Syllabus Information. This document provides important information about course expectations and logistics, and serves as a contract between the students and teaching team of this course. Note that text which is *italicized and purple* links to sections in the document. Text which is underlined and blue links to an external site. This document includes:

1. *Course Information*: course description, learning outcomes, textbook, modality
2. *Assessment and Grading*: graded work descriptions, late submission policies, grade adjustment policy
3. *Course Sites*: required sites, optional resources
4. *Course Support*: tutorials, office hours, Piazza
5. *Email and Etiquette*: etiquette for sending email, guide for who to contact
6. *Teaching Team*: instructor list with bios and contact information, TA information
7. *Further Course Policies*: including regrade requests, absences and late work, calculator policy
8. *Additional Information*: land acknowledgment, diversity, accessibility, access to technology, resources

Course Information

Course Description. Linear algebra is the study of linear equations, vectors, vector spaces (which generalize "flat spaces" like lines and planes), and linear transformations (which are functions between vector spaces which preserve linearity). The beauty of linear algebra lies in the interplay between these objects: moving between algebraic and geometric perspectives allows us to leverage the strengths of one to deepen our understanding of another.

This course will focus on the fundamentals of linear algebra in Euclidean space. Focusing our study on Euclidean space allows the theory to develop naturally. We will use geometric intuition from familiar two- and three-dimensional settings to build "higher-dimensional" spaces by carrying forward formalized versions of properties we observe. In the next course, MAT224, you will take this abstraction further, removing the notion of vectors from Euclidean spaces entirely.

Learning Outcomes. By the end of the course, a successful student will be able to:

1. Use matrices, matrix arithmetic, matrix inverses, matrix decompositions, systems of linear equations, row reduction, determinants, and eigenvalues and eigenvectors to solve problems. As well, write vectors in different bases and pick an appropriate basis when working on problems.
2. Translate between algebraic and geometric viewpoints to solve problems.
3. Work independently on problem solving and also collaborate effectively with classmates, TAs, and instructors.
4. Clearly and correctly express the mathematical ideas of linear algebra to others, and understand and apply logical arguments and definitions that have been written by others.

Textbook. There is no textbook for this course. Instead, we will use the lectures notes: Linear Algebra in Euclidean Space, which will be updated as the course progresses. A list of alternate resources is available in the preface of the course lecture notes.

Modality. MAT223 will be taught via research-based teaching, learning, and assessment methods. Lecture sections will use a mixed modality of active learning techniques, including inquiry-based learning, as well as lecture-based presentation of material. This course heavily relies on student engagement in exercises during and outside of class. Please come to your lectures and tutorials prepared to be an active participant in the day's activity.

Assessment and Grading

There are **five** types of graded work you will be doing throughout the course, which are weighted accordingly:

- Chapter Activity Packets, submitted via Quercus (10%)
- Online Homework, submitted via Webwork (15%)
- Problem Set Quizzes (13%) and Peer Review Worksheets (2%), taken in tutorials
- One Term Test, taken in Week 8 of the semester (25%)
- Final Exam (35%)

Details and policies for each of these components are given below.

Chapter Activity Packets (10%). Each week, you will be assigned an activity packet related to the current week's material. The purpose of these packets is to facilitate active lectures, and to provide scaffolding for material that is assigned for self-study. These packets will also help prepare you for the "Section A" questions on the term test and final exam.

- Chapter Activity Packets are due on Quercus each Monday by 11:59pm, and will be graded **on completion only**. To receive full credit for a problem, you must demonstrate that you have honestly engaged with the problem. This can be done either by including a fully worked out solution, or by providing a clear outline to how you approached the problem and where you got stuck.
- We will spend time during lecture working on most of the activity packets together, but several problems may be left for you to complete as homework.
- You must complete your work directly on the Chapter Activity packet, either on a printed copy (in which case you will scan and upload your work to Quercus), or directly on the pdf of the assignment. Course instructors will provide printed copies of the activity packets for all students who request it. The print request form will be posted to Quercus during the first week of the course.
- Note that we will not be able to accommodate extensions to Chapter Activity Packet submissions. Instead, we will **drop your lowest three scores** to accommodate for any circumstances that may prevent you from submitting the assignment on time.

