

# WOMEN'S MATHEMATICS

MAT193H1 | University of Toronto | Fall 2022

## What you will learn

This math in this course is inspired by the mathematical contributions of women, while also learning about the lives of those women, gender issues within the field of math, and how this impacts UofT. You'll learn math not typically seen outside of a math major while enhancing your general academic skills.

## What you will read

You will read a selection of book chapters, newspaper articles, and academic articles from several different sources. You will also read some excerpts of math books, mostly that aren't textbooks.

## What you will do

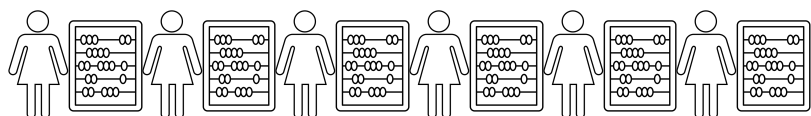
Classes will be active and will include student-led math presentations, whole-class discussions, and guest speakers. Outside of class you'll prepare 3 problem sets and 3 projects, and establish baseline knowledge. The projects are about applying what we are learning to the University of Toronto and involve original research.



The Association for Women in Math Logo at the University of Toronto, designed by Ghazal Malekanian

## Welcome!

This is a course that I have been dreaming about for many years. I first heard of a course about women and math when I was invited to a weekend all about women's influence on mathematics at the Banff International Research Station in 2016 immediately knew that I'd teach something like it some day. Some of the greatest mathematicians in history have been women - but their names are still unknown, even to math students. You might hear that math is a "relatively equitable" subject, because about 50% of math undergrad degrees are awarded to women. But, once you dig below the surface you find this isn't so. Fewer than 30% of math PhDs are awarded to women, and fewer than 15% of professors in elite research institutions are women. This semester we'll celebrate women's accomplishments and look at all that's left to do. Welcome to the course! I look forward to learning with you this semester!



## Class Attendance & Mask Policy

Class Attendance is mandatory. If you cannot make a class meeting due to circumstances email me before class or as soon as possible after class.

### Please wear a mask!

Please wear a mask in lectures, tutorials, and office hours to protect yourself, your classmates, and your community. We can create a safe community for all to learn and be healthy. Wearing a mask is one of the most significant things you can do for your own safety and the safety of our community. Masking significantly reduces forward transmission of COVID-19, which can cause serious illness and/or long-term disability even in young people and people who are vaccinated.

Colleges and universities are centres of community bringing together students, educators, and staff. Universities should be healthy, inclusive, and safe. Layered mitigation is most effective, and mitigation supports mental health. It is hard to learn, teach, work or be healthy, if you are worried about your health. COVID-19 policies are also equity and inclusion policies, because COVID disproportionately affects marginalized people. Reducing COVID cases reduces inequities.

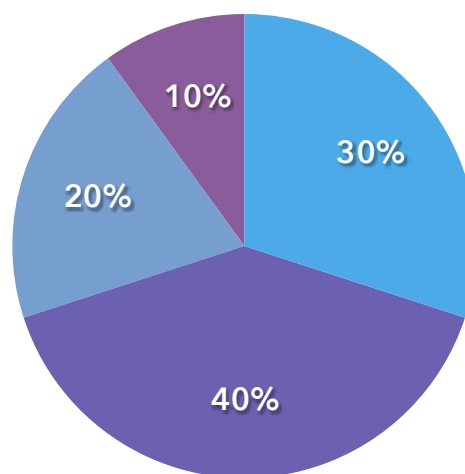
It is recommended that students wear an N95/KN95/KF94 mask (or similar respirator or elastomeric).

## Units

	Unit 1: Weeks 1-4	Unit 2: Weeks 5-8	Unit 3: Weeks 9-12
Campus Project	What are the Numbers?	Their Stories & Our Stories	Make a Difference
Women in Math Focus	What are the numbers?	What are women's stories?	How does this apply to us - as mathematicians? as academics? as citizens? as dreamers?
Math Theme	Data Visualization	Abstraction (Group Theory)	Spaces & Knots (Topology)
Math by Women (e.g.)	Data visualizations produced by women	Using abstraction to frame arguments about feminism	How crochet explains topology
Women whose work we'll study (e.g.)	Florence Nightingale & modern data scientists	Cheryl Praegar	Joan Birman & Maryam Mirzakhani

