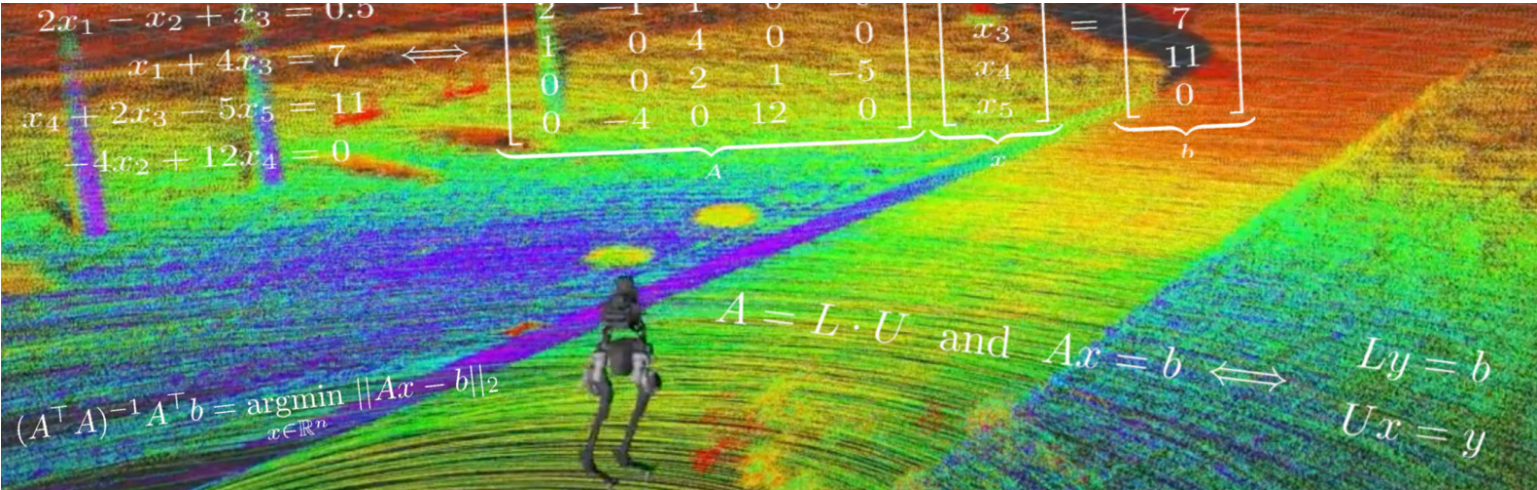


Course Syllabus

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SYLLABUS - MATH 210.002 - FALL 2025

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

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SCHEDULE

Week	Dates	Textbok Sections	Topic	Quizzes and Tests
1	Aug 18 - 22	• Hartman1.1	• Systems of linear equations • Solving systems of linear	

		Hartman1.2	equations	
2	Aug 25 - 29	- Hartman1.3 - Hartman1.4	- Reduced Row Echelon Form and Gaussian elimination - Existence and uniqueness of solutions	
3	(no class Sep 1) Sep 3 - 5	- Hartman2.1 - Hartman2.2	- Matrix addition and scalar multiplication - Matrix multiplication	
4	Sep 8 - 12	- Hartman2.3 - Hartman2.4 - Hartman2.5	- Vectors - Vector equations - Matrix equations	
5	(no class Sep 15) Sep 17 - 19	- Hartman2.6 - Hartman2.7 - Hartman3.1	- Matrix Inverses - Properties of inverses	
6	Sep 22 - 26		- Transpose - Catch up and Review - Test 1	Test 1 (Sep 26)
7	Sep 29 - Oct 3	- Hartman3.2 - Hartman3.3 - Hartman3.4	- Trace - Determinants - Properties of determinants	

8	Oct 6 - 10	- Hartman2.3Bonus - Hartman4.1	- Linear transformations - Eigenvalues and eigenvectors	
9	Oct 13 - 15 (no class Oct 17)	- Hartman4.2 - Holt6.2 - Holt8.1	- Properties of eigenvalues - Diagonalization	
10	Oct 20 - 24	- Holt8.1 - Holt8.3	- Dot products and orthogonal vectors - Orthogonal matrices and symmetric matrices - Catch up and review - Test 2	Test 2 (Oct 24)
11	Oct 27 - 31	- Holt2.3 - Holt8.2 - Holt8.4	- Linearly independent vectors - Gram-Schmidt orthogonalization - Singular value decomposition	
12	Nov 3 - Nov 7	Holt8.4	- Singular value decomposition - SVD applications: Image compression and principal component analysis	
13	Nov 10 - 14		- Introduction to derivatives - Calculating derivatives of polynomials and exponential functions - Level Curves - Partial Derivatives	