Online Homework (15%). The purpose of online homework is to give you practice solving new problems with the benefit of receiving immediate feedback on your performance. By doing this, you will solidify concepts learned during lecture and extend the depth of your understanding of course material. These assignments will also serve to prepare you for the "Section B" questions on the term test and final exam.

- Online homework will take place on Webwork, which can be accessed via your Quercus assignments.
- New assignments will open on Tuesday each week and will close at 11:59pm the following Monday.
- You are allowed infinite attempts at every problem.
- You may use any resource you need, but ultimately the work you submit must be your own. Note that Webwork assignments are one of the primary tools you have to prepare for exams. Relying too heavily on resources **will only harm your ability to perform on course exams**.
- Note that we will not be able to accommodate extensions to online homework assignments. Instead, we will **drop your lowest three scores** to accommodate for any circumstances that may prevent you from submitting the assignment on time.

Problem Set Quizzes (13%) and Peer Review Worksheets (2%). The purpose of the Problem Set Quizzes is to help you learn how to ACCURATELY COMMUNICATE MATHEMATICAL IDEAS, oftentimes through the mathematical proof. These assignments will also prepare you for the "Section C" questions on the term test and final exam.

- New problem sets will be posted on the course website.
- During tutorial every other week, **one problem** and **one definition** from the current problem set will be randomly selected for you to complete **without notes or any other resources**. You will have 30 minutes to complete the quiz, and it will be marked and returned to you in the following tutorial.
- The following week, you will be paired with a classmates to complete a peer review worksheet. You will be given time during tutorial to use your peer's feedback to improve your writing and submit a rewrite of your work. This may earn you up to one point back onto your previous week's problem set quiz. Your rewrite must be completed and submitted during the tutorial you complete the associated peer review worksheet.
- Students who earn 100% on a problem set quiz will not earn extra credit on the assignment, but are still required to complete the corresponding peer review worksheet.
- There will be no peer review rewrite opportunity for the Problem Set 5 tutorial quiz.
- If you are absent from the tutorial a problem set was given, you will have an opportunity to complete a late quiz submission in the following week's tutorial for reduced credit. Note that you will not be able to complete the associated peer review worksheet for that week, and will not be allowed a rewrite opportunity.
- Note that we will not be able to accommodate extensions or makeups on any Problem Set Quiz beyond what is offered above. Instead, we will **drop your lowest score**. That is, we will take your **best four** Problem Set Quiz scores out of the five available.
- We will not be able to accommodate extensions on the Peer Review Worksheets. Instead, we will **drop your lowest score**. That is, we will take your **best four** Peer Review Worksheet scores out of the five available.

Term Test (25%). The purpose of the term test is to give you FEEDBACK on your progress toward the course learning objectives, and to PREPARE you for the style and format of the final exam.

- The Term Test will take place during your scheduled lecture section on Tuesday or Wednesday in Week 8 (Oct 21 or Oct 22), and will cover material from Chapters 1 through 6 of the course lecture notes.
- You are not allowed calculators, notes, or any other devices on the term test.
- We will **replace your Term Test score with your Final Exam score** if it will positively impact your overall course grade.
- Note that there will be **no makeup term tests**. If you cannot attend the term test during your scheduled lecture section, **you do not need to submit an absence declaration**. You will automatically receive a 0 on the assignment, and your final exam score will replace your term test score.

Final Exam (35%). The final exam will be cumulative (that is, it will cover all material from the course). Please check the final exam schedule later in the semester for details about our final exam date. Similar to the term test, you are not allowed calculators, notes, or any other devices on the final exam.

Test and Exam Structure. The Term Test and Final Exam will each contain three parts, as outlined below.