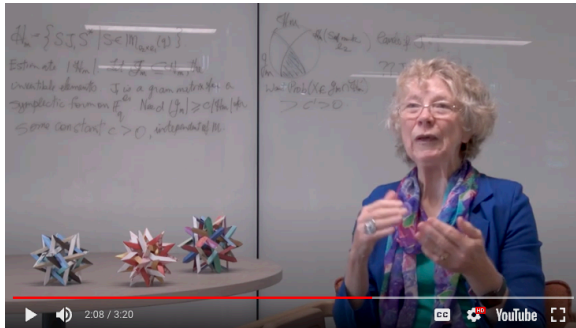
## Assessment Information

- Problems
- Annotations / Class Prep
- Campus Projects
- Reflections



The breakdown of grades is shown above. In addition, because participation is a key element of being in a seminar, to receive an A in the course you must attend all classes, to receive a B you must attend 10 classes, and to receive a C you must attend 8 classes. Note that you are counted as "attend" if you tell me you

will miss class ahead of time, if you have an emergency, or if you attend one of the classes during the first two weeks virtually.



What do the 3D paper shapes behind mathematician Cheryl Praeger have to do with her group theory research in areas as wide ranging as crop arrangements (agriculture) and laying woven fabrics flat (textiles)?

you are willing to present. More details will be posted at the beginning of the semester.

### *Campus Projects*

One of the ultimate goals of this seminar is to take what you learn about women mathematicians and their contributions elsewhere and apply it to the University of Toronto context. I would like you to ask research questions about what is happening at the University and what *has* happened here.

We will follow a research process for the projects:

1. Formulate a research question and write a project proposal
2. Gather data
3. Analyze data
4. Transform data into a representation that is easily understood by audience

These three projects lie somewhere between group projects and individual projects and on the border of original research. You will be accessing and representing knowledge that is not easily found so that it is easier for others to access - this is the research component. Further, you will work as a class to ensure that you are not repeating each others' efforts. How much you choose to truly work collaboratively - in pairs, in trios, or so on - is up to you, but I expect that if you work in larger groups your efforts will reflect this collaboration and that you will be responsible for ensuring that the collaboration goes smoothly.

The three projects are:

### *Problems*

It is often said that in order to learn math you must do math. This is at the core of my beliefs about how you learn math and how you become a mathematician. If you are going to appreciate the contributions of women in mathematics, you need to engage in math!

Each week I will assign problems for you to complete on the Ed Forum for the course. They are posted there to encourage you to talk about the problems with your classmates (yes, you should talk about the problems with them!). These problems will likely look different than many of the problems that you have done in previous mathematics classes.

We will open each class with a discussion of the most pressing problems. You will sign up for problems that

- ♦ What are the Numbers?: In this project you will gather data related to women in mathematics at UofT and - more importantly - represent it visually. There are several directions you can go with this project and several different types of data you can gather.
- ♦ Their Stories & Our Stories: This is my favourite!! We will have the AMAZING opportunity to visit the University of Toronto Archives for this project, where the official University records are kept. You will get your hands on records that few - if any - people have touched in decades, and use what you find to tell the story of a woman or women who have worked at the University in the past.
- ♦ Impact: Make a Difference After all that you have learned about women in mathematics in general, what impact can you have locally? You'll identify a problem related to women or girls and math that you would like to tackle and propose a partial solution to it that you can implement at the end of the semester. If feasible, you may also be able to measure the impact of your solution.

### *Class Preparation*

For a seminar course in particular, it is absolutely vital that you be prepared. If you are not prepared you cannot participate fully in class.

As academics (students and professors, members of a University community) we engage in academic conversations. Part of this is that we are grounded in conversations that others have had before us. This is why we read. Academic book chapters and articles are part of conversations. By reading them we get a glimpse into the questions, issues, and arguments that academics are having so that we can then continue them ourselves.

The reading - and any other pre-class preparation, like videos or podcasts - is assigned on Perusall, a program that allows you to talk about the reading with your classmates. You can also tag me to ask questions. You will read a selection of book chapters, newspaper articles, and academic articles from several different sources.

Each week a different student or pair of students will be responsible for reading the texts by Friday evening (they will be available a week before this), and populating the text with some questions about the text. At the end of the discussion period they will summarize the comments and discussion in a "precis". I will give an example the first week.

