compute their kernels and images, and their determinants. We will cover most of chapters 1, 2 and 3 of Lay (perhaps skipping a couple of applications) then chapter 4 up to and including section 4.6.

Learning outcomes for Math 341:

- Find the general solutions of systems of linear equations using row reduction.

- Understand the notions of subspace, basis and dimension in the context of $\mathbb{R}^n$.

- Know how to convert spanning sets into bases and to work out if a given vector lies in the span of some other vectors.

- Understand the definition of linear transformations and visualize them in low dimensions.

- Be able to compute the coordinates of a vector with respect to some given basis. Be able to compute the matrix of a linear transformation with respect to some given bases.

- Compute kernels and images of linear transformations, know the rank-nullity theorem. Compute determinants using an appropriate method.

Syllabus for Math 342:

Like Math 341, Math 342 is also a practical class, the main goal being to understand how and why you should change bases. But there is also a more theoretical aspect to Math 342 as we will start using the more abstract "coordinate-free" language of vector spaces and linear transformations rather than thinking just in terms of column vectors and matrices. You will learn how to compute eigenvalues and eigenvectors of matrices over the real and complex numbers. We also discuss symmetric matrices, quadratic forms and some applications. The syllabus for Math 342 is to cover chapters 4 through 7 of Lay. Note the first few sections of chapter 4 probably already got covered in Math 341—the repetition of this material at the start of Math 342 is entirely deliberate.

Learning outcomes for Math 342:

- Be familiar with the abstract language of vector spaces and linear transformations.

- Understand how the (rectangular) matrix of a linear transformation from one vector space to another transforms when you change bases.

- Understand how the (square) matrix of a linear transformation from a vector space back to itself transforms when you change basis.

- Diagonalize matrices by finding eigenvectors and eigenvalues.

- Know some applications of diagonalization to linear differential and difference equations.

- Understand the spectral theorem for real symmetric matrices and its implications for quadratic forms.

- Apply the Gram-Schmidt algorithm to find orthogonal bases.

- Know some applications of quadratic forms to optimization problems.