**Course Title** Intro Linear Algebra

**Course Number:** MATH 235

**Instructor, Office, Email** Martina Rovelli, LGRT1115J, mrovelli@umass.edu

**Coursewide Page:** https://people.umass.edu/~esarfoampons/math235coursewide.html

**Prerequisites:** Math 132 or consent of the instructor. (Gen.Ed. R2)

**Course Description:** Math 235 is an introductory course on linear algebra, covering systems of linear equations, matrices, linear transformations, determinants, vector spaces, eigenvalues and eigenvectors, and orthogonality.  
**Number of course credits:** 3. Note: 1 credit is equivalent to an average of 3 hours of work per week.   
  
**Learning Objectives**:

Upon completion of this course, the successful student will be able to:

1. Use Gaussian elimination to do all of the following: solve a linear system with reduced row echelon form, solve a linear system with row echelon form and backward substitution, find the inverse of a given matrix, and find the determinant of a given matrix.

2. Demonstrate proficiency at matrix algebra. For matrix multiplication, demonstrate understanding of the associative law, the reverse order law for inverses and transposes, and the failure of the commutative law and the cancellation law.

3. Use Cramer's rule to solve a linear system.

4. Use cofactors to find the inverse of a given matrix and the determinant of a given matrix.

5. Determine whether a set with a given notion of addition and scalar multiplication is a vector space.

6. Determine whether a given subset of a vector space is a subspace.

7. Determine whether a given set of vectors is linearly independent, spans, or is a basis.

8. Determine the dimension of a given vector space or of a given subspace.

9. Find bases for the null space, row space, and column space of a given matrix, and determine its rank.

10. Demonstrate understanding of the Rank-Nullity Theorem and its applications.

11. Given a description of a linear transformation, find its matrix representation relative to given bases.

12. Demonstrate understanding of the relationship between similarity and change of basis.

13. Find the norm of a vector and the angle between two vectors in an inner product space.

14. Use the inner product to express a vector in an inner product space as a linear combination of an orthogonal set of vectors.

15. Find the orthogonal complement of a given subspace.

16. Demonstrate understanding of the relationship of the row space, column space, and nullspace of a matrix (and its transpose) via orthogonal complements.

17. Demonstrate understanding of the Cauchy-Schwartz inequality and its applications.

18. Determine whether a vector space with a given form is an inner product space.

19. Use the Gram-Schmidt process to find an orthonormal basis of an inner product space. Be capable of doing this both in Rn and in function spaces that are inner product spaces.

20. Find orthogonal projections onto subspaces.

21. Find (real and complex) eigenvalues and eigenvectors of 2 × 2 or 3 × 3 matrices.

22. Determine whether a given matrix is diagonalizable. If so, find a matrix that diagonalizes it via similarity.

23. Demonstrate understanding of the relationship between eigenvalues of a square matrix and its determinant, its trace, and its invertibility/singularity.

24. Use the concepts of linear systems for polynomial curve fitting.

25. Correctly define terms and give examples relating to the above concepts.

26. Be familiar with basic theorems about the above concepts.

27. Prove or disprove statements relating to the above concepts.

28. Be adept at hand computation for row reduction, matrix inversion and similar problems.

**Process Learning Outcomes:**

• Students will be able to understand linear algebra problems from three

perspectives of analysis, algebra, and geometry.

• Students will be able to appropriately apply linear algebra methods.

• Students will improve their technical reading and writing skills in the context of linear algebra.

**Text** - Linear Algebra and its Applications (6th edition) by David Lay, Steven Lay & Judi McDonald.

**MyMathLab** is required for this course. An **electronic copy of the textbook** is included in your purchase of MyMathLab. Go to [www.mymathlab.com](http://www.mymathlab.com/) and use the Course ID TBD. On-line homework and quizzes will be assigned through MyMathLab. Here are suggestions from Pearson for [getting started with MyMathLab](http://www.gang.umass.edu/~kusner/class/235mml.html). USE YOUR @UMASS EMAIL WHEN ENROLLING. Everyone has free access for 14 days and can register for temporary access before the add/drop date.

**Delivery Mode:** In-person with Canvas, Gradescope and MyMathlab as supporting online platforms.

**Class Attendance:** Students are expected to attend all classes. Attendance policies for synchronous-required courses are consistent with the [University Attendance Policies](https://www.umass.edu/registrar/students/policies-and-practices/class-absence-policy).

**Assessments:** Students must complete all assignments as described below

|  |  |
| --- | --- |
| **Course Component** | **Weight** |
| Exam 1 | 20% |
| Exam 2 | 20% |
| Exam 3 | 20% |
| MyMathLab Assignments (HW-20% Quiz - 10% min) | 30%\*\* |
| Other assignments determined by section instructor\*\* Example: Gradescope Quizzes | 10%\*\* |

***To receive a passing grade, students must complete each exam and achieve an overall average of 40%***

**Grading Scale:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | A- | B+ | B | B- | C+ | C | C- | D+ | D | F |
| 90 | 87 | 83 | 79 | 75 | 71 | 67 | 63 | 59 | 55 | <55 |

There is **no rounding** of grades in this course. For example, an 89.99999 is an A- and not an A.

**Calculator:** Calculators will not be allowed in the exams. You may use calculators to check your homework solutions, but credit will be given only for answers showing all your steps (unless mentioned otherwise in the assignment).

**MyMathLab Assignments:** There will be at least 29 homework assignments and 29 quizzes on mymathlab (one from each section). You will have 8 attempts for homework problems and only two attempts for quizzes. Students must complete the assignments within the week they are taught in accordance with the course schedule. Students who miss deadlines for MyMathlab assignments can attempt them for 50% credit within a limited time.

