

## Fall 2024 Math 2360-022 Linear Algebra

<b>Instructor:</b> Dr. Alexander Solynin	<b>Place:</b> MATH 016
<b>Office Hours:</b> MW 11:00am - 1:00pm or by appointment	<b>Text:</b> <i>Elementary Linear Algebra</i> , 8 <sup>th</sup> Edition by Ron Larson. Cengage (2023).
<b>Office:</b> MA 231	<b>Time:</b> 11:00-12:20 pm TR
<b>Email:</b> alex.solynin@ttu.edu	<b>Prerequisites:</b> MATH 1352 or 1452

**About the Course:** It is essential that the presentation be very elementary with a great deal of attention directed to solving specific problems in order to meet with any great degree of success. This is not intended to be a course in abstract mathematics. Rigor, with proofs, is expected, but all examples and applications should be concrete. The plan is to cover Chapters 1 – 7.

**Student Learning Outcomes:** MATH 2360 satisfies the university core curriculum requirement in Mathematics: "Students graduating from Texas Tech University should be able to demonstrate the ability to apply quantitative and logical skills to solve problems". It meets the following TTU general education student learning outcomes for mathematics that students will: apply arithmetic, algebraic, geometric, statistical and logical reasoning to solve problems; represent and evaluate basic mathematical and/or logical information numerically, graphically, and symbolically; interpret mathematical and/or logical models such as formulas, graphs, tables and schematics, and draw inference from them.

Students will develop skills in manipulating with matrices and understand their relationship to linear systems. They understand the concept of bases and vector spaces, as well as eigenvectors and eigenspaces. In particular, students perform basic vector algebra, and compute their bases; express a linear transformation as a matrix; perform basic matrix manipulations and compute the determinant of a matrix; compute eigenvalues and eigenvectors; use the Gram-Schmidt process.

**Methods for Assessment of Learning Outcomes:** The expected learning outcomes for the course will be assessed through graded activities and ungraded activities. The graded activities include exams, homework and quizzes. The ungraded activities will be used to monitor your progress. A variety of these ungraded assessment techniques may be employed, including problems to be completed during class, direct questioning of students, answering students' questions in class, one-minute classroom assessment techniques, and discussions during office hours.

**Formula sheets:** At least one class before the Final and in-class exams, I will provide students with a one-quarter page, valid for that particular exam, where you may write (do not type!) formulas and theorems, which you are going to use in class. Students are not allowed to use their own pages as formula sheets in the class.

**General Policies:** *Texas Tech Policies Concerning Academic Honesty, Special Accommodations for Students with Disabilities, Student Absences for Observance of Religious Holy Days, and Statement of Accommodation for Pregnant Students* may be found on Blackboard. Relevant Texas Tech policies can be found here:

- <https://www.depts.ttu.edu/tlpdc/RequiredSyllabusStatements.php>
- <https://www.depts.ttu.edu/tlpdc/RecommendedSyllabusStatements.php>

***Absence due to religious observance:*** The Texas Tech University OP 34.19 states that a student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. As your instructor, I request that notification be made in writing and submitted no later than the 15th class day of the semester. Absence due to officially approved trips - The Texas Tech University OP 34.04 states department chairpersons, directors, or others responsible for a student representing the university on officially approved trips must notify the student's instructors of the departure and return schedules. The instructor so notified must not penalize the student, although the student is responsible for material missed. Any student absent because of university business must be allowed to make up missed work within a reasonable span of time or have alternate grades substituted for work due to an excused absence. Students absent because of university business must be given the same privileges as other students.

***Academic Integrity (extracted from OP 34.12):*** It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and high standard of integrity. The attempt of students to present as their own any work not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offenders liable to serious consequences, possibly suspension. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, falsifying academic records, misrepresenting facts, and any act designed to give unfair academic advantage to the student (such as, but not limited to, submission of essentially the same written assignment for two courses without the prior permission of the instructor) or the attempt to commit such an act.

***Civility in the Classroom:*** Incivility is any action that interferes with the classroom learning environment. This includes, but is not limited to, eating, arriving late, leaving early, a ringing cell phone, text messaging, sleeping, chatting during class, dominating the class discussion by not allowing other students to speak, and putting books away before the end of class. Be respectful to the instructor and to your fellow students. I will ask anyone participating in what I perceive to be inappropriate behavior to stop immediately.

