

## MATHEMATICS 2201 A (CRN 611)

Introduction to Linear Algebra

Fall Semester 2011

Monday, Wednesday 3:00-4:15

Instructional Complex 220

INSTRUCTOR: Dr. Allen G. Fuller

OFFICE: Instructional Complex 225

OFFICE HOURS: 10:10-11:00, 12:30-2:00 Monday  
10:10-11:00, 12:30-2:00 Wednesday  
10:10-11:00, 12:30-3:00 Friday  
And by appointment

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PREREQUISITE: MATH 1501

CREDIT HOURS: 3 semester credit hours

CALCULATOR: Graphing calculator required. TI-83/84 recommended.

TEXT: Anton, Howard. 2010. *Elementary Linear Algebra*. 10<sup>th</sup> Edition. John Wiley & Sons, Inc.. ISBN-13: 978-0-470-45821-1.

### COURSE DESCRIPTION

This course includes a variety of topics in elementary linear algebra including systems of linear equations, matrix algebra, determinants, vector spaces, Euclidean  $n$ -space, inner product spaces, linear independence, bases, linear transformations, and eigenvalues and eigenvectors. Students will also be exposed to and required to do mathematical proofs. Emphasis is put on student preparation, critical thinking, and problem solving.

This course will emphasize student preparation, critical thinking, and problem solving. To do well in the course, you must **read the assignment ahead of time** and prepare questions, do problems from the text, and prepare for test by reviewing those problems worked in class and at home. Over the course of the semester, you should devote about two hours of outside work for each hour in class. Calculus demands your time and effort! **First, study the examples worked in class as well as those in the textbook, then practice, practice, practice problems.**

This course, as many other courses, will emphasize the written communication of ideas to others. In this course, you will be communicating mathematical ideas. Just as it is important in an English course to use the proper format in your essays and term papers, it is important to use proper form when communicating mathematical ideas. You will learn how to write mathematics so that it can be understood by others. You should carefully study how mathematics is written in class as well as how it is written in the textbook. You should pattern your writing after these sources.

### COURSE OBJECTIVES

This objective is directed toward the following general education expected outcome of the college:

**Mathematical Skills:** Students will demonstrate a basic knowledge of the fundamentals of college-level mathematics.

Upon completion of Elementary Linear Algebra, students should have an understanding of:

1. Solving linear systems using matrices.
2. Matrix operations, matrix algebra, and determinants.
3. Euclidean  $n$ -dimensional vector spaces.
4. Abstract vector spaces and subspaces.
5. Linear independence and dependence of vectors, basis and dimension of a vector space.
6. Inner product spaces, length of a vector, and orthogonality of vectors.
7. Linear transformations.
8. The characteristic polynomial, eigenvalues and eigenvectors of a square matrix and their application to diagonalizable matrices.

### METHOD OF EVALUATION

- A. There will be eleven (11) take-home assignments given during the semester. The due dates for the assignments are given in the Course Outline on page 4 of the syllabus. Assignments are due at the **beginning of class** on the date due. For each day an assignment is late, **five (5) points will be deducted** from the assignment. Late assignments will only be accepted for **three (3) class days** following the due date. After this time, a zero (0) is recorded as the assignment grade. Just having the correct answer to a homework question will **NOT** earn you credit for the problem; you must use clear mathematical reasoning and clear mathematical writing to show me how you arrive at your solution.
- B. There will be three (3) in-class tests given during the semester. The dates of these exams are: Wednesday, September 14; Wednesday, November 2; and Wednesday, November 30, 2011. **If a make-up test is required, there will be 20% penalty unless there is a documented medical excuse or documented death in the immediate family.** A make-up test **must** be taken within **48 hours** of your return to class or by the last day of class (whichever comes first), after which you receive a grade of zero. All tests will be taken without references of any description.
- C. There will also be a comprehensive Final Examination given on Wednesday, December 7, 2011 at 12:30 pm. Gordon College policy states the Final Examinations must be taken at the scheduled time with the following exception. Students who have three or more finals on the same day may petition to take the third and/or fourth exam on another day or days. Student Petition forms are available in the Academic Affairs Office (Lambdin Hall 347). Please make your plans accordingly.
- D. The student's final grade will be computed as follows:
- |                   |            |
|-------------------|------------|
| Assignments       | 15%        |
| Tests             | 60%        |
| <u>Final Exam</u> | <u>25%</u> |
| TOTAL             | 100%       |
- E. If your grade on the Final Exam is higher than your highest test score, the grade on the Final Exam will replace your lowest test score.
- F. The following grading scale will be used.
- |               |   |               |   |
|---------------|---|---------------|---|
| 89.5 or above | A | 59.5 to 69.49 | D |
| 79.5 to 89.49 | B | Below 59.5    | F |
| 69.5 to 79.49 | C |               |   |

