DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES
UNIVERSITY OF TORONTO MISSISSAUGA

MAT137H5F LEC0102
Differential Calculus for Mathematical Sciences
Course Outline - Fall 2023

Class Location & Time	Tue, 09:00 AM - 10:00 AM DV 2080
	Thu, 09:00 AM - 11:00 AM DV 2082
	Fri, 05:00 PM - 07:00 PM ZZ TBA
Instructor	Ivan Khatchatourian
Office Location	DH-3098
Office Hours	Thursdays, 11am-1pm
E-mail Address	ivan.khatchatourian@utoronto.ca
Course Web Site	https://q.utoronto.ca
Co-Instructor	Ali Feizmohammadi
Office Location	DH-3027
Office Hours	Mondays 2-3pm, Thursdays 1-2pm
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Teaching Assistant	David Cobo
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Teaching Assistant	Pouya Honaryar
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Course Description

A conceptual approach to calculus. A focus on theoretical foundations and proofs as well as some emphasis on geometric and physical intuition. Limits and continuity, differentiation, the mean value, extreme value and inverse function theorems. Applications typically include related rates and optimization.

Prerequisite:

Minimum 70% in Grade 12 Advanced Functions (MHF4U) and Minimum 70% in Grade 12 Calculus and Vectors (MCV4U).

Exclusion:
MAT132H5 or MAT133Y5 or MAT134Y5 or MAT135H5 or MAT137Y5 or MAT135Y5 or MAT157H5 or MAT157Y5 or MAT133Y1 or MAT135Y1 or MAT135H1 or MAT137Y1 or MAT157Y1 or MATA30H3 or MATA31H3 or MATA32H3 or MATA33H3 or MATA35H3 or MATA36H3 or MATA37H3

(SCI)
Distribution Requirement: SCI

Students who lack a pre/co-requisite can be removed at any time unless they have received an explicit waiver from the department. The waiver form can be downloaded from here.

Detailed Course Description

In this course we study calculus and some of its applications, with an emphasis on mathematical rigour and problem solving skills. In more detail, this course emphasizes:

- Precise definitions of the main concepts in calculus.

- The ability to perform basic computations related to calculus and its applications.
- Developing a deep understanding of the main theorems of calculus, including why they are true and the ability to know when they do and do not apply.
- Developing mathematical rigour. In particular, reading, understanding, critiquing, and creating definitions and short proofs.
- The ability to determine if a given, potentially novel mathematical statement is true or false, and justify that determination appropriately.
- Developing a collection of examples which illustrate the richness of the subject, and serve as a testing ground for understanding new definitions, and determining whether given statements are true or false.
- Developing a range of problem solving skills, to help students become comfortable attacking *new* problems that they have not seen before and provide them the tools to know when to be confident in their answers.

Learning Outcomes

By the end of this course, we expect a successful student to achieve the following goals.

- Understand why careful definitions are necessary, and how to identify whether a definition is written correctly.
- Understand why it is necessary to prove statements in math.
- Develop a set of tools and heuristics for proving mathematical statements.
- Understand that the hypotheses of a theorem must be carefully checked before it can be applied.
- Be able to accurately critique "proof" for correctness and style, including being able to spot errors in logic and applications of theorems.
- Be able to write correct proofs of mathematical statements related to course concepts.
- Be able to use correct notation and terminology for course concepts.
- Approach understanding definitions and statements of *new* concepts with intuition and a toolkit of examples.
- Understand and work with the key concepts of calculus, such as the definition of a limit, IVT, EVT, MVT, etc.
- Understand the proofs of the major theorems presented in the course, and use this understanding to solve a range of problems, both computational and conceptual.
- Determine if a given mathematical statement related to course concepts is true or false, and justify that determination appropriately.

Textbooks and Other Materials

There is no required textbook for this course. The primary source material for the course will be a comprehensive series of YouTube videos, which can be found [here](). The playlists will be our "chapters", and the course will cover playlists 1 through 6. If students wish to refer to a book as an extra resource and for even more practice, there are many potential options. The following textbook has been used by this course in the past, though **we will not be following it.** It is just a potentially helpful resource students may consult.

OPTIONAL: *Calculus in One Dimension Vol I*, by T. Holden. The bookstore has copies of this book.

Assessment and Deadlines

Type	Description	Due Date	Weight
Assignment	Best four out of five homework assignments	On-going	16%
Class Participation	In-class MathMatize polling	On-going	4%
Term Test	Term Test 1	2023-10-20	20%
Term Test	Term Test 2	2023-11-24	20%
Final Exam		TBA	40%
		Total	100%

More Details for Assessment and Deadlines

A student's final grade in this course is based on their performance on the assessments listed here only. No extra work can be submitted to improve a student's final grade.

