

Linear Equations

Syllabus

Instructor

Instructor: Dr. Greg Mayer

Course Description

This course takes you through the first three weeks of MATH 1554, Linear Algebra, as taught in the School of Mathematics at The Georgia Institute of Technology.

Systems of equations live at the heart of linear algebra. In this course you will explore fundamental concepts by exploring definitions and theorems that give a basis for this subject. At the start of this course we introduce systems of linear equations and a systematic method for solving them. This algorithm will be used for computations throughout the course as you investigate applications of linear algebra and more complex algorithms for analyzing them.

Later in this course you will later see how a system of linear equations can be represented in other ways, which can reduce problems involving linear combinations of vectors to approaches that involve systems of linear equations. Towards the end of the course we explore linear independence and linear transformations. They have an essential role throughout our course and in applications of linear algebra to many areas of industry, science, and engineering.

Course Learning Outcomes

- Evaluate mathematical expressions to compute quantities that deal with linear systems
- Characterize a linear system in terms of the number of solutions, and whether the system is consistent or inconsistent.
- Apply elementary row operations to solve linear systems of equations.
- Characterize a set of vectors in terms of linear combinations, their span, and how they are related to each other geometrically
- Characterize a set of vectors and linear systems using the concept of linear independence.
- Construct dependence relations between linearly dependent vectors.
- Identify and construct linear transformations of a matrix.
- Characterize linear transformations as onto and/or one-to-one.

Topics Covered

- Systems of Linear Equations
- Row Reduction and Echelon Forms
- Vector Equations
- The Matrix Equation
- Solution Sets of Linear Systems
- Linear Independence
- Linear Transforms

Grades

Final grades are calculated using the following grade weighting.

Module 1 Quiz	20%
Module 2 Quiz	20%
Module 3 Quiz	20%
Final Exam	40%

A passing grade is 70% and above.

Attendance Policy

- This is a fully online course.
- Log in on a regular basis to complete your work, so that you do not have to spend a lot of time reviewing and refreshing yourself regarding the content.

Plagiarism Policy

Plagiarism is considered a serious offense. You are not allowed to copy and paste or submit materials created or published by others, as if you created the materials. All materials submitted and posted must be your own. Any background materials you use should be cited.

Quizzes and Test Procedures

The purpose of the Module Quizzes to help students gain a deeper understanding of course concepts, and help students become more aware of their level of understanding of course material. Solutions to Module Quizzes will be provided to students.

The Final Exam is a summative assessment: the purpose of the Final Exam is to help students become more aware of their level of understanding of course material, and to assess student learning.

Students will have unlimited attempts to take each quiz. Students will have 30-minutes to take each quiz each time they start an attempt. Students will have 60 minutes to take the Final Exam after they have started it, and will have unlimited attempts.

Student Honor Code

All Audit and Verified learners are expected and required to abide by the letter and the spirit of the edX honor code.

- Ethical behavior is extremely important in all facets of life.
- Review the edX Honor Code <https://www.edx.org/edx-terms-service>
- You are responsible for completing your own work.
- Any learners suspected of behavior in violation of the Honor Code will be subject to any/all of the actions listed in the edX Honor Code.

Communication

All learners should ask questions, and answer their fellow learners' questions, on the course discussion forums. Often, discussions with fellow learners are the sources of key pieces of learning.

Netiquette

Netiquette refers to etiquette that is used when communicating on the Internet. When you are communicating via email, discussion forums or synchronously (real-time), please use correct spelling, punctuation and grammar consistent with the academic environment and scholarship.

We expect all participants (learners, faculty, teaching assistants, staff) to interact respectfully. Learners who do not adhere to this guideline may be removed from the course.

Course Schedule

Module	Topic	Lesson
Module 1: Linear Systems and Span	Topic 1: Systems of Linear Equations	Lesson 1: Solutions Sets of Linear Equations
		Lesson 2: Consistent Systems
	Topic 2: Row Reduction and Echelon Forms	Lesson 1: Echelon Form and RREF
		Lesson 2: The Row Reduction Algorithm
		Lesson 3: Existence and Uniqueness
	Topic 3: Vector Equations	Lesson 1: Vectors in \mathbb{R}^n
		Lesson 2: Linear Combinations
		Lesson 3: Span

Module	Topic	Lesson
Module 2: Solution Sets and Linear Independence	Topic 1: The Matrix Equation	Lesson 1: The Matrix Vector Product
		Lesson 2: Existence of Solutions
	Topic 2: Solution Sets of Linear Systems	Lesson 1: Homogeneous systems
		Lesson 2: Parametric vector forms
	Topic 3: Linear Independence	Lesson 1: A Definition of Linear Independence
		Lesson 2: Linear independence Theorems
Module 3: Linear Transforms	Topic 1: An Introduction to Linear Transforms	Lesson 1: Domain, Codomain, Range
		Lesson 2: Geometric Interpretations of Linear Transforms
	Topic 2: Linear Transforms	Lesson 1: Standard Vectors
		Lesson 2: Standard Matrices of Linear Transforms
		Lesson 3: Onto and One-to-one

Course Materials

- All content and course materials can be accessed online
- There is no required textbook but students may find the following textbook a helpful companion to the course: Interactive Linear Algebra, by D. Margalit and J. Rabinoff. The textbook is available as a downloadable PDF in the course.

Technology/Software Requirements

- Internet connection (DSL, LAN, or cable connection desirable)
- Adobe Acrobat PDF reader (free download; see <https://get.adobe.com/reader/>)