### *Reflections*



This semester, we'll see how crochet is the perfect medium for understanding topology, a mathematical study of space. (Hyperbolic Crochet Coral Reef by Daina Taimina)



What does the dance arrangement on the left tell us about the theorem on the right? Quite a bit as Nancy Scherich's [Dance your PhD video](#) tells us.

During the course you will write a formal reflection at the beginning / end of each of the units to reflect on your current goals for your learning, what you have learned, and how you have grown up to this point in the course. I will also ask you to self-assess and provide a grade for what you think your grade should be in the course. Your letters will be used - in large part - to help me determine your grades for the course.

## What you will learn

### Fundamental Knowledge

- Identify women who have made contributions to mathematics, in history and in current times, including women from the university of Toronto
- Represent concepts from the fields of data, group theory, and knot theory in multiple ways, and translate between representations
- Explain some factors contributing to women's lower rates of participation in mathematics

### Application

- Solve mathematical problems
- Mine the University Archives for "lost" stories of women at the University

- Use mathematical tools to represent and understand data related women in math at the University of Toronto
- Design an intervention to impact the knowledge of or representation of women in math at UofT

### Integration:

- Identify similarities and differences between mathematics and other fields of study
- Build tools to understand data from different fields of study

### Human Dimension

- Come to see yourself as a capable doer and user of mathematics
- Come to see yourself as part of the history at the University of Toronto and, if applicable, as part of the community of women at the University



**Caring**

- Value mathematics and mathematical thinking as human endeavours
- Be more interested in barriers that may prevent women and girls from fully participating in academic life, and work to remove these barriers in your own life beyond this course.

**Learning How to Learn**

- Develop skills to critically evaluate quantitative texts
- Identify the steps of an academic inquiry and frame useful questions to begin.

## Books and Readings

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There is no required textbook or books for the course. You will read a selection of book chapters, newspaper articles, and academic articles from several different sources.

## About Me & Course Contact Information

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I'm a mathematician and a professor in the Department of Mathematics. I was awarded my doctorate in math in 2013 from the University of Michigan with a thesis entitled *The Asymptotic Behaviour of Generic Initial Systems*. I enter into the study of math in literature (and literature in math) from this perspective; indeed, this is a math course and you can expect to learn a lot of math.

After I received my PhD I began teaching at Quest University Canada - in large part because I wanted to teach a lot of First-Year Seminars and learn how to design courses like this from experts! I taught there for four years. It was at Quest that I really began to learn the importance of gender issues in math. First, since I was teaching many students who would normally never take mathematics, I heard about a lot of ways that girls dropped out of math due to social issues or expectations that were different from my experiences. Second, I experienced blatant gender discrimination personally for the first time. Students accused me - and another younger woman STEM colleague - of not knowing what I was teaching and had different expectations of me than of my male colleagues. Also, *some* of my colleagues (not all!) thought that the solution to these issues was to just act more like a man! While Quest was overall a wonderful experience of growth in teaching, these issues began my journey towards interest in women in math.

At UofT I've continued to be involved with Women in Math and other diversity initiatives across campus. The more I learn, the more passionate I become! I balance my passion and advocacy with education, and work to become educated

If you have a question about the course, ask it on the Ed Forum first. If it is confidential, email me (not Quercus inbox - I don't check it and won't ever get your message): [smt@math.toronto.edu](mailto:smt@math.toronto.edu). Please put MAT193 in the title so I know what course you are talking about! But, before you email me, make sure you've read this syllabus, checked course announcements, and looked on the course website. A prerequisite to being a scholar is being able to find information for yourself, and I will expect that you