14	Nov 17 - 21		• Catch up and review • Test 3 • Gradient	Test 3 (Nov 19)
15	Nov 24 (Nov 26-28 Thanksgiving)		• Max and Min Values and Gradient Descent	
16	Dec 1-3		• Neural networks • Catch up and review	
Final Exam	Dec 5 (12-3 PM)			Final Exam

OVERVIEW

Course Description

Math 210 introduces students to the tools of linear algebra and optimization, including solving linear systems, matrices as linear transformations, eigenvalues and eigenvectors, approximations, derivatives, and optimization in multiple dimensions. This course emphasizes multidimensional thinking and applications to data science. Python will be used as a computational tool.

Target Audience

This course is intended for data science minors and for students who want to learn linear algebra and optimization techniques for application to economics or other quantitative fields. Students who have already taken Math 347 or Math 577 should not take this class due to the substantial overlap.

Prerequisites

Students are expected to be proficient working with functions and their graphs, manipulating variable expressions, and solving equations using algebra, as demonstrated by Math 110 or Math 110P credit.

Learning Outcomes

This course will enable students to:

1. Perform operations on matrices
2. Use matrices to solve problems
3. Describe how matrices are used to simplify data and compress images
4. Calculate and interpret derivatives
5. Use derivatives to maximize or minimize quantities and to train neural networks

Course topics

This list is tentative and may be changed. Any changes will be announced in class and posted on Sakai.

1. Systems of linear equations and matrices
2. Elementary row operations and Gaussian elimination
3. Existence and uniqueness of solutions
4. Matrix operations (addition, scalar multiplication, multiplication)
5. Vectors
6. Solving matrix equations
7. Inverses of matrices
8. Transpose, trace, and determinant
9. Eigenvalues and eigenvectors
10. Diagonalizing matrices
11. Dot product and orthogonality
12. Symmetric matrices
13. Linear independence
14. Gram-Schmidt orthogonalization
15. Singular value decomposition
16. Derivatives
17. Optimization
18. Partial derivatives
19. Gradient and gradient descent

20. Neural networks

IDEAS in Action Learning Outcomes

This course satisfies the Quantitative Reasoning requirement, and the following IDEAS in Action student learning outcomes:

- Summarize, interpret, and present quantitative data in mathematical forms, such as graphs, diagrams, tables, or mathematical text.
- Develop or compute representations of data using mathematical forms or equations as models, and use statistical methods to assess their validity.
- Make and evaluate important assumptions in the estimation, modeling, and analysis of data, and recognize the limitations of the results.
- Apply mathematical concepts, data, procedures, and solutions to make judgments and draw conclusions.
- Synthesize and present quantitative data to others to explain findings or to provide quantitative evidence in support of a position.

Course Structure

Class meets MWF 9:05 - 9:55 in Phillips Hall room 228. Class activities will include interactive lecture and problem solving in small groups.

Students are expected to prepare for each class by reading assigned sections from pre-lecture notes and completing before class assignments. Homework assignments will be due three times a week. There will be three midterms and a final exam.

Instructional Staff

Instructor

Saiful Tamim [stamim@unc.edu
(<mailto:stamim@unc.edu>)]



MATERIALS

Textbooks

We will use the following textbooks:

1. ***Fundamentals of Matrix Algebra*** [↗](https://open.umn.edu/opentextbooks/textbooks/fundamentals-of-matrix-algebra) (<https://open.umn.edu/opentextbooks/textbooks/fundamentals-of-matrix-algebra>) by G. Hartman, ISBN: 978-1467901598 (required - pdf is free, hard copy is ~\$10 from Amazon)
2. ***Linear Algebra with Applications*** [↗](https://www.amazon.com/Linear-Algebra-Applications-Jeffrey-Holt-dp-1464193347/dp/1464193347/ref=dp_ob_title_bk) (https://www.amazon.com/Linear-Algebra-Applications-Jeffrey-Holt-dp-1464193347/dp/1464193347/ref=dp_ob_title_bk) by J. Holt, ISBN: 978-1464193347 (recommended as a reference)
3. ***Applied Calculus*** [↗](https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_(Calaway_Hoffman_and_Lippman)) ([https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_\(Calaway_Hoffman_and_Lippman\)](https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_(Calaway_Hoffman_and_Lippman))) by S. Calaway, D. Hoffman, and D. Lippman (recommended as a reference, [online version](https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_(Calaway_Hoffman_and_Lippman)) [↗](https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_(Calaway_Hoffman_and_Lippman)) ([https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_\(Calaway_Hoffman_and_Lippman\)](https://math.libretexts.org/Bookshelves/Calculus/Applied_Calculus_(Calaway_Hoffman_and_Lippman))) and [pdf](https://www.opentextbookstore.com/details.php?id=14) [↗](https://www.opentextbookstore.com/details.php?id=14) (<https://www.opentextbookstore.com/details.php?id=14>) are free)