### CLASS PROCEDURES

- A. **Attendance:** Attendance at class is important. I will take attendance by passing an Attendance Sheet for you to sign. ***If your signature is not beside your name for a particular day, you are considered absent. It is your responsibility to make sure you sign the Attendance Sheet.*** Students are responsible for every instruction, every change in the syllabus, and all material covered in class whether or not they are present. ***Students who enroll in the course late are responsible for material covered before they enrolled.***
- B. **Working Problems:** Most students will benefit by working *many, many* problems for practice. On the Tentative Course Outline is a list of suggested problems for each section covered. These are intended to give the student practice in specific concepts that are taught in class. The problems will not be graded. However, I strongly encourage you to work them to better prepare for the tests. I will use approximately the first ten minutes of class to answer any questions about the homework problems. Math is not a spectator sport!
- C. **Group Work:** I encourage students to work together on homework.
- D. **Academic Honesty:** Each student must do his or her own work on exams without any assistance from any outside source not specifically authorized by me. The student handbook details school policies on academic honesty.
- E. **Calculator Policy:** A graphing calculator is required for this course. The TI-83 or TI-84 is recommended. Please bring your calculator for all tests and quizzes. I will not provide calculators for your use. Also, sharing calculators during a test or quiz will be considered cheating. Calculators that can manipulate symbolically, e.g. the TI-89 or TI-92, are NOT allowed during tests and quizzes.
- F. **Accommodations for Students with Disabilities:** Only students who have documented their learning disabilities through the Counseling Center and present me with the paper work from Ms. Kristina Henderson will be given special accommodations. Ms. Henderson's office is in Student Center Room 202.
- G. **Gordon E-mail:** Your Gordon e-mail address is where all official communication from Gordon College is sent. This includes registration information, etc. Please check your Gordon e-mail account periodically for important information. You should also delete junk e-mail to keep your mailbox from getting full. If your mailbox is full, you may not receive important e-mail notifications. Also, if I need to communicate with you via e-mail, I will send the message to your Gordon e-mail account.
- H. **Classroom Etiquette:** Students are expected to treat the instructor and other students with respect. Please refrain from the following during class time:
1. Talking with other students (other than during classroom or group activities).
  2. Leaving class early (other than an emergency).
  3. Leaving the desk to sharpen a pencil in the middle of a lecture.
  4. Consistently late coming to class.
  5. Cell phones ringing during class. Placing or receiving cellular phone calls during class.
  6. I-pods or other music listening devices should NOT be in use during class time or during tests and quizzes.

### OFFICE PROCEDURES

When you come to my office for help, please be prepared by doing the following.

1. Bring your textbook, your calculator, and your class notes.
2. Make sure you have read the section in the text, read the class notes, and studied the examples.
3. Be prepared to show me at least two odd-numbered problems, from the section that you have worked.
4. Bring your incomplete or incorrect solution to each problem about which you have a question.
5. Ask for help as early as possible. **Don't wait until the day of a test!**