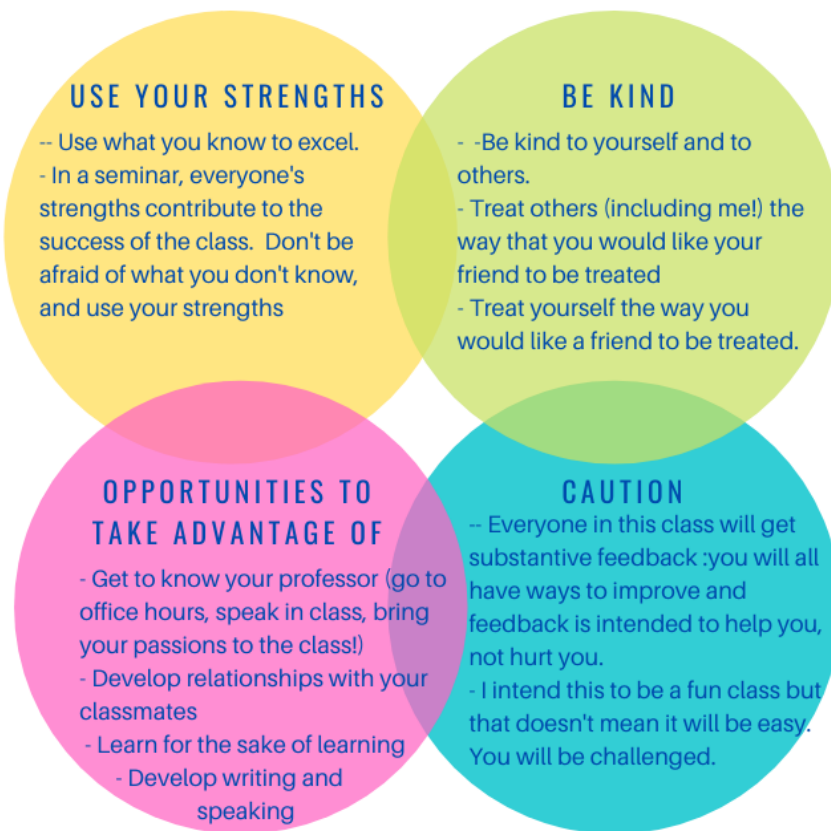
have checked those places first. If you do not receive a response, it is likely because the information is already available online somewhere.

You should call me “Professor Mayes-Tang” or “Dr. Mayes-Tang.”

## Succeeding in this Seminar

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This seminar does not require any prerequisites in math, English, or any other subject. This means that the most important things that you can bring to the course is your unique strengths and your engagement. Make sure that you take advantage of the unique opportunities that being in a first-year seminar offers! And make sure that you work with others. The syllabus says below what is and is what not a violation of academic integrity: if you have any questions about whether working with someone on an assignment is allowed or not, ask me!



## Feminist Pedagogy

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*Pedagogy* refers to the “method or practice of teaching.” So, when I refer to “my pedagogy” I am speaking about how I teach and the influences that inform how I teach.

Women’s work will not only be the subject that we study, it will inform how we study it and how I teach it. I aim to implement feminist pedagogical principles in this classroom or – in other words – teach using methods and practices that have been developed to respect the way that women think, learn, and work.

In mainstream Western culture, “feminine” thinking is often associated with the illogical, irrational, unreliable, and inferior. When speaking with women from a variety of walks of life, Belenky et al. (1988) found that women would often use metaphors of “voice” and listening to describe how their process of thinking (e.g. inner voice, silenced) rather than of the visual metaphors from the mainstream culture (e.g. lightbulb moment, came to me in a flash). This suggests that we should consider developing a voice and feeling as though one has a voice is an integral part of learning and self-identity as a learner.

Teaching is more than just “depositing” knowledge in a learner like a banker “deposits” money in the bank. Knowledge-making is a social process.

Classroom Application: Students become part of a community with teachers. They all work together to construct knowledge together.

In mainstream Western culture, women’s intuitions are usually dismissed and often the subject of jokes. Personal stories relevant to a topic are dismissed as “antec-data”.

In feminist pedagogies, intuitions, personal stories, and anecdotes are ways of knowing. Alternative ways of knowing are considered valid. They will not stand on their own as “complete knowledge” for the discipline, but they are respected, listened to, and used as part of a knowledge framework developed by our community.

Classroom Application: Anecdotes, personal stories, and intuitions are valued because they help connect us – as people and as a community – to the subjects that we are studying. They help to remind us that the material that we study is not simply intellectual fun. This also means that emotions become part of learning and a part of the material that we study. We acknowledge, however, that anecdotes and stories do not prove or disprove anything and that we have to go beyond these for a proof.