- PART A will require you to precisely reproduce definitions, proof statements, and proofs as they are scaffolded in the Chapter Activity Packets. All definitions, proof statements, and proofs that appear in the Chapter Activity

Packets may appear on the term test or final exam.

- PART B will include multiple choice and computational questions, and will be most similar in style to your Webwork problems. In this section, you generally will not need to show any work.
- PART C will include conceptual and proof-based problems, and will be similar in style to your problem sets. In this section, you will be expected to provide justification for your work, and to accurately construct formal mathematical proofs.

TCard Requirement. On the term test and final exam, you will be required to present your TCard both to enter the room and to submit your test/exam. If you do not have your TCard, you will not be able to take the test/exam and you will receive a 0 on the assignment.

Missed Final Exam. If you have a schedule conflict or otherwise cannot make the Final Exam for reasons outside of your control, you can petition for a deferred exam. If you miss the final exam without petitioning to defer the exam, you will receive a score of 0.

Course Grade Calculation. Your numerical grade will be updated in Quercus as the semester progresses. At the end of the semester, after final exams are marked, we will use your total numerical grade in Quercus (rounded up to the nearest percentage) to calculate your letter grade using the the UofT Grading Scheme. Note that any grade above 50% is counted as passing, and grades below 50% are not counted as passing.

Grade Adjustment Policy. Unless otherwise stated, there will be no adjustments made to your final course grade. All requests for special considerations will be denied. If you believe there has been an error in your grade calculation, please follow the instructions below that are appropriate for your circumstance.

- If there is a discrepancy between your grade on Acorn and your grade on Quercus, email the administrative inbox (mat223H1F.a@course.utoronto.ca) and we will correct the error.
- If you believe your final exam has been marked incorrectly, you may request an exam reread by following the instructions on this page: https://www.artsci.utoronto.ca/current/faculty-registrar/final-exams/exam-reread-course-mark-recheck
- If you believe your course grade has been calculated incorrectly, you may submit a recheck of course mark calculations by following the instructions on this page: https://www.artsci.utoronto.ca/current/faculty-registrar/final-exams/exam-reread-course-mark-recheck

Course Websites

We will be using several websites this semester. Information about each of these sites is given below.

Required Course Sites: There are three sites in this course you will need to access regularly.

1. **Course Website**: The course website will be used to store most of our course materials. We suggest you bookmark this page and visit it regularly.
2. **Quercus**: Quercus will be used for announcements, to post Webwork assignments, and to store additional course documents. Lecture recordings will also be stored on the "Pages" tab of our Quercus site. We suggest you change your notification settings on Quercus to receive emails when course announcements are posted. Note that all sections of MAT223 share the same Quercus site.
3. **Gradescope**: The term test and final exam will be uploaded to and marked on Gradescope. You will generally have one week after scores are released to submit a regrade request. Please refer to the *Further Course Policies* section for more information about submitting regrade requests.

Optional Course Sites: The following sites are meant to serve as resources for the course. I suggest you become familiar with each of these sites, but it is not required that you interact with them.

1. **3Blue1Brown** This site holds beautifully created visualizations of core concepts in the course. We recommend using this as a resource to build intuition on course topics.

2. **WolframAlpha**. A computational tool which can do just about everything we need in the course. Documentation on using this tool with topics in our course can be found here.

3. **Desmos**. A free online graphing calculator.

Course Support

Outside of lectures, there are several activities we have prepared to help support you this semester. Details about each of these support options are outlined below.

Tutorials. Course tutorials are led by our course TAs, and will help you learn key skills that will not be covered in lecture. This includes writing mathematical arguments, solving new problems in timed settings, and collaborating effectively with peers. These skills are **vital for your success in the course**, and will not be discussed in lecture. We suggest you make every effort to attend all tutorial sessions. Tutorial attendance is also mandatory to complete your problem set quizzes and peer review worksheets. Note that you must attend the tutorial you are registered for.