***Accommodation for Students with Disabilities (extracted from OP 34.22):*** Any student who, because of a disability, may require some special arrangements in order to meet course requirements should contact the instructor as soon as possible to make the necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until the appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405.

***Absence due to officially approved trips:*** The Texas Tech University Catalog states that the person responsible for a student missing class due to a trip should notify the instructor of the departure and return schedule in advance of the trip. The student may not be penalized and is responsible for the material missed.

**Title IX Syllabus Statement - TTU Resources for Discrimination, Harassment, and Sexual Violence:** Texas Tech University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from gender and/or sex discrimination of any kind. Sexual assault, discrimination, harassment, and other [Title IX violations](#) are not tolerated by the University. Report any incidents to the *Office for Student Rights & Resolution*, (806)-742-SAFE (7233) or file a report online at [titleix.ttu.edu/students](http://titleix.ttu.edu/students). Faculty and staff members at TTU are committed to connecting you to resources on campus. Some of these available resources are: **TTU Student Counseling Center**, 806-742-3674, <https://www.depts.ttu.edu/scc/> (*Provides confidential support on campus.*) **TTU Student Counseling Center 24-hour Helpline**, 806-742-5555, (*Assists students who are experiencing a mental*

health or interpersonal violence crisis. If you call the helpline, you will speak with a mental health counselor.) **Voice of Hope Lubbock Rape Crisis Center**, 806-763-7273, [voiceofhopelubbock.org](http://voiceofhopelubbock.org) (24-hour hotline that provides support for survivors of sexual violence.) **The Risk, Intervention, Safety and Education (RISE) Office**, 806-742-2110, [rise.ttu.edu](http://rise.ttu.edu) (Provides a range of resources and support options focused on prevention education and student wellness.) **Texas Tech Police Department**, 806-742-3931, <http://www.depts.ttu.edu/ttpd/> (To report criminal activity that occurs on or near Texas Tech campus.)

### Important Dates:

Thursday, August 22 – Classes begin.  
September 2 - Labor Day Holiday.  
Nov. 27- Dec. 1 - Thanksgiving Vacation.  
November 18 - Last day to drop a course.  
December 3 - Last Day of classes.  
Nov. 25 – Dec. 4 – Period of no examinations.

### Friday, December 6, 7:30 a.m. to 10:00 a.m. Final Exam.

Wednesday, December 11 at noon - Grades Due for Graduating Students via Raiderlink.  
Monday, December 16 at 5:00 p.m. - Final Grades Due via Raiderlink.

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## STUDENT EVALUATION:

- Final examination – comprehensive, course wide exam written by the instructor.

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### ◆ Friday, December 6, 7:30 a.m. to 10:00 a.m. FINAL EXAMINATION 140 pts (23%)

This exam is scheduled by Texas Tech University before the semester begins.

Students should **eliminate any conflicts NOW**.

- **IN-CLASS EXAMS:** September 24, November 5 2×100 = 200 pts (34%)  
Each exam consists of 10-12 problems
- 15-min **QUIZZES:** 5×20 = 100 pts (17%)  
Each 15-minute quiz consists of 2 problems: 2×10 = 20 pts
- 5-min **QUIZZES:** total = 20 pts (3%)  
There will be several 5-minute quizzes (usually first 5 minutes of a class), where students will be asked to write a particular formula/definition/theorem/etc.
- **HOMEWORK:** Instructor will collect homework six times and will grade 8-10 problems of these homework assignments.  
Each homework is worth 20 pts: 6×20 = 120 pts (20%)
- **Perfect attendance** (≤3 missed classes, all excused absences must be supported by official notes). 20 pts (3%)

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- **MAXIMAL TOTAL:** 600 pts (100%)