In mainstream Western culture, a power hierarchy exists everywhere we go. Power dynamics play out – even in our classrooms – and allow those with traditionally “stronger voices” to have a greater say. It is assumed that everyone experiences the same objective world. In feminist pedagogy, we are conscious of the power and power dynamics in the world, including the fact that the classroom itself is situated in this system. We acknowledge that there are differences between our lived experiences. “community, understood in conjunction with solidarity and coalition, lies at the centre of the feminist value system” (hooks 43).

Classroom Application: We “deliberately pay attention to listening, speaking, risk-taking, respect, reconciliation, and mutuality as central to [the class’s] success” (from the main source). We value the intersectional and individual identities of instructors, students, visitors, and authors of the course texts that we choose. We acknowledge that a power hierarchy must sometimes exist – for example, in a classroom between professors and students – but we are aware of the implications of it.

*The information above primarily comes from Bostow et al.*



Cathleen Morawetz, UofT graduate and the first woman mathematician to receive a National Medal of Science (among many other honours)



Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986). *Women's ways of knowing: The development of self, voice, and mind* (Vol. 15). New York: Basic books.

Bostow R., Brewer S., Chick N., Galina , McGrath A. Mendoza K., Navarro K., & Valle-Ruiz L. (2015). *A Guide to Feminist Pedagogy*. <https://my.vanderbilt.edu/femped/>. Accessed August 2022.

hooks, bell. (1984) *Feminist Theory: From Margin to Center*. New York: Routledge, 2015.

## Important Course Policies

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### *Academic Integrity & What It Means in This Course*

Academic integrity is fundamental to learning and scholarship at the University of Toronto and beyond. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T 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. Violating standards of academic integrity will prevent you from learning material, refining your problem-solving skills, and developing self-sufficiency and self-esteem.

I am strongly committed to assigning grades based on students' honest efforts to demonstrate learning in this course. Academic dishonesty in any form will thus not be tolerated in this course.

Students are expected to know what constitutes academic integrity: familiarize yourself with the information available at [this site](#). It is the rule book for academic behaviour at the U of T. Potential offences include, but are not limited to:

- Having another student, stranger, or someone else write a paper or assignment for you (in part or in full)
- Copying or paraphrasing a source without citing it
- Allowing someone else to copy the ideas in your journal, papers, or other assignments



The final mural (click to enlarge)

Drawing the Dictionary by Stefanie Posavec, is a collection of drawings representing the 1000 most used English words. We will study unique visualizations like this in Unit 1.

- Taking unattributed text from somewhere else
- Misrepresenting reasons for being late or absent for a class or presentation

The following actions are NOT offences in this class.

- Discussing questions from homework with classmates, building off of each others' ideas
- Using online resources to help you understand the content of the course or homework problems
- Using sources for ideas and quoting them with citations

In accordance with the University's Code of Behaviour on Academic Matters, we will actively investigate any suspected cheating, plagiarism, misrepresentation or other dishonest practices. The consequences for academic misconduct can be severe, including a failure in the course, a notation on your transcript, suspension, and expulsion.

If you have any questions about what is or is not permitted in this course, please do not hesitate to contact your me. Students are usually reluctant to report incidents of academic dishonesty. As we are working together to preserve the fairness of this course, I encourage you to let me know (anonymously, if necessary) if you observe behaviour that you feel might be unethical. Your name will be held in confidence.

### *Academic Accommodations*

If you have a documented academic accommodation please share your letter from Accessibility Services with me as soon as you can in the term so that we can work together to provide an equitable learning environment for you. If you suspect that you need academic accommodations, I encourage you to contact the Accessibility Services office.

### *Due Dates & Late Policy*

I set due dates so that you keep up with the course and for practical reasons - like ensuring that you pace yourself throughout the semester and don't have work piling on top of itself. I will accept requests for extensions on late work submitted via email, and trust that you have a good reason (e.g. medical trauma, personal crisis) for submitting an assignment late. You must make the request at least 24 hours before the due date (unless there is an emergency circumstance). Some limits to this policy (that is, places where it is not reasonable or fair to accept late work) are outlined below.

- When another member of our class depends on you for their work (e.g. peer review) due dates will be very strictly enforced. This is because it is not fair to your classmates. All term work must be completed before the end of classes.
- If you have an official academic accommodation that impacts late work, your Accessibility Advisor needs to be aware of the extension request, so you should also file a form signed by them from Accessibility Services.