Office Hours. Office hours are a place for you to drop-in with any questions you might have. Our goal is to create a casual and welcoming environment for you to have more personal interactions with the teaching team.

- The office hour schedule is available on this calendar. Note that our office hours schedules may change throughout the semester – please make sure to check the calendar each week for changes.
- You may attend any of the office hours on the schedule (you do not need to attend only your instructor's office hour), and there will be a mix of in-person and Zoom office hours.
- All questions are welcome, and no preparation is necessary. Note that **we want to help you**. Having a full and vibrant office hour is one of the joys of teaching, so please never feel like your questions are a burden.

Piazza. Piazza is a discussion board for students enrolled in MAT223, and will be monitored by our course TAs. You can ask math questions or logistics questions on Piazza. Your classmates and TAs are on Piazza to help you learn and get info.

Piazza is a good place to ask questions like: "I'm stuck on problem X, this is what I tried... what are your suggestions?" or "Where do I get the handout on X...?" Piazza is not appropriate for asking personal questions (for example, questions related to your grades), since it is a public forum. For personal matters, please instead send an email either to the administrative inbox or your instructor. Piazza can be found on the sidebar of our Quercus site.

Summary of Course Support. Below is a table summarizing your options for course support:

Support	**Purpose**	**How to access this support**
Tutorial	Skill development to prepare for course exams	Attend the tutorial you are registered for
Office Hours	Drop-in hours for content related questions	See the office hour calendar. You may attend any instructor's office hours
Piazza	Discussion board monitored by course TAs Content and logistics questions are welcome No personal questions	Available through the sidebar on Quercus

Email and Etiquette

In general, the teaching team will aim to respond to emails **within two business days**. Note that the teaching team will not respond to emails over the weekend. During busy times (like before the term test or the final exam) it might take several days to respond. If your situation is urgent, we suggest that you talk to your instructor after class or during office hour.

Email Etiquette. When writing an email:

- Use your utoronto.ca email address, and identify yourself by name and UTORid.
- Put MAT223 in the subject line
- Be specific. We're better able to help you if you're specific about your issue and you include all necessary information. If your situation is complex, it is best to schedule an appointment to discuss it.
- Check the syllabus and course webpage first. Please be mindful that each of our instructors are responsible for several hundred students, and we have taken the time to outline policies as clearly as possible in this document. **Do your best to make sure that your question is not already answered on the syllabus.**
- Be professional. Please use appropriate tone and level of formality in your emails. Do not use slang or texting abbreviations. Make sure to address your instructor with their indicated preference in the *Teaching Team* section. It is tradition in North America to start emails "Dear Professor ...," and end them, "Thank you, ... "
- No content questions. If you have mathematical questions, please bring your question to office hours.

Who to Contact. Below is a quick guide to help you navigate who to contact. For most logistics questions, you should email our administrative inbox at mat223H1F.a@course.utoronto.ca.

Type of question	**Options for help**	**Contact information**
Content questions (math, homework, etc)	Bring your question to drop-in office hour Post your question on Piazza Do not send an email	See the office hour calendar
Questions about your grade Questions about course policy	Email your course instructor Carefully check the syllabus	See the *Teaching Team* for emails If unresolved, email the admin inbox
Questions about the syllabus Other questions not listed above	Email the admin inbox	

Teaching Team

The MAT223 teaching team consists of 7 INSTRUCTORS and over 25 TEACHING ASSISTANTS (TAs).

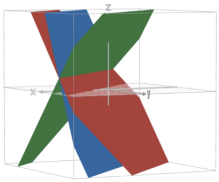
Course Instructors. Instructors work together to design and facilitate lectures, design and mark assessments, provide drop-in office hours, and generally oversee the content of the course. Below you will find information about each of the course instructors.

Elisa Bellah
Roles: Course Coordinator, Instructor for LEC0201 and LEC0401
Addressed as: Dr. B, Prof. B, Dr. Bellah, or Professor Bellah
Pronouns: she/her
Office: PG 113
Email: elisa.bellah@utoronto.ca

Professor Bellah is an Assistant Professor, Teaching Stream, at the University of Toronto. She earned her PhD in mathematics from the University of Oregon in 2022. Before joining the UofT, she was a postdoctoral teaching fellow at Carnegie Mellon University. Her research interests include number theory and mathematics education.