**Quizzes (on gradescope)\*\*\*instructor’s choice\*:** There will be at least 10 written quizzes (this will be weekly except the first and last week of the semester, and the exam weeks). Your two lowest scores will be dropped.

**Exams:** There will be two midterms and a final exam. All exams are closed-book, however, you will be allowed a single paper note sheet (ONE SIDED ONLY). Paper size should not exceed A4 size and notes MUST be handwritten (not printed). To receive a passing grade, students must take all 3 exams with an average of 40%. Students MUST follow the in-person exam protocols as stated on the course website.

**Make-up Policy:** Students who are absent due to **excusable extenuating circumstances** remain responsible for meeting all class requirements and contacting me in a timely fashion about making up missed work. The following are acceptable reasons for missing an exam:

Exam/Class Conflict: If you have two exams scheduled during the same time period, or a class during our scheduled exam, you are eligible for a make-up exam. You must submit documentation from the Registrar's Office to your instructor at least two weeks before the scheduled exam.

Religious Observance: You should contact your instructor at the beginning of the semester if you must miss an exam due to religious observance.

Medical Reasons: If you will be absent from an exam due to medical reasons, you should notify your instructor at least one week in advance of the exam. If you have a medical emergency, you should notify your instructor as soon as possible. In either case, you may need to provide a documentation. You need not disclose any details of the reason for a medical excuse, but there must be enough information to allow the absence to be excused.

Other Circumstances: It is impossible to anticipate all of the possible things that can occur. In case of an exceptional event beyond those covered above, contact your instructor and explain the problem. (You should be prepared to provide a written statement if necessary.) Your instructor will evaluate the reasons that you have given and come to a decision.

Note that there is **no re-taking of exams** in this course. So, if you are sick and take the exam anyway, you cannot re-take the exam later for a better grade. Regardless of the situation, if you do not feel you can take the exam on the scheduled date notify your instructor immediately. Once you take the exam, there is nothing that can be done to change the grade.

**Make-up exams will not be given to accommodate travel plans**.

**Electronic Submission:** In case an online platform is utilized, it is your responsibility to make sure any electronic submission goes through successfully (uploaded, no blurry images, and the questions and answers match) and check with your instructor or TA that the submission is successful. You should make sure you submit your exams on gradescope **before the exam time runs out**.

**Accommodation Statement:** The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires accommodation, please notify Disability Services and me within the first two weeks of the semester so that we may make appropriate arrangements. For further information, please visit Disability Services (https://www.umass.edu/disability/).

**Academic Honesty Statement**

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (<http://www.umass.edu/dean_students/codeofconduct/acadhonesty/>).

**Chegg, Discord, ChatGPT and other online help resources:** Seeking answers from any website is a clear violation of the academic honesty policy, while submitting course materials to these sites or similar ones is a violation of the instructor’s copyright. Instructors may be monitoring such websites throughout the semester.

Do not use AI tools such as ChatGPT to complete the homework. If you are stuck, you have several other options:

•Ask instructor, TA or fellow student using the discussion forum.

•Go to office hours.

•Send an email to the instructor.

•Review the content in the textbook.

**Title IX Statement**

In accordance with Title IX of the Education Amendments of 1972 that prohibits gender-based discrimination in educational settings that receive federal funds, the University of Massachusetts Amherst is committed to providing a safe learning environment for all students, free from all forms of discrimination, including sexual assault, sexual harassment, domestic violence, dating violence, stalking, and retaliation. This includes interactions in person or online through digital platforms and social media. Title IX also protects against discrimination on the basis of pregnancy, childbirth, false pregnancy, miscarriage, abortion, or related conditions, including recovery. There are resources here on campus to support you. A summary of the available Title IX resources (confidential and non-confidential) can be found at the following link: https://www.umass.edu/titleix/resources. You do not need to make a formal report to access them. If you need immediate support, you are not alone. Free and confidential support is available 24 hours a day / 7 days a week / 365 days a year at the SASA Hotline 413-545-0800.   
  
TENTATIVE COURSE SCHEDULE

|  |  |  |  |
| --- | --- | --- | --- |
| **Weeks** | **Dates** | **Cover at least** | **Exam dates** |
| Week 1 | 3-Sep | 1.1, 1.2 |  |
| Week 2 | 10-Sep | 1.3, 1.4 |  |
| Week 3 | 17-Sep | 1.5, 1.7 |  |
| Week 4 | 24-Sep | 1.8, 1.9 |  |
| Week 5 | 1-Oct | 1.6/1.10, 2.1 | **Exam 1-Thurs-Oct 3** |
| Week 6 | 8-Oct | 2.2, 2.3, 3.1 | (7:00pm-9:00pm ET) |
| Week 7 | 15-Oct | 3.2, 3.3 | Covers 1.1-1.10 |
| Week 8 | 22-Oct | 4.1, 4.2, 4.3 |  |
| Week 9 | 29-Oct | 4.3, 4.4, 4.5 | **Exam 2 -Wed-Oct 30** |
| Week 10 | 5-Nov | 4.5, 4.6, 5.1 | (7:00pm-9:00pm ET) |
| Week 11 | 12-Nov | 5.1, 5.2 | Covers 2.1-4.3 |
| Week 12 | 19-Nov | 5.3, 5.5 |  |
| Week 13 | 26-Nov | 6.1, Thanksgiving |  |
| Week 14 | 3-Dec | 6.2, 6.3 |  |
| Week 15 | 10-Dec | 6.4, | **Final Exam (TBD on Spire)** |
|  |  |  | Covers 4.4-6.4 |