

# MATH 3304: Linear Algebra

Sul Ross State University ~ Rio Grande College  
Fall 2015

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**Course Description** MTH 3304 is intended as an introduction to linear algebra.

**Course Objectives** Students will solve systems of linear equations and use them in applied problems; learn the properties of matrix operations and use them in applied problems; compute determinants using a variety of methods; be introduced to vector spaces, inner products, and linear transformations, and learn their applications; and compute the eigenvalues and eigenvectors of a matrix or linear transformation.

**Mathematics Program Outcomes** The graduating student will be able to demonstrate content knowledge in mathematics including arithmetic, algebra, geometry, probability, statistics, and calculus.

**Class Time** T/Th 4:30 – 5:45

**Class Location** Del Rio 107; Eagle Pass B112; Uvalde B114c

**Required Text** Larson, *Elementary Linear Algebra*, Seventh Edition, ISBN 9781133110873

**Office Hours** M/W, 12:00 p.m. – 2:00 p.m.; T/Th, 10:30 a.m. – 12:30 p.m.

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## Course Policies

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### Attendance Policy

Attendance is mandatory. You will be held responsible for all material covered in class or in the reading assignments. If you have to miss a class, it is your responsibility to obtain all notes, assignments, and announcements from someone else in the class. Make-up exams will be given only in the event of an emergency, in which case written justification and/or documentation must be provided and approved.

### Communication

I will post course documents, reminders, announcements, and assignments on the Blackboard system. I may also occasionally send announcements via e-mail. You should make sure you know how to access and use these tools. E-mail is the best way to contact me.

You are welcome to stop by my office if you need help with the homework or wish to speak about your progress in the course. If you would like to meet with me and can't travel to Uvalde, please let me know, and we will try to arrange an appointment at your site.

**I am here to help you.** Ask questions in class, call me, e-mail me, or come to my office. If

you don't communicate with me, then I can't help you.

### Homework

Homework will be assigned for each section that we cover in the text. Although most of the homework will not be collected and graded, you should regard it as the most essential component of the course. It is very important that you complete each homework assignment before the next class period. This will allow you to make the most of our time together. We will always have time in class to discuss the homework.

During the final weeks of the semester you will turn in a homework folder. This should contain every assigned homework **in order**, with **all the work shown**, handwritten on **looseleaf paper**. Solutions with just the answers will not receive credit. These will be graded for completeness, not correctness.

### Grading Policy

Your grades will be weighted as follows:

|                 |     |
|-----------------|-----|
| Homework Folder | 15% |
| Midterm Exam    | 35% |
| Final Exam      | 50% |

A student who averages at least 90% will receive an A; at least 80% will receive at least a B; at least 70% will receive at least a C; at least 60% will receive at least a D.

### Exams

There will one midterm exam. The tentative date is October 15. This is subject to change. You will be notified of a change at least one week in advance. Make-up exams will be given only in the event of an emergency, in which case written justification and/or documentation must be provided and approved.

Implicit in registering for this course is your agreement that you will be present to take the final exam at the time determined by the University, which is Tuesday, December 8, from 3:00 – 5:45 p.m. The final exam will be comprehensive.

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## Subject Outline

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*Below is a tentative outline of the subjects we will cover in this course.*

#### I. Basic Linear Algebra

1. Systems of Linear Equations: *linear equations – systems of linear equations – solving a system of equations – the coefficient matrix – Gaussian and Gauss-Jordan elimination – homogeneous systems – applications*
2. Matrix Operations: *matrix addition and multiplication – arithmetic properties – the identity matrix – the transpose of a matrix*

3. Matrix Equations: *writing a system of equations as a matrix equation – the inverse of a matrix – properties of the inverse – using the inverse to solve a system of equations*
4. Determinants: *the determinant of a matrix – evaluation of a determinant using elementary row operations – properties of determinants – applications*

## II. Vector Spaces

1. Introduction to Vector Spaces: *vectors in  $\mathbb{R}^n$  – abstract vector spaces – matrix spaces – polynomial spaces – function spaces – subspaces – the subspace test – examples of subspaces – intersections of subspaces*
2. Spanning Sets and Linear Independence: *linear combinations – spanning sets – linear independence – basis and dimension – rank*
3. Coordinates: *coordinates relative to a basis – change of basis – transition matrices – the general equation of a conic section*

## III. Inner Product Spaces

1. Inner Product Spaces: *length in  $\mathbb{R}^n$  – unit vectors – distance – the dot product – angle – the Cauchy-Schwarz Inequality – the Triangle Inequality – the Pythagorean Theorem – abstract inner product spaces – orthogonal projection*
2. Orthonormal Bases: *orthogonal and orthonormal bases – the Gram-Schmidt process – Legendre polynomials – orthogonal complements – projection onto a subspace*
3. Function Spaces: *infinite-dimensional vector spaces – inner products – orthogonal functions – orthonormal sequences – approximating bases – periodic functions – Fourier series – sound waves and electrical engineering – quantum theory*

## IV. Linear Transformations

1. Introduction: *linear transformations and their properties – examples – kernel – range – one-to-one and onto transformations*
2. Matrices and Linear Transformations: *the matrix of a transformation – products and composition – invertible transformations – determinants and volume*
3. Eigenvalues and Eigenvectors: *eigenvalues – eigenspaces – diagonalization*

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## Schedule

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*This schedule is tentative only. The unit numbers refer to the above outline.*

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|---------------|---------------------------|
| Unit I        | August 25 – September 15  |
| Unit II       | September 17 – October 13 |
| Midterm Exam  | October 15                |
| Unit III      | October 17 – November 13  |
| Unit IV       | November 17 – December 1  |
| Course Review | December 3                |
| Final Exam    | December 8                |

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## **Americans With Disabilities Act**

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*Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Kathy Biddick, Student Services Administrative Secretary.*