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 <u>underlined and blue</u> 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, missed and conflicting exams
- 3. Course Websites: 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 vectors, vector spaces ("flat spaces") like lines and planes, and linear transformations like rotations and scalings. Vectors originated in the study of physics and the 3D world, but through the mathematical practice of abstraction, we now use vectors in non-spatial realms, like music, computer graphics, and the study of physical forces.

Transformations are functions that move vectors around, and in this class we will focus on linear transformations. Why? Because we have a complete theory of linear functions. And, although mankind has tried to understand the non-linear phenomena of the universe, we haven't gotten very far. Despite 200 years of effort, the non-linear equations governing fluid flow haven't been solved! Because of this, our approach to answering general questions about the universe is often to convert the problems into linear ones—ones that we can actually understand, and ones which we will study in this course.

This course will cover the fundamentals of linear algebra. We will ground our study in \mathbb{R}^n (n-dimensional Euclidean space), using spatial intuition to guide us. However, we will also pay close attention to the mathematical definitions we encounter along the way. These carefully constructed definitions—the result of hundreds of years of human endeavor—will allow us to solve problems where our intuition fails (for example, how can you find the angle between two 17-dimensional vectors?). In the next course, MAT224, the idea of vectors themselves will be decoupled from Euclidean space and linear algebra will become even more broadly applicable.

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

- 1. Use matrices, matrix arithmetic, matrix inverses, 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. This includes proficiency at reading and writing some basic mathematical proofs.

Textbook. There is no required course textbook for this course. Instead, we will follow a set of lecture notes designed specifically for this course, which will be updated each week. Supplemental resources for the course can be found in the preface of our course lecture notes.

Modality. MAT223 will be taught via research-based teaching, learning, and assessment methods. In lectures and tutorials, students will engage in MAT223 ideas through various active, student-centered teaching frameworks, including <u>inquiry-based learning</u> (or IBL). Students are expected to actively participate in each lecture and tutorial they attend.

Assessment and Grading

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

- READING AND REFLECTION ASSIGNMENTS, submitted via Quercus (10%)
- Online Homework, submitted via Webwork (15%)
- PROBLEM SET QUIZZES, taken in tutorials (15%)
- TERM TEST, taken in Week 8 of the semester (25%)
- FINAL EXAM (35%)

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

Reading and Reflection Assignments (10%). These assignments are meant to help you REFLECT on the work you've done, and PREPARE you for the next week of work ahead.

- Reading and Reflection Assignments will generally be posted to the course website by Tuesday each week. There will be an associated Quercus reading quiz and reflection survey due the following Monday each week.
- These assignments will involve a mix of reflective writing, reading from your text, and engagement with additional resources (for example, watching <u>3Blue1Brown</u> videos or interacting with <u>Desmos</u>).
- Note that we will not be able to accommodate extensions to reading and reflection assignments. Instead, we will **drop your lowest six scores** from this category 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 course exams.

- Online homework will take place on Webwork. New assignments will generally open on Tuesday each week and will close at the end of 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 reading and reflection 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 (15%). The purpose of the Problem Set Quizzes is to help you in learn how to ACCU-RATELY COMMUNICATE MATHEMATICAL IDEAS, oftentimes through the mathematical proof. These assignments will also prepare you for the "Section C" questions on course exams.

- Each Monday, a new problem set will be posted related that the current week of content we are covering.
- During tutorial the following week, your TA will randomly select one problem from the current problem set for you to complete **without notes or any other resources**. You will have 15 minutes to complete the problem, and it will be marked and returned to you in the following tutorial.
- Note that we will not be able to accommodate extensions or makeups on any Problem Set Quizzes. Instead, we will take your **best five** Problem Set Quiz scores out of the **nine 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 on Friday, March 7th (during Week 8 of the semester) from 5-7pm.
- You are not allowed calculators, notes, or any other devices on either of the midterm exams.
- We will **replace your Term Test score with your Final Exam score** if it will positively impact your overall course grade.

Final Exam (35%). There are two types of assessment: *summative assessment*, which evaluates your knowledge of the course, and *formative assessment*, which gives you feedback about what you need to improve. The purpose of the final exam is summative (to measure how well you know linear algebra), whereas the reading and reflection assignments, as well as the online homework assignments, are meant to be formative.

- The <u>final exam schedule</u> will be released later in the semester.
- The final exam will be cumulative.
- You are not allowed calculators, notes, or any other devices on the final exam.

Exam Structure. The Term Test and Final Exam will each have three parts: PART A, PART B and PART C.

- PART A will require you to precisely reproduce definitions and proofs discussed during lecture. We will provide you with a list of definitions and proofs which you will be be responsible for before the term test and 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. You will learn more about how to write these types of problems in your tutorials (see the section on *Course Support* for more information).

Note that on all course exams, you will be required to present your $\underline{\text{TCard}}$ both to enter the exam room and to submit your exam. If you do not have your TCard, you will not be able to take the exam and you will receive a 0 on the assignment.

Term Test Conflicts. If our Term Test conflicts with another UofT course you are registered for, please email <u>mat223H1F.a@course.utoronto.ca</u> to schedule an alternative sitting. In your email, please include a screenshot of your ROSI/ACORN schedule showing a legitimate conflict.

Missed Term Test. There will be no make-up Term Test any unexcused missed Term Test will be given a score of 0. If you are experiencing an extenuating circumstance, you can request an <u>absence declaration</u> through the Registrar's office. If you absence is approved, you will be excused from the Term Test.