Term Tests

There will be two term tests, both written on Fridays, 5pm-7pm, at the dates listed below. Both lecture sections will write the same test at the same time, in person, at locations to be announced closer to the test dates.

The dates of the tests are as follows.

- Term Test 1 - Friday, 20 October, 2023
- Term Test 2 - Friday, 24 November, 2023

By registering for this course, you are confirming that you will be available (barring unforeseen circumstances) to write these two tests on the dates and times above.

The two term tests are each worth 20% of your final grade. However,**if you write two term tests, the higher test grade will count for 23% of your final grade and the lower grade will count for 17% of your final grade.**

See the Missed Term Work section below for what to do if you have to miss a term test.

Homework Assignments

There will be five written homework assignments throughout the course, of which the highest four grades will count for 16% of your final grade, weighted equally (in other words, the highest four assignment grades count for 4% of your final grade each). Assignments will be completed individually and submitted online via Crowdmark.

All homework assignments will be due at on Sundays at**9pm sharp** on Crowdmark except for the last one, which is due on the last day of classes. Specifically, they are due on the following dates.

- Assignment 1: Sunday, 1 October
- Assignment 2: Sunday, 15 October
- Assignment 3: Sunday, 5 November
- Assignment 4: Sunday, 19 November
- Assignment 5: Tuesday, 5 December

All students are entitled to **one**, 36h extension on a homework assignment during the course. See the next section for details. Outside of these extensions, late assignments will not be accepted under any circumstances and will receive a grade of zero.

Polling Questions

During most lectures, we will use a free polling system called MathMatize to conduct short polling questions. The primary purpose of these polls is to help you check your understanding of basic concepts, and for your instructor to quickly gather data about that understanding from the whole class.

Your participation in these in-class polling questions will count for 4% of your final grade. To earn the full 4%, you must participate in a minimum of 80% of the polls conducted in your section over the course of the term, so if you are ill or otherwise unable to attend a few classes you can still get a perfect participation score. In order for your participation to be recorded, you must be logged in to your MathMatize account while answering the polls. Instructions for setting up a MathMatize account will be posted on Quercus.

These polling questions are graded for participation**only**, meaning you do not need to choose the correct answer to get credit. However, we strongly suggest that you try your best to answer each problem correctly, both because it will benefit your learning and because it will help your instructor understand the class' needs in the moment.

Please note that participation in these polls requires that students bring a device (a smart phone, tablet, or laptop) that can connect to the internet to class. If you do not have access to such a device, please contact the course coordinator.

Penalties for Lateness

Each student is entitled to **one** 36h extension on a homework assignment.

If you submit your homework assignment late (when using your 36h extension), you must notify the coordinator (Ivan Khatchatourian) that you have submitted your assignment late and are intending to use your one extension. Your email should

include your name, your student number, the assignment number (e.g., Assignment 4), and a clear statement that you are using your one extension for that assignment.

Outside of these extensions (at most one per student in this course), late assignments will not be accepted under any circumstances and will receive a grade of zero. There will be no make-up assignments of any kind.

Procedures and Rules

Missed Term Work

Missing assignments

The grading scheme of the course will automatically drop your lowest homework assignment score, so any student can miss one homework assignment without penalty if necessary. Any other homework assignments that are missed or handed in late will receive a grade of 0. There will be no make-up assignments of any kind.

Missing tests

Students should only miss term tests if they are sick or for very severe circumstances otherwise. Students who miss one or more term tests typically do not do as well in the course, so should write both term tests if at all possible.

For students who have to miss Term Test 1 or Term Test 2, no documentation is needed (no doctor's notes are required to verify an injury or illness, for example). However, such students must **fill out the MAT137 Absence Declaration Form**, which will be available on Quercus.

Students who miss Term Test 1 and/or 2 (and only those students) are entitled to write a **make-up test**, taking place during Week 11 on Friday, 1 December (location TBA). All students who are entitled to do so (see below) will write the same make-up test, regardless of which test they missed. The make-up test will cover all the material covered by *both* Term Test 1 and Term Test 2.

If you miss one term test, you have one of two options:

- **(Recommended!)** Write the make-up test.
  - If you choose this option, your grade on the make-up test will "replace" your grade on the missed test, including the preferential weighting for your higher test grade as described above.
- **(Not recommended!)** Don't write the make-up test.
  - If you choose this option, the term test that you do write will be worth 20% of your final grade, and the final exam will be worth 60% of your final grade.
  - Note that you cannot choose this option if you start writing the make-up test. In other words, you cannot decide to have your make-up test not count if you start writing it.