Jason Siefken
Role: Instructor for LEC0101
Addressed as: Dr. Siefken or Professor Siefken
Pronouns: he/him
Office: PG 101
Email: siefkenj@math.toronto.edu

Professor Siefken is a teaching stream professor at the University of Toronto. He earned his PhD at the University of Victoria studying Dynamical Systems and Aperiodic Tilings. He now focuses his research efforts on education (especially how students learn linear algebra!)

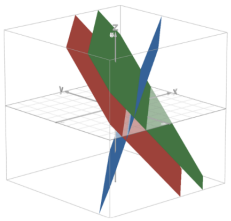


Isabella Negrini
Role: Instructor for LEC0301
Addressed as: Dr. Negrini
Pronouns: she/her
Office: BA 6256
Email: isabella.negrini@utoronto.ca

Dr. Negrini is a postdoctoral fellow at University of Toronto, with research revolving around algebraic number theory. She earned her PhD in Mathematics from the University of McGill. Before joining the UofT, she was postdoctoral fellow at University of British Columbia and MSRI Berkeley.

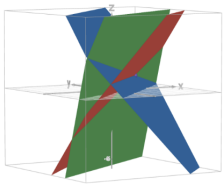
Sarah Mayes-Tang
Role: Instructor for LEC0501 and LEC0701
Addressed as: Prof. Mayes-Tang (or Dr. Mayes-Tang)
Pronouns: she/her
Office: PG 101B
Email: sarah.mayes.tang@utoronto.ca

Professor Mayes-Tang is an Associate Professor in the Mathematics Department at the University of Toronto. She earned her PhD in mathematics from the University of Michigan with a dissertation entitled *The Asymptotic Behaviour of Generic Initial Ideals*. Prior to joining the UofT math department in 2017, she was a professor at the innovative Quest University Canada for four years. While her mathematical research is in algebraic geometry, she also has scholarly interests in building mathematical understanding and in feminist mathematics.



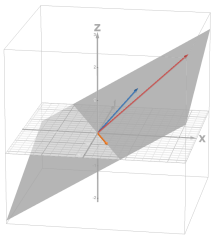
Enrique Nunez Lon-wo
Role: Instructor for LEC0601
Addressed as: Enrique
Pronouns: he/him
Office: TBD
Email: enrique.nunezlon.wo@mail.utoronto.ca

Professor Nunez is a PhD student at the University of Toronto. His interests include number theory and mathematics education.



Simon Xu
Role: Instructor for LEC0702
Addressed as: Simon
Pronouns: he/him
Office: TBD
Email: shuofeng.xu@mail.utoronto.ca

Simon is a postdoc at University of Toronto, and just finished his Ph.D. here as well.



Yi Shan
Role: Instructor for LEC5101
Addressed as: Yi, Yi Shan, or Dr. Shan
Pronouns: she/her
Office: PG 307B
Email: yshan@math.utoronto.ca

Yi Shan is a postdoctoral fellow at the University of Toronto, with research revolving around automorphic forms and Langlands program. She earned her PhD in mathematics from École Normale Supérieure in 2025.

Course TAs. TAs lead tutorials, monitor the course Piazza, mark assessments, and assist in lectures. Our course TAs are a mix of graduate students and undergraduate students at the UofT who have received ample training to assist us with the course this semester.

Further Course Policies

Anonymous Grading. The term test and final exam will both be graded blindly (with the help of Gradescope) to help account for grader bias. Please do not put any identifying information on your course exams outside of the space indicated.

Regrade Requests. During the course of grading the term test, it is possible that a mistake could be made, particularly when trying to return tests to students in a timely manner. Credit for work will be recorded only as reported by the course TAs. It is your responsibility to make sure that your work has been properly marked on Gradescope.