Missed Final Exam. If you have a schedule conflict or otherwise cannot make the Final Exam for reasons outside of your control, you can <u>petition for a deferred exam</u>. 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 to calculate your letter grade using the the <u>UofT Grading Scheme</u>. Unless otherwise stated, we will not plan to adjust grades or curve the course. Note that any grade above 50% is counted as passing, and grades below 50% are not counted as passing.

Course Websites

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

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

- 1. <u>Course Website</u>: The course website will be used to store most of our course materials. We suggest you bookmark this page and visit in regularly.
- 2. Quercus: Quercus will be used for announcements, to post grades, for reading and reflection 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. <u>Webwork</u>: Webwork will be used for online homework assignments. This platform is free for you to use. Note that you will not be given a username and password. To login, you will need to open a Webwork assignment through the "Assignments" tab on Quercus.
- 4. **Gradescope**: All course exams will be uploaded to and marked on Gradescope. You will generally have one week after scores are released to submit a <u>regrade request</u>. 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. <u>3Blue1Brown</u> This site holds beautifully created visualizations of core concepts in the course, and will be regularly featured in your Reading and Reflection assignments. I 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 <u>here</u>.
- 3. <u>Desmos</u>. 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. In addition, most tutorials will have a 15 minute required quiz which cannot be made up outside of your tutorial section. Your first course tutorial will take place on Monday of Week 3. 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 <u>on this calendar</u>. 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 or TAs office hour), and there will be a mix of in-person and Zoom office hours. Please attend the office hours that work best for you.
- 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, TAs, and instructors 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 schedule an appointment as outlined above. Piazza can be found on the sidebar of our Quercus site.

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 <u>office hour calendar</u> .	
		You may attend any instructor or TA office hours	
Piazza	Discussion board monitored by course TAs	Available through the sidebar on Quercus	
	Content and logistics questions are welcome		
	No personal questions		

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

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 an exam) it might take several days to respond. If your situation is urgent, we suggest that you talk to your instructor after class or schedule an appointment (as outlined in the *Course Support* section).

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	See the <u>office hour calendar</u>
	Post your question on Piazza	
	Do not send an email	
Questions about your grade	Email your course instructor	See the <i>Teaching Team</i> for emails
Questions about course policy	Carefully check the syllabus	If unresolved, email the admin inbox
Schedule alternative midterm sitting	Email the admin inbox	
Questions about the syllabus		
Other questions not listed above		

Teaching Team

The MAT223 teaching team consists of 5 INSTRUCTORS and over 20 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.



Professor Elisa Bellah

Roles: Course Coordinator, Instructor for Sections 0301 and 0401 Addressed as: Dr. B, Prof B, Dr. Bellah, or Professor Bellah Pronouns: she/her Email: <u>elisa.bellah@utoronto.ca</u> Office: Physical Geography Building, Room 113

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. In her free time, she enjoys practicing <u>Ashtanga yoga</u> and hanging out with her cat Emmy (named after the mathematician Emmy Noether).



Professor Arnab Kundu Role: Instructor for Section 5101 Addressed as: Professor Kundu Pronouns: he/him Email: arnab.kundu@utoronto.ca Office: PG 111

Professor Kundu is a postdoctoral fellow at the University of Toronto, with research revolving around algebraic geometry. He earned his PhD in Mathematics from Université Paris-Saclay.



Professor Isabella Negrini

Role: Instructor for Section 0101 Addressed as: Dr. Negrini Pronouns: she/her Email: isabella.negrini@utoronto.ca Office: Bahen Centre, Room BA6256

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.



Professor Sebastián Olano Espinosa Role: Instructor for Section 0201 Addressed as: Dr. Olano or Professor Olano Pronouns: he/him Email: sebastian.olano@utoronto.ca Office: Health Sciences Building, Room 372

Professor Olano is an Assistant Professor at the University of Toronto. He earned his PhD in mathematics from Northwestern University in 2020. Before joining the university, he had a postdoctoral position at the University of Michigan. His main research interest is in Algebraic Geometry.



Instructor Kevin Watmough Role: Instructor for Section 0501 Addressed as: Instructor Kevin Pronouns: he/him Email: kevin.watmough@mail.utoronto.ca Office: HU1012

Instructor Kevin is a PhD student at the University of Toronto. Before coming to U of T, he completed his Master's degree in mathematics at McGill University. His research interests are in number theory and arithmetic geometry.

Course TAs. TAs lead tutorials, monitor the course Piazza, mark assessments, assist in lectures, and provide drop-in office hours. 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

Verification of Identity. During all course exams (Midterm 1, Midterm 2, and the Final Exam), you will be required to present your <u>TCard</u> both to enter the exam room and to submit your exam. If you do not have your TCard, you will not be able to take the exam and you will receive a 0 on the assignment.

Anonymous Grading. All exams will 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 exams, it is possible that a mistake could be made, particularly when trying to return exams 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 for an assignment, please adhere to the following policy:

- 1. All regrade requests should be <u>submitted on Gradescope</u> 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 requests, 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 and Webwork extension 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 <u>absence declaration</u> 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 course exams. You are allowed to use any resources on your Webwork Assignments and Reading and Reflection Assignments, however the work you submit must ultimately by 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 <u>UofT Code of Behaviour</u>. 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 <u>UofT Student Life</u> page.
- If at some point during the term you find yourself in need of immediate support, visit the <u>Feeling Distressed</u> webpage for more campus resources.
- Immediate help is available 24/7 through the UofT <u>My Student Support Program</u> 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 <u>College Registrar</u> who can advise on academic and personal matters.