

LINEAR ALGEBRA
MATH 20
Spring 2011

Dr. Ray Rosentrater	Office hours: Mon. 2:30 – 4:30
Office: Winter Hall	Wed. 9:30 – 10:20
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Prerequisites: The mathematical content required to function successfully in this course is minimal. You should be familiar and comfortable with mathematical notation and algebraic manipulations. You should be able to solve simultaneous linear equations with symbolic coefficients. You should also be acquainted with the idea of a mathematical proof.

Far more important, though much harder to quantify, is a level of mathematical maturity. This course will be concerned with investigating relationships between concepts, understanding definitions, and developing theorems. You should be able to work with definitions and should be able to distinguish between valid and invalid proofs. Successful completion of Math 10, Math 15 or Math 19 is considered sufficient evidence of the required mathematical maturity.

Texts: Lay, *Linear Algebra and its Applications* (3rd Ed.).
Solow, *How to Read and Do Proofs* (5th Ed.).

Objectives:

By the time you complete this course you should be able to:

1. explain the relationship between matrices and linear functions,
2. state the relationships between invertability, determinants, Eigenvalues, characteristic roots, rank and characteristic polynomials and use them in proofs,
3. work with the concepts of vector space, linear independence, basis, and dimension,
4. appreciate the beauty of the subject of linear algebra,
5. read and write proofs,
6. clearly express mathematical ideas and questions in writing.

Outline: The course will consist of three major sections with an exam at the end of each section. The mathematical content of the course, for the most part, can be found in the first six chapters of Lay. Topics from Solow will be interspersed with the material from Lay as the term progresses. For additional details, see the attached schedule of topics.

Evaluation: Evaluation will be based on the following criteria.

Weekly homework (Lay)	27%
Weekly homework (Solow)	8%
Class Contribution	5%
Definition Quizzes	5%
Regular Exams (2)	35%
Cumulative Final	20%

1. **Homework** from Lay will be assigned weekly and will generally be due on Wednesdays at the beginning of class. The readings, problems and due dates will be posted to the course web site. Homework papers should be neat, organized, and clearly presented. Multiple pages should include your name at the top of each page and should be stapled together.

The majority of assigned problems will involve proofs. Solutions to such problems should be carefully written using complete sentences. Your sentences should maintain proper form including capitalization, punctuation, the inclusion of both a subject and a verb, and agreement of subject and predicate. Notation and equations should be properly set up by means of introductory sentences and phrases. In particular, you should identify the meaning of any variable before using it in your proof.

Each assignment will be worth 25 points and will consist of both computational and theoretical problems. You may do extra even-numbered problems on one assignment to compensate for an assignment for which you did not do well on the assigned problems. Though you may do as many extra problems as you desire, your total score on any given assignment is limited to 30 points. Extra computational problems are worth 1 point each (maximum 3 points per assignment) and theoretical problems are worth 2 points each. *Any extra problems should be placed after the required problems and should be ordered by section.*

The problems from Solow without solutions in the back of the book or on the web are worth 2 points each. You should read the material from Solow at the rate of one chapter per week and turn in 8 points worth problems each Friday. You may do extra problems on one assignment to compensate for an assignment for which you received less than 8 points. You may also do extra problems up to 120% of the total value of the homework from Solow for the semester.

Collaboration on homework is expected and encouraged. There is no reduction in score due to working with others provided the following guidelines are adhered to:

- All students in the group *understand* the solution and are not merely copying solutions.
 - All collaboration is credited. This will generally take the form of a note at the end of a solution like “this solution was developed in collaboration with Jane Smith and Sam Jones.” Alternatively or in addition, you may choose to include a note at the top of the first page like “the solutions in this assignment were compared with those of John Martin for verification” or “I received help from Prof. Rosentrater on problems 12 and 18.”
 - Any paper that does not include acknowledgements must include a statement indicating that the work was done without assistance.
2. Each class period will begin with a **vocabulary quiz**. A term from the current lectures or readings will be written on the board and you will be given a minute to write its correct definition on a sheet of paper. You should come to class with a sheet of paper appropriate to the occasion.
 3. **Exam** dates are included on the accompanying schedule of topics.
 4. The **final exam** will be Monday, May 2 at 8:00 am. Exceptions can be made only by petition to the registrar and are rarely granted.

Absence: While attendance is expected and absence is unwise, there is no formal penalty for absence. Responsibility is expected. If you are forced to miss class for some reason, you should make arrangements for your homework to be brought to class for you. If you know you will be absent on a particular day or for several days, you should make prior arrangements with me to get a list of assignments and to make up the work.

Dishonesty: Dishonesty of any kind will result in loss of credit for the work involved. Major or repeated infractions will result in dismissal from the course with a grade of F. Collaboration is encouraged, but you must do your own, independent write up. Mere copying of another's work is dishonest. Give credit on all collaborative work.

Schedule of Topics:

January	10	Linear Equations
	12	Row Operations
	14	Vector and Matrix Equations
	17	Martin Luther King Holiday
	18	Solutions of linear systems (Monday Schedule)
	19	Linear Independence
	21	Applications
	24	Matrices
	26	Matrix Operations
	28	Inverses
	31	Factorizations
February	2	Applications
	4	Review
	7	Exam 1 (Through Matrices)
	9	Determinants
	11	Properties
	14	Applications
	16	Vector Spaces
	18	Subspaces
	21	President's Holiday
	23	Special Subspaces
	25	Bases
	28	Coordinate Systems
March	2	Dimension and Rank
	4	Change of Basis
	7	Applications
	9	Review
	11	Exam 2 (Through Vector Spaces)
	14	Spring
	16	Recess
	18	
	21	Eigenvectors and Eigenvalues
	23	Characteristic Equation
	25	Diagonalization
	28	Linear Transformations
	30	Applications
April	1	Orthogonality
	4	Inner product
	6	Orthogonal Sets
	8	Gram-Schmidt
	11	Least Squares and Projection
	13	Inner Product Spaces
	15	Applications
	18	
	20	Review
	22	Easter
	25	Recess
	27	Review
May	2	8:00 - 10:00 Final Exam