Edfinity

Homework and before class assignments will be on Edfinity. Please use the link at left to access Edfinity via Canvas. Once you have accessed it via Canvas once, you can also go to edfinity.com directly. There is a \$29 fee for Edfinity.

Gradescope

Tests will be given on paper and graded via Gradescope. You should be able to access Gradescope from the tab at the left of Canvas. There is no charge for using Gradescope.

Colab

We will use **Google Colab notebooks** [↗](https://colab.research.google.com/notebooks/intro.ipynb#) (<https://colab.research.google.com/notebooks/intro.ipynb#>) with Python to supplement by-hand computations. Colab is free and integrated with Google docs. You may need a gmail account to use it. No prior experience with Colab, Python, or any other programming language is expected.

Colab documents from class will be available at tinyurl.com/math210Tamim [↗](https://tinyurl.com/math210Tamim) (<https://tinyurl.com/math210Tamim>)

Piazza

Instead of emailing the instructor with questions about homework problems or logistics, please post your questions on Piazza. Other students and the instructor can answer them there for the benefit of all students. If you were not automatically added to Piazza, you can register yourself here:

<https://piazza.com/unc/spring2025/math210> ➞ <https://piazza.com/unc/spring2025/math210>. There is no charge for using Piazza.

Calculators

For homework and some classwork, you will need a basic scientific calculator or a graphing calculator or a calculator app. Basic and scientific calculators are allowed on tests.

ASSIGNMENTS AND EXAMS

The following components of this course will contribute to your grade.

Before Class Assignments

For most classes, there are one or two before class assignment on Edfinity, due at the start of class on Mondays, Wednesdays, and Fridays. Instructions on what to do before class are posted on Canvas > Modules. Your lowest two before class assignment grades will be dropped.

Homework

Most homework assignments will be on Edfinity. Homework will be due three times a week: on Sundays, Tuesdays, and Thursdays at 11:59 pm. Normally, assignments on topics discussed in class on Monday will be due on Thursday, topics discussed on Wednesday will be due on Sunday, topics discussed on Friday will be due on Tuesday. Occasionally, more than one assignment may be due on the same day. Due dates can be found on Edfinity.

Your lowest homework score will be dropped if at least 80% complete the end of semester course evaluation.

Participation

Attendance and participation in class will be measured using one of the following methods: an attendance sheet, a check-in app, or PollEverywhere questions. Your lowest 4 scores will be dropped.

Tests

There will be three tests given in class. Your lowest test grade will be replaced by your final exam grade, if your final exam grade is higher.

Tentative test dates are as follows:

- Test 1: 9/26/2025
- Test 2: 10/24/2025
- Test 3: 11/19/2025

Final Exam

The cumulative final exam will be on **Friday, December 5 from 12 - 3 pm** in accordance with UNC's final exam schedule. The final exam is given in compliance with UNC's final exam regulations and calendar, and will not be given prior to this exam date. In order to take the make-up exam after this date, you must have an official examination excuse from the Dean or authorized agent of the Dean (in Steele Building).

GRADES

Assignment	Percentage of Final Grade
Class Performance	5%
Homework	20%
Before Class Assignments	5%
Tests	45%
Final Exam	25%

Grading Scale

Percentages will be converted to letter grades according to the following scale.

Letter Grade	Percentage
A	93–100%
A-	90–92%
B+	87–89%
B	83–86%
B-	80–82%
C+	77–79%
C	73–76%
C-	70–72%
D+	67–69%
D	60–66%
F	0–59%

Final Grading schemes are subject to change without prior notice at the sole discretion of the instructor. Posted final grades will be final and no regrading requests are accepted.

COURSE POLICIES

Communication

Please post questions about homework and class logistics on Piazza.