# Tentative Course Outline

MATH 2201

Fall Semester 2011

Date	Section	Assignment	Homework
Mon, Aug 15	1.1: Introduction to Systems of Linear Equations	12, 14 (Due Wed, Aug 24)	1-17 odd
	1.2: Gaussian Elimination	6, 18, 41 (Due Wed, Aug 24)	1-31 odd
Wed, Aug 17	1.2: Concluded		
	1.3: Matrices and Matrix Operations	4(a), 6(a), 12, 14, 18 (Due Wed, Aug 24)	1-23 odd
Mon, Aug 22	1.4: Inverses; Algebraic Properties of Matrices	4, 16, 28, 42 (Due Wed, Aug 31)	1-49 odd
	1.5: Elementary Matrices and a Method for Finding $A^{-1}$	8, 14, 20, 42 (Due Wed, Aug 31)	1-39 odd
Wed, Aug 24	1.5: Concluded		
	1.6: More on Linear Systems and Invertible Matrices	2, 10 (Due Wed, Aug 31)	1-19 odd
Mon, Aug 29	1.7: Diagonal, Triangular, and Symmetric Matrices	10, 28, 32 (Due Wed, Aug 31)	1-35 odd
	2.1: Determinants by Cofactor Expansion	6, 10, 16, 20(b) (Due Mon, Sep 19)	1-41 odd
Wed, Aug 31	2.1: Concluded		
	2.2: Evaluation Determinants by Row Reduction	10, 16, 20, 24, 28 (Due Mon, Sep 19)	1-35 odd
Mon, Sep 5	<b>Labor Day Holiday—No Class</b>		
Wed, Sep 7	2.2: Concluded		
	2.3: Properties of Determinants	8, 10, 18, 20, 26 (Due Mon, Sep 19)	1-39 odd
Mon, Sep 12	2.3: Concluded		
Wed, Sep 14	<b>TEST I</b>		
Mon, Sep 19	3.1: Vectors in 2-Space, 3-Space, and $n$ -Space	14, 18, 24 (Due Mon, Sep 26)	1-37 odd
	3.2: Norm, Dot Product, and Distance in $R^n$	6, 10, 12, 20 (Due Mon, Sep 26)	1-33 odd
Wed, Sep 21	3.3: Orthogonality	2, 10, 20, 28 (Due Mon, Sep 26)	1-43 odd
	3.4: The Geometry of Linear Systems	4, 18, 26 (Due Mon, Oct 3)	1-27 odd
Mon, Sep 26	3.5: The Cross Product	4, 8, 18, 32 (Due Mon, Oct 3)	1-35 odd
	4.1: Real Vector Spaces	2, 32 (Due Oct 12)	1-27 odd
Wed, Sep 28	4.1: Concluded		
	4.2: Subspaces	2, 10, 12 (Due Oct 12)	1-19 odd
Mon, Oct 3	4.2: Concluded		
	4.3: Linear Independence	2, 8, 16 (Due Oct 12)	1-27 odd
Wed, Oct 5 (Midterm 10/6)	4.3: Concluded		
	4.4: Coordinates and Basis	6, 10 (Due Oct 24)	1-19 odd
Mon, Oct 10 – Tue, Oct 11	<b>Fall Break – No Class</b>		
Wed, Oct 12	4.4: Concluded		
	4.5: Dimension	4, 8, 14 (Due Oct 24)	1-21 odd
Mon, Oct 17	4.5: Concluded		
	4.6: Change of Basis	2, 8, 14 (Due Oct 24)	1-27 odd
Wed, Oct 19	4.7: Row Space, Column Space, and Null Space	2(b), 6(c), 8(c) (Due Oct 31)	1-19 odd
Mon, Oct 24	4.8: Rank, Nullity, and the Fundamental Matrix Spaces	2(d) (Due Oct 31)	1-19 odd

Date	Section	Assignment	Homework
Wed, Oct 26	4.9: Matrix Transformations from $R^n$ to $R^m$	8(b), 10, 12(b) (Due Nov 7)	1-35 odd
Mon, Oct 31	4.10: Properties of Matrix Transformations	4, 14(Due Nov 7)	1-29 odd
Wed, Nov 2	<b>TEST II</b>		
Mon, Nov 7	5.1: Eigenvalues and Eigenvectors	6(a), 8(a), 18 (Due Nov 16)	1-27 odd
Wed, Nov 9	5.2: Diagonalization	6, 14, 18 (Due Nov 16)	1-31 odd
Mon, Nov 14	6.1: Inner Products	2, 14, 24(b) (Due Mon, Nov 28)	1-31 odd
	6.2: Angle and Orthogonality in Inner Product Spaces	2, 6, 18, 26 (Due Mon, Nov 28)	1-25 odd
Wed, Nov 16	6.3: The Gram-Schmidt Process; $QR$ -Decomposition	8, 22(b) (Due Mon, Nov 28)	1-27 odd
Mon, Nov 21	7.1: Orthogonal Matrices		1-17 odd
Wed, Nov 23 – Fri, Nov 25	<b>Thanksgiving Holiday—No Class</b>		
Mon, Nov, 28	7.2: Orthogonal Diagonalization		1-19 odd
Wed, Nov 30	<b>TEST III</b>		
Mon, Dec 5	Review		
<b>Wed, Dec 7 12:30 pm</b>	<b>FINAL EXAMINATION</b>		