If you miss both term tests, you will write the make-up test, which is **not** optional in this case. In this case, the make-up test will be worth 25% of your final grade, and the final exam will be worth 55% of your final grade. If you miss both term tests *and* you miss the make-up test, we will normally record a grade of zero for the make-up test (which, again, in this case is worth 25% of your final grade), and your final exam will be worth 55% of your final grade.

To reiterate, if you miss both term tests and the make-up test, 25% of your final grade will normally be a zero, automatically.

A note on the value of tests

It is recommended that you write the two regular term tests if you are at all able. If you miss a term test, you will miss out on receiving valuable feedback earlier in the course. Also, the material on the make-up may be different than the material tested on the missed test.

In the past, students who wrote all of the the regular term tests tended to do better in the course. Although we do not set out to make our final exams more difficult than term tests, students often find them more difficult, likely due to the larger amount of material being covered. We often hear about students who miss a test and believe they will study extra hard and make up for it on the final, but that rarely works out in the student's favour. It is therefore highly recommended to write both of the regular term tests if possible.

For those who must miss a test (for example due to illness), writing the make-up test provides an opportunity to not have as much weight on the final exam grade.

Missed Final Exam

Students who cannot complete their final examination due to illness or other serious causes must file an online petition **within 72 hours of the missed examination**. Late petitions will **NOT** be considered. Upon approval of a deferred exam request, a non-refundable fee of $72 is required for each examination approved.

Academic Integrity

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto Mississauga is a strong signal of each student's individual academic achievement. As a result, UTM treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters outlines behaviours that constitute academic dishonesty and the process for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course, or more than once in the same course, without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.
3. Misrepresenting your identity.

In academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources.

Generative AI

The use of generative artificial intelligence tools or apps for assignments in this course, including tools like ChatGPT and other AI writing or coding assistants, is prohibited unless explicitly and specifically called for in a given homework problem.

Plagiarism Detection

Normally, students will be required to submit their course essays 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 essays 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 this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

Students may wish to opt out of using the plagiarism detection tool. In order to opt out, contact your instructor by email no later than two (2) weeks after the start of classes. If you have opted out, then specific information on an alternative method to submit your assignment can be found below.

Informed Consent – Email Lists

As a student enrolled in this course, you understand that you are providing your implicit consent to be included in an email list for the department to send you non-essential information from time to time. If you do not wish to be included in such an email list, please request to be removed by contacting one of the Academic Advisors & Undergraduate Program Administrators. Their information can be found on the MCS Website Contact Us page .

Final Exam Information

Duration:	3 hours

Additional Information

Inclusion & Accessibility

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.

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.

At UTM, the Accessibility Office can provide more information about accessibility accommodations for students.

Weekly Cycle

This course is taught in an *active learning* style. This means that you will be learning the basics on your own **before** class, and in class you will **participate** in working on a variety of activities, problems, and examples. Studies have shown that courses in which students actively participate throughout lead to better results, and in particular that students learn more in such an environment than in a passive, "lecture-style" environment.

A typical week in MAT137

- **Before class**
  - Watch an assigned set of videos from the MAT137 YouTube channel. These videos will serve as your first introduction to the course content. You'll learn definitions, see some theorems, and some basic examples. You're encouraged to take notes on these videos.
- **During class**
  - Participate in polling questions (via MathMatize, graded for participation), and other non-polling questions.
  - More generally, work on problems, both individually and with your colleagues, which have been designed to help you make sure you understand the subtle points in the material and be ready to solve homework problems.
- **After class**
  - In tutorials, you will work on a variety of problems: some computational, some conceptual. Your TA will help you work on these problems, and then take some of them up.
  - Work on practice problems, which will be provided on Quercus and divided in correspondence with the YouTube video playlists.
  - Work on homework assignments.

During any given week, students can consult the Weekly Guides on Quercus to help you keep track of what needs to be done, and by when.

Tutorials

Tutorials will begin during the week of **September 11**. All students must be enrolled in a tutorial section, and should only attend the tutorial in which they are enrolled.

The primary purpose of tutorials is to give students an opportunity to ask questions and work through examples together with your colleagues and your TA. The tutorials in this course should **not** be thought of as optional, as they will contain valuable examples, and extra writing and computational practice beyond what is covered in lectures.

Each week we will post a worksheet that your TA will have you work on, either in small groups or independently, and then discuss the how to approach and solve some or all of those problems *after* you have worked on them. These worksheets will be posted in the Weekly Guides at least a few days before the week's tutorials. To get the most from tutorials, you should review lecture

material and attempt the assigned tutorial problems *before* each week's tutorials. These problems will help you understand the material, practice computational skills and mathematical writing skills, solve your homework problems, and prepare for tests and exams. Specifically, there will be a variety of writing activities in tutorials which intersect with parts of your homework. The aim of these activities is to help support your mathematical writing, which will improve your overall course grades.