If you have a private question, specific to your individual circumstances, you can post privately on Piazza or send the instructor an email. If the instructor does not respond to an email or private message within 48 hours, please send a second message.

If you need to have a private conversation, not appropriate for a public office hours setting, please book an appointment by email to the instructor.

Illness

Please do not attend class if you are sick and notify the instructor. Please consult the filled in notes posted after class to see what you miss.

Late Work and Make-up Work

No make-up tests will be given. Tests can be given early if the student will be absent for university athletics, an academic field trip, or a religious holiday and makes prior arrangements with written documentation at least a week in advance. Exceptions may be made in extreme circumstances with intervention from the Dean of Students. The lowest test score will be replaced by the final exam score, so one missed test will not affect your grade.

Homework on Edfinity will be accepted up to 3 days late for a 25% penalty.

Honor Code

It is expected that each student in this class will conduct themselves within the guidelines of the UNC Honor System, described at <https://catalog.unc.edu/policies-procedures/honor-code/>  (<https://catalog.unc.edu/policies-procedures/honor-code/>).

On homework, before class assignments, and in-class worksheets, students are encouraged to work together in pairs or small groups, provided that all participants are contributing and the collaboration benefits the learning of all involved. Simply copying or trading answers is an instance of cheating. Homework are open book and open notes, and calculators and computer apps are permitted.

Tests and the final exam are closed book and closed notes unless otherwise specified. Calculators are permitted unless otherwise specified. It is an instance of cheating to give or receive help on a test or exam, except from the instructor.

If you are not sure what is permitted on any assignment, please ask!

In addition to avoiding actual academic dishonesty, please avoid appearances of academic dishonesty. In particular, please silence and put away cell phones before any exams are handed out, please avoid the appearance of looking at other students' papers. In order to maintain a proper testing atmosphere, the instructor may ask students to switch seats before or during an in-person exam.

Students who observe a violation of the honor code should report it to the instructor. The instructor will report any suspected honor code violations to the Honor Court.

Artificial Intelligence Use Policy

The following uses of generative AI tools are permitted in this course: helping write Python code, generating problems to study for tests, checking answers to homework (with a critical eye, since AI makes mistakes!). Please do not use AI to do your homework, since that will rob you of the practice you need to learn the material.

HELP WITH THIS COURSE

There are several ways to get help for this class.

Office Hours

- Instructor office hours at PH 344: TBD

Tutoring

- The math department offers free in-person and online tutoring at the [Math Help Center](https://math.unc.edu/undergraduate/resources)  (<https://math.unc.edu/undergraduate/resources>), M - F and possibly weekends.
- The Learning Center sponsors free peer tutoring. See <https://learningcenter.unc.edu/services/peer-tutoring>  (<https://learningcenter.unc.edu/services/peer-tutoring>).
- The math department maintains a [tutor list](https://math.unc.edu/undergraduate/resources)  (<https://math.unc.edu/undergraduate/resources>) of math grad students offering paid private tutoring.

Other Resources

- Dr. Linda Green has a very useful playlist of videos discussing the materials in this course: [Linear algebra playlist](https://youtube.com/playlist?list=PLAEgL_CQRjwQq9-V0rcnC5Q_tA42eVYZ1&si=NIhacOyxO8wcZj7)  (https://youtube.com/playlist?list=PLAEgL_CQRjwQq9-V0rcnC5Q_tA42eVYZ1&si=NIhacOyxO8wcZj7) (recommended, not required).
- A nice visual guide to the basic concepts of linear algebra: [Essence of Linear Algebra - 3Blue1Brown](https://youtube.com/playlist?list=PLZHQObOWTQDPD3MizzM2xVFitgF8hE_ab&si=1_ay4zCrQ5ZNsqg3)  (https://youtube.com/playlist?list=PLZHQObOWTQDPD3MizzM2xVFitgF8hE_ab&si=1_ay4zCrQ5ZNsqg3).
- The Learning Center has a math coach who can give you tips on how to study for and succeed in a math class - you can make an appointment here: <https://learningcenter.unc.edu/services/stem/academic-coaching> 

(<https://learningcenter.unc.edu/services/stem/academic-coaching/>). ➞

(<https://math.unc.edu/undergraduate/resources/>)

UNC POLICIES AND SERVICES

UNC Attendance Policy

As stated in the University's [Class Attendance Policy](https://catalog.unc.edu/policies-procedures/attendance-grading-examination/#text) ➞ (<https://catalog.unc.edu/policies-procedures/attendance-grading-examination/#text>), no right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:

