MAT240H1 F: Algebra 1
Fall 2024
University of Toronto

I. Instructor and Teaching Assistants

Course Instructor
Name: Mathilde Gerbelli-Gauthier
Email: m.gerbelli@utoronto.ca
Office Hours: Tuesdays 2-3PM, online.

Email Policy
Please reserve email communication for personal, individual issues such as illness or emergencies significantly impacting your performance in the course. Otherwise, use our discussion forum on Piazza, described in Resources for this Class below. If you do use email, please have a look at this video (and replace "McGill" by "UofT" in all the advice.) In particular, all communications with the Course Instructor or TA's must be sent from your official utoronto email address, with the course number included in the subject line.

TA(s)
Name: Kevin Watmough
Email: kevin.watmough@mail.utoronto.ca
Office Hours: TBD

Name: Yukai Zhang
Email: yukai.zhang@mail.utoronto.ca
Office Hours: TBD

Name: Yiming Tang
Email: ytang@math.utoronto.ca
Office Hours: TBD

Name: Ivan Ovchinnikov
Email: i.ovchinnikov@mail.utoronto.ca
Office Hours: TBD

Name: Howard Xiao
Email: howard.xiao@mail.utoronto.ca
Office Hours: TBD

I. Course Overview

Course Description
This course is an introduction to linear algebra, designed for students with a serious interest in mathematics. It emphasizes the conceptual structure of the subject, building up from basic axioms through proofs, while also covering some computational techniques.

Prerequisite: High school level calculus
Corequisite: MAT157Y1

Course Objectives
- Understand and describe the properties of, and relationships between, the basic objects of linear algebra, formulated in a modern abstract way, including vector spaces and their subspaces, linear transformations, and determinants.
- Write proofs and express mathematical ideas in modern mathematical language.

In order to do well in this class, you need to spend focused time with the material and you need to practice. In addition to the 3 hours of lectures, you should be spending at least 4-5 hours a week thinking about the material, reading the suggested texts, and meditating upon the nature of n-dimensional space. You will spend a lot of time with this material and there will be growing pains, but in my experience it's also extremely rewarding.

Textbooks/ Course Readings

Friedberg, Insel and Spence, *Linear Algebra*, 4th or 5th edition, Prentice Hall. We will cover chapters 1-4.

Linear algebra is a very standardized topic; buying the textbook is not strictly necessary. With the guidance given in class, a student could use any of the following alternative references to learn the material:

- Linear Algebra, by Hoffman and Kunze
- Linear Algebra done right, by Axler
- Linear Algebra done Wrong, by Treil
- Introduction to Linear Algebra, by Lang
- Linear Algebra and Its Applications, by Strang

How this course is organized:
This course will consist of: three weekly hours of lecture Tuesday 11:10am-1pm and Thursday 12:10pm-1pm and a weekly tutorial.

Assignments will be due on Friday at 5pm, and cover the material of the previous week. They will be handed in and graded on Gradescope. No late assignment will be accepted—please leave yourself ample time to upload the assignment!

Every week, I will post the topics of the week, as well as the reading and assignment.

Additionally to gradescope, we will use Quercus for course organization, assigned readings, etc, and Piazza (integrated with Quercus) for discussions.

Resources for this class

Tutorials: **Tutorials will begin the week of September 9th**. In tutorials, you will review the material from class and solve problems. These are an integral part of the class and your occasion to interact with the material in a small(er) group. Since this class is gigantic and you are learning a new language, it is essential to attend your tutorial. Please try to attend the tutorial for which you are registered. If you can't attend your own tutorial on a given week and you want to go to another tutorial, that's ok, but please do this within the limits of reason (for example, give priority for seating to people registered in this tutorial).

Office hours: These are a venue for you to ask questions related to the course material. Please take advantage of them. You don't need to make an appointment, just show up! The instructor or TA has blocked off the time in their schedule to be there for you.

Piazza discussion forum: This is another place to ask questions about the course material and help each other. The TA's will monitor the Piazza, but they can't answer all questions. If you think you know the answer to a question, go for it and answer! Explaining the material to others is a wonderful way to learn mathematics. It's also the place to ask questions about the course logistics. In order to not cause confusion, please only answer those questions if you're 100% sure of the answer. The instructional staff will answer them.

Each other: Beyond the discussion forum, you all are a great resource for each other! We strongly encourage you to form study groups and work together for this class. We simply ask you to remember two things: (1) stay cordial and respectful with one another when you are working together, and (2) all submitted work should be written up individually. A good way to do this is to figure out the ideas for a solution with your classmates and write down some notes for yourself, and then be alone when you write out the full solution.

Technical Requirements

In order to participate in this course, students will need to have equipment sufficient to upload their assignments to Gradescope with good enough quality to be graded.

If you are facing financial hardship, you are encouraged to contact your college or divisional registrar (https://future.utoronto.ca/current-students/registrars/) to apply for an emergency bursary.

II. Evaluation/ Grading Scheme

Assignments

There will be 10 assignments, each with 10 points. We will try to grade all questions on each assignment. Your total assignment grade will be calculated using the following grading scheme: if you accumulate n points, your grade will be the maximum of 100 and $n/0.8=(n/80)*100$. We chose this grading scheme over "dropping the two lowest assignments" because it is even more flexible, and because this class rewards putting in work every week.

Term Test
There will be two term tests, 1 hour each.

Test 1 will be on ***Thursday, October 3rd, 12:10-1PM (during class time), location TBA.***
Test 2 will be on ***Thursday, November 7th, 12:10-1PM (during class time), location TBA.***

Final Exam
The final assessment will be held during the final assessment period in December 2024 and will be scheduled by the registrar.