## GRADING PROCEDURE:

- A** - 90 - 100%
- B** - 80 - 89%
- C** - 70 - 79%
- D** - 60 - 69%

## Course Calendar

Date	Textbook	Tentative Lecture Topics
Aug. 22	Sec.1.1	Introduction to systems of linear equations.
Aug. 27	Sec.1.2	Gaussian elimination and Gauss-Jordan elimination. Sec.1.3 Applications.
Aug. 29	Sec.2.1	Operations with matrices. Sec.2.2 Properties of matrix operations.
Sep. 3	Sec.2.3	The inverse of a matrix.
Sep. 5 <b>Q1</b>	Sec.2.4	Elementary matrices. (Examples from Sec. 2.5 and 2.6 if time permit).
Sep. 10	Sec.3.1	The determinant of a matrix. Sec.3.2 Determinants and elementary operations.
Sep. 12	Sec.3.3	Properties of determinants.
Sep. 17 <b>Q2</b>	Sec.3.4	Applications of determinants.
Sep. 19		Review for Exam #1.
<b>Sep. 24</b>	<b>Lecture Exam #1</b>	<b>covered Sections 1.1 – 3.4.</b>
Sep. 26	Sec.4.1	Vectors in $\mathbb{R}^n$ . Sec.4.2 Vector spaces.
Oct. 1	Sec. 4.3	Subspaces of vector spaces. Sec.4.4 Spanning sets and linear independence.
Oct. 3 <b>Q3</b>	Sec.4.5	Basis and dimension.
Oct. 8	Sec.4.6	Rank of a matrix and systems of linear equations.
Oct. 10	Sec.4.7	Coordinates and change of basis.
Oct. 15	Sec.4.8	Applications of vector spaces.
Oct. 17 <b>Q4</b>	Sec.5.1	Length and Dot Product in $\mathbb{R}^n$ . Sec.5.2 Inner product spaces.
Oct. 22	Sec.5.3	Orthonormal bases: Gram-Schmidt process.
Oct. 24	Sec.5.4	Mathematical models. Sec.5.5 Applications of inner product spaces.
Oct. 29	Sec.6.1	Introduction to linear transformations. Sec.6.2 The kernel and range.
Oct. 31		Review for Exam #2.
<b>Nov. 5</b>	<b>Lecture Exam #2,</b>	<b>covered Sections 4.1 – 6.2.</b>
Nov. 7	Sec.6.3	Matrices for linear transformations.
Nov. 12	Sec.6.4	Transition matrices and similarity.
Nov. 14 <b>Q5</b>	Sec.6.5	Applications of linear transformations.
Nov. 19	Sec.7.1	Eigenvalues and eigenvectors. Sec.7.2 Diagonalization.
Nov. 21	Sec.7.3	Symmetric matrices and orthogonal diagonalization.
Nov. 26	Sec.7.4	Applications of Eigenvalues and eigenvectors.
Dec. 3		Review of the course.
<b>Dec. 6</b>	<b>Friday</b>	<b>7:30 a.m. – 10:00 a.m. FINAL EXAM</b>

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## Tentative Homework Assignments

Chapter	Assignment
<b>HW1</b>	<b>Due September 3</b>
Chapter 1	1.2,1.20,1.28, 1.48,2.8,2.14,2.34,2.56,3.2,3.16
Chapter 2	1.6,1.14,1.38,1.44,1.56,1.60,2.14,2.18,2.26
<b>HW2</b>	<b>Due September 17</b>
Chapter 2	2.42,2.76, 3.10,3.18,3.40,3.46,4.16,4.22,4.48
Chapter 3	1.4,1.12,1.20,1.46,2.26,2.42,3.2,3.4,3.22,3.34,3.40,3.44
<b>HW3</b>	<b>Due October 3</b>
Chapter 3	4.4,4.10,4.18,4.30,4.44,4.54
Chapter 4	1.8,1.24,1.34,1.50,2.22,2.32,3.2,3.24,3.30,4.2,4.12,4.32,4.44,4.52
<b>HW4</b>	<b>Due October 22</b>
Chapter 4	5.12,5.16,5.40,5.54,6.8,6.14,6.24,6.32,6.44,7.12,7.20,7.30,7.38,8.2,8.20,8.34,8.64
Chapter 5	1.4,1.8,1.20,1.26,1.32,1.42,1.50,1.58,2.2,2.18,2.26,2.32,2.42,2.44
<b>HW5</b>	<b>Due November 19</b>
Chapter 5	3.2,3.6,3.22,3.30,4.2,4.26,5.8,5.16,5.44,5.62(a),(c),
Chapter 6	1.6,1.10,1.16,1.26,1.34,2.2,2.16,2.26,3.2,3.8,3.18,3.28,3.34,4.2,4.20,5.2,16,2.28
<b>HW6</b>	<b>Due November 26</b>
Chapter 7	1.2,1.6,1.10,1.16,1.22,1.42,2.2,2.16,2.34,3.2,3.4,3.10,3.34,3.46