1. Authorized University activities: [University Approved Absence Office \(UAAO\)](https://uaao.unc.edu/) ➞ (<https://uaao.unc.edu/>) website provides information and [FAQs for students](https://uaao.unc.edu/faqs-for-students/) ➞ (<https://uaao.unc.edu/faqs-for-students/>) and [FAQs for faculty](https://uaao.unc.edu/faqs-for-faculty/) ➞ (<https://uaao.unc.edu/faqs-for-faculty/>) related to University Approved Absences
2. Disability/religious observance/pregnancy, as required by law and approved by the [Equal Opportunity and Compliance Office](https://eoc.unc.edu/what-we-do/accommodations/) ➞ (<https://eoc.unc.edu/what-we-do/accommodations/>) (EOC)
3. Significant health condition and/or personal/family emergency as approved by the [Office of the Dean of Students](https://odos.unc.edu/) ➞ (<https://odos.unc.edu/>), [Gender Violence Service Coordinators](https://gvsc.unc.edu/) ➞ (<https://gvsc.unc.edu/>), and/or the [Equal Opportunity and Compliance Office](https://eoc.unc.edu/what-we-do/accommodations/) ➞ (<https://eoc.unc.edu/what-we-do/accommodations/>) (EOC).

Instructors may work with students to meet attendance needs that do not fall within University approved absences. For situations when an absence is not University approved (e.g., a job interview, illness/flu, or club activity), instructors are encouraged to work directly with students to determine the best approach to missed classes and make-up assessment and assignments.

Code of Conduct

All students are expected to adhere to University policy and follow the guidelines of the UNC Code of Conduct. Additional information can be found at studentconduct.unc.edu ➞ (<https://studentconduct.unc.edu/>).

UNC Syllabus Change Policy

The instructor reserves the right to make changes to the syllabus including project due dates and test

dates. These changes will be announced as early as possible.

Equal Opportunity and Compliance - Accommodations

Equal Opportunity and Compliance Accommodations Team ([Accommodations - UNC Equal Opportunity and Compliance](#)) [↗\(https://eoc.unc.edu/accommodations\)](https://eoc.unc.edu/accommodations) receives requests for accommodations for disability, pregnancy and related conditions, and sincerely held religious beliefs and practices through the University's Policy on Accommodations. EOC Accommodations team determines eligibility and reasonable accommodations consistent with state and federal laws.

Accessibility Resources and Services

[Accessibility Resources and Service](#) [↗\(https://ars.unc.edu\)](https://ars.unc.edu) (ARS – ars@unc.edu (<mailto:ars@unc.edu>)) receives requests for accommodations, and through the Student and Applicant Accommodations Policy determines eligibility and identifies reasonable accommodations for students with disabilities and/or chronic medical conditions to mitigate or remove the barriers experienced in accessing University courses, programs and activities.

ARS also offers its Testing Center resources to students and instructors to facilitate the implementation of testing accommodations.

Counseling and Psychological Services (CAPS)

UNC-Chapel Hill is strongly committed to addressing the mental health needs of a diverse student body. The [Heels Care Network](#) [↗\(http://care.unc.edu\)](http://care.unc.edu) website is a place to access the many mental health resources at Carolina. CAPS is the primary mental health provider for students, offering timely access to consultation and connection to clinically appropriate services. Go to the [CAPS website](#) [↗\(https://caps.unc.edu/\)](https://caps.unc.edu/) or visit their facilities on the third floor of the Campus Health building for an initial evaluation to learn more. Students can also call CAPS 24/7 at 919-966-3658 for immediate assistance.

Title IX Resources

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made [online to the EOC](#) [↗\(https://eoc.unc.edu/report-an-incident/\)](https://eoc.unc.edu/report-an-incident/) or by contacting the [University's Title IX Coordinator](#) (<mailto:%20titleixcoordinator@unc.edu>), Elizabeth Hall, or the [Report and Response Coordinators](#) (<mailto:reportandresponse@unc.edu>) in the Equal

Opportunity and Compliance Office. Please note that I am designated as a Responsible Employee, which means I must report to the EOC any information I receive about the forms of misconduct listed in this paragraph. If you'd like to speak with a confidential resource, those include Counseling and Psychological Services and the [Gender Violence Services Coordinators \(mailto:gvsc@unc.edu\)](mailto:gvsc@unc.edu). Additional resources are available at safe.unc.edu  (<https://safe.unc.edu/>).