Mark Breakdown
The grading scheme will be the maximum of the following two grading schemes, where **a** stand for your grade on assignments, t_1 and t_2 are the grades of the respective term tests, and **f** is your grade on the final.

- $0.20a + 0.225t_1 + 0.225t_2 + 0.35f$
- $0.20a + 0.25\max(t_1, t_2) + 0.10\min(t_1, t_2) + 0.45f$

You don't have to request a grading scheme: we will automatically assign you the highest of the two grades. Note that the first grading scheme is meant to reduce the pressure of the final exam, and that the second is useful if you "bomb" one of the term tests. *If you are found guilty of academic dishonesty on one of the midterms, the second grading scheme will not be available to you and we will use the first one.*

III. Course Policies

Policy on Missed Term Work

No extensions will be given on homework. That's why have a flexible grading scheme!

Students who are absent from class for prolonged periods and who require consideration for missed academic work *should contact the instructor and verify their absence(s) through either the Absence Declaration tool, Verification of Illness or Injury (VOI) form, College Registrar Letter, or Letter of Academic Accommodation from Accessibility Services, as appropriate to their situation*.
https://www.artsci.utoronto.ca/current/academics/student-absences

The absence declaration can be used once per term. Outside of the one time absence declaration use, students must adhere to the alternate processes for absences listed above, as well as the missed work policy as set out in each course's syllabus.

If you miss a term test or the final assessment, then you must inform your course Instructor within 72 hours of the test. No exceptions. If your request is approved, you may receive an accommodation. The accommodation to be used will be decided by your instructor. Some examples of accommodations may include: an oral exam, written make-up test, or a re-weighting of your assessments.

Re-marking Policy
A student who believes an individual item of work has been incorrectly or unfairly marked may ask the person who marked it for a re-evaluation. For exams, this will be done through an online form, made available after grades are returned and open for a week. For homework, with evidence to back their appeal,

students should make such requests as soon as reasonably possible after receiving the work back, but no later than 2 weeks after it was returned.

Plagiarism Detection Tool
A plagiarism detection tool may be used for detecting plagiarism in some of the written work submitted in this course. Normally, students will be required to submit their written work to the university's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their work to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the this tool's service are described on the Centre for Teaching Support and Innovation web site: https://teaching.utoronto.ca/resources/plagiarism-detection/

Etiquette/Participation
This is a large class, but the team will attempt to make it as interactive as possible, including opportunities to ask and answer questions, to solve problems in class, and to share your thoughts with your classmates. In tutorials, you will be given even more opportunities to interact with the material in a hands-on way. It is expected that you will always remain respectful in your interactions with your classmates and the instruction staff, listen to the ideas of others, and provide constructive criticism when appropriate.

Land Acknowledgement
We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

IV. Institutional Policies and Support

Academic Integrity
All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters (https://governingcouncil.utoronto.ca/secretariat/policies/codebehaviour-academic-matters-july-1-2019). If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to your Course Instructor. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the University of Toronto website on Academic Integrity http://academicintegrity.utoronto.ca/). *(Academic Handbook Section 12 Academic Integrity)*

Accessibility
The University provides academic accommodations for students with disabilities in accordance with the terms of the Ontario Human Rights Code. This occurs through a collaborative process that acknowledges a collective obligation to develop an accessible learning environment that both meets the needs of students and preserves the essential academic requirements of the University's courses and programs.
Students with diverse learning styles and needs are welcome in this course. If you have a disability that may require accommodations, please feel free to approach your Course Instructor and/or the Accessibility Services office as soon as possible. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Link to Accessibility Services website: https://studentlife.utoronto.ca/department/accessibility-services/

Equity, Diversity and Inclusion
The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

Other Academic and Personal Supports

- Writing Centre https://writing.utoronto.ca/writing-centres/arts-and-science/
- U of T Libraries https://onesearch.library.utoronto.ca/
- Student Code of Conduct: https://governingcouncil.utoronto.ca/secretariat/policies/code-studentconduct-december-13-2019
- Feeling Distressed? https://studentlife.utoronto.ca/task/support-when-you-feel-distressed/
- Academic Success Centre https://studentlife.utoronto.ca/department/academic-success/
- College/Faculty Registrars https://future.utoronto.ca/current-students/registrars/

V. Tentative Schedule of Lectures

Date		Topic	Reading
September 3		Syllabus + Course Mechanics Sets and Maps	Appendices A-B
September 5		Fields, complex numbers, modular arithmetic.	Appendicx C
September 10		Finite fields	Notes on Finite Fields
September 12		Vector spaces	1.1-1.2
September 17		Vector spaces + subspaces	1.3-1.4
September 19		Linear relations + dependence	1.4-1.5
September 24		Bases and dimension, (max LL subset, if time)	1.6-1.7
September 26		Review	
October 1		Linear transformations	2.1

October 3		Midterm 1	
October 8		Matrix of a linear transformation.	2.2
October 10		Composition	2.3
October 15		Invertibility and Isomorphisms	2.4
October 17		Dual Spaces	2.6
October 22		Change of basis	2.5
October 24		Review	
READING WEEK			
November 5		Elementary matrices	3.1
November 7		Midterm 2	
November 12		Rank and Inverse	3.2
November 14		2x2 Determinants	4.1
November 19		nxn Determinants	4.2
November 21		properties of the determinant	4.3
November 26		Characterization of the determinant	4.4
November 28		Review	