Help and other Resources

If you need help in MAT137, there are many resources available to you. Please don't hesitate to ask us for help as soon as you need it, and try not to let yourself fall behind, particularly in the first two weeks of the course! Here are some options for help.

Office hours

All instructors and TAs will be available for extra help outside of lecture/tutorial hours. Certain times will be designated drop-in hours, during which any student (from any lecture section) should feel free to come by questions. Special meetings with instructors can outside those times can be booked ahead as necessarily, and as time allows.

Details for when and where office hours take place can be found on Quercus on the Office Hours page, linked from the homepage.

Discussion board - Piazza

In this course we will be using Piazza for discussions about math. It is a FREE online discussion forum, where you can post questions related to the course and get answers from instructors, TAs, and other students. Using Piazza is completely optional; however, it is a great place to get help from fellow students and see what questions others are asking as well! Rather than emailing questions to the teaching staff, we encourage you to post your questions on Piazza.

See the Piazza page on the Quercus (linked from the homepage) for details.

In addition:

- You will have opportunities to ask questions in tutorials.
- You may find working in a small study group can be very helpful.
- The Math Learning Centre (MLC) is located in DH2027. This is where your TAs will hold their office hours, but outside of those times it is also available as a drop-in centre for math questions. No appointments are required to talk to any TA in the MLC (though TAs who are there for other courses will naturally prioritize students from those courses). A complete schedule of when TAs are in the MLC will be posted on Quercus on the Office Hours page.
- The Robert Gillespie Academic Skills Centre (RGASC) offers individual consultations, workshops, and a wide range of programs to help students identify and develop the academic skills they need for success in their studies. Visit the RGASC website to explore their online resources, book an online appointment, or learn about other programming such as Writing Retreats, the Program for Accessing Research Training (PART), Mathematics and Numeracy Support, and dedicated resources for English Language Learners.

Email Policy

Instructor and TA email addresses can be found on the Contacts page on Quercus, linked from the home page. Before you send an email to any course staff, please check if the answer to your question is in this syllabus or on Piazza.

For general course questions (questions that don't involve personal information), and in particular for any questions *about math*, please make a post on **Piazza**. As a courtesy to your fellow students, first check if another student has already asked the same question, and if not please give your post a descriptive title, referring to the assessment and question number if applicable. We will not answer questions about math over email.

For questions about grades, questions involving personal information, you **must** email us from your U of T email address only. **Please include "MAT137" in the subject line.** Here's whom you should email:

- For logistical questions about the course as a whole and questions concerning your grades, email the course coordinator

(Ivan Khatchatourian).

- For tutorials and tutorial activities only, email your TA. (Math questions should go on Piazza though!)

Technology requirements/recommendations

- All lectures and tutorials are planned to be in-person. However, there are circumstances in which a class or tutorial may need to be delivered online via Zoom, such as an instructor or TA being ill. In addition, some office hours may have to move online on short notice. Please register for a Zoom account using your UTORid and password at https://utoronto.zoom.us.
- As described above, please bring a device to every class that can access the internet, so you can participate in polling.
- You should have access to a camera (such as a smartphone camera) or scanner, in order to upload your homework assignments to Crowdmark. If you're using a camera, we recommend finding a "camera scanner" app to facilitate taking clear, easy to read images of your pages. If we cannot read your photos/scans, we cannot grade them!

Since it is possible that some lectures or tutorials may have be delivered online in certain circumstances, we include the following notice:

Some lectures or tutorials in this course, including your participation in them, may be recorded on video and made be available to students in the course for viewing remotely 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 recording and use of videos in which you appear, please contact your instructor.

Copyright Policy

Course materials (such as notes, assignments, worksheets, and so on) prepared by the instructor(s) are considered by the University to be an instructor's intellectual property covered by the Copyright Act, RSC 1985, c C-42. These materials are made available to you for your own study purposes, and cannot be shared outside of the class or "published" in any way. Lectures, whether in person or online, cannot be recorded without the instructor's permission. Posting course materials or any recordings you may make to other websites without the express permission of the instructor(s) will constitute copyright infringement. Please note, posting homework and/or test questions to online forums outside of our course discussion board (Piazza) constitutes a copyright violation, and may also constitute an academic offence.

Course Schedule

See the Course Outline and Schedule page on the course website for a schedule of topics and a list of exact due dates for all assessments.

Last Date to drop course from Academic Record and GPA is November 6, 2023.