Please note that any regrade requests submitted past the regrade deadline will not be accepted.

If you need to request a regrade on the term test, please adhere to the following policy:

1. All regrade requests should be submitted on Gradescope and will be evaluated anonymously. **Students should not approach either their instructor or the course TAs with an oral or email regrade request**.
2. You will generally have one week after scores are released to submit your regrade requests. Please refer to the Gradescope assignment for the regrade request deadline.
3. Any regrade requests submitted past the regrade deadline will not be accepted.
4. When submitting a regrade request, **be clear, specific, and include an argument for why you think you deserve a different mark**.
5. Here are examples of appropriate regrade requests:
    - You lost points for something you did correctly. For example, the grader said "-2 points for not doing X" and you actually did do X.
    - There is an error in the solutions or rubric that you can accurately argue is an error.
    - You do not understand why you have lost points for something.
6. Here are examples that are not appropriate for regrade requests:
    - Your score is accurately represented by the rubric, but you do not agree with the rubric.
    - You do not agree that a problem used on the exam was an accurate assessment of a course learning goal.
    - You would like to request higher marks due to personal circumstances, or any other reason not reflected by your performance.
    - You could receive more points if you provided more work or justification than what is written on your exam (we will only mark what you submit).

Absences and Late Work: We generally will not accept any late work or allow for makeups in the course beyond what is specified in the *Assessments and Grading* section. The generous drop policies outlined in this section were created specifically to accommodate life events that prevent you from completing assignments on time. Note that you do not need to communicate any personal information to receive this built-in flexibility. If you are experiencing an extenuating circumstance in the course that you would like additional flexibility for, you can submit an absence declaration with the University Registrar's Office. If your absences is approved by the registrar's office, you may be excused from the relevant assignment.

Recording of Course Materials. Course lectures, including your participation, may be recorded on video and may be available to students in the course for viewing after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor. For questions about the recording and use of videos in which you appear, please contact the Course Coordinator.

Calculator Policy and Use of Resources. Calculators will not be permitted on any of the term test, problem set quizzes, or final exam. You are allowed to use any resources on your Webwork Assignments and Chapter Activity Packets, however the work you submit must ultimately be your own. Any verbatim copying, or use of resources to directly complete assignments for you, will be treated as cases of academic dishonesty.

Academic Integrity. Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the University of Toronto degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves. Familiarize yourself with the UofT Code of Behaviour. It is the rule book for academic behaviour at the University of Toronto, and you are expected to know the rules.

The University of Toronto treats cases of academic misconduct very seriously. All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code. The consequences for academic misconduct can be severe, including a failure in the course and a notation on your transcript. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact your instructor or the course coordinator. If you have questions about appropriate research and citation methods, seek out additional information from your instructor or from other available campus resources like the University of Toronto Writing Website. If you are experiencing personal challenges that are having an impact on your academic work, please speak to your instructor or seek the advice of your college registrar.

Additional Information

Land Acknowledgment. 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.

Respect for Diversity. It is our intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups.

Accessibility. The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible.

Access to Technology. Many University of Toronto libraries lend devices to current UofT students. Please see the technology loans website on the UofT Libraries page to learn how to access this resource.

Resources. Human lives come with human difficulties. As a university student, you may experience a range of issues, for example regarding your physical or mental health, regarding your financial situation or regarding your friends and family. These may result in significant barriers to achieving your personal and academic goals. The University of Toronto offers a wide range of free and confidential services and programs that may be able to assist you. We encourage you to seek out these resources early and often.

- You can find resources on the UofT Student Life page.
- If at some point during the term you find yourself in need of immediate support, visit the Feeling Distressed webpage for more campus resources.
- Immediate help is available 24/7 through the UofT My Student Support Program in 35 languages. You can call via phone or wifi or even chat using the app.
- All students in the Faculty of Arts & Sciences have a College Registrar who can advise on academic and personal matters.