Textbook: *OpenStax Calculus Volumes 2 & 3* Tutorials: Starting Monday, Jan. 20

Webpage: https://q.utoronto.ca

The *Calculus* revolutionized modern science when Newton and Leibniz invented it. Not only did the Calculus provide ways to model and compute previously difficult-to-understand phenomena, it also presented a new way to conceptualize the world.

In your previous Calculus course, you studied *derivatives*, or rates of change. In this course, we will study the derivative's companion, the *integral*, as well as ways to apply derivatives and integrals to approximate functions (e.g., Taylor series approximations) and to model via differential equations.

The *Calculus* has been extremely successful, and most of the mechanical procedures needed for doing Calculus have been automated by computers (e.g., Wolfram Alpha). Because computers remove much of the need to memorize complicated procedures, this course will focus on the ways that framing questions in terms of calculus can help us solve problems. We will also focus on how to communicate mathematics to others, which is especially important in the Engineering domain.

Learning Outcomes

After taking this course, you will be able to:

- Apply the methods of calculus, especially integral caculus and differential equations, to solve novel problems.
- Use approximations to simplify complex problems.
- Model and solve real-world problems using differential equations.
- Solve basic integrals using standard techniques like integration by parts, trigonometric substitution, and partial fractions.

To Succeed

Learning is hard! It is exercise for the mind, and like exercise, when you're doing it, it feels pretty uncomfortable. Here are some tips to help you succeed academically (getting the grade you want) and intellectually (learning the most you can).

- Form a regularly-meeting study group of 3–4 people. Math should not be done in isolation! You need others to bounce ideas off of and to motivate you when you're feeling down.
- Do your *Pre-Class Essentials* reading. A good rule of thumb is *every hour spent studying before class is worth two hours of studying after class.*
- Force yourself to explain. When reviewing, it's easy to glance at a solution and think, "Oh yeah, I knew that." Don't do it! Force yourself to explain each problem/concept without referencing a solution. Be patient with yourself—it might take 5 or 10 minutes before it finally comes to mind, but studying this way will be significantly more effective.

Prereq's

To be prepared for this course, you need to have a solid understanding of Calculus I (MAT186). If you're feeling shaky on your foundation, start reviewing earlier rather than later.

Homework

Like in MAT186, this course will feature homework assignments that will not be turned in. However, these assignments are not optional—they are an essential tool for properly learning the course material.

Assessment

Reflections 2%

The only way to learn mathematics is by doing mathematics. In this course you are asked to be an active agent in your own learning. You are expected to be present in all sessions of your lectures and tutorials. During lectures, you will be working on problems and sharing your ideas. Some lectures will end with a reflection activity; these activities will compose your *Reflections* mark.

Pre-Class Essentials (PCEs) 10%

Pre-Class Essentials (PCEs) are assigned readings or videos, followed by a short quiz. You are expected to do the PCE reading and check in before each lecture. There will be about 30 Pre-Class Essentials (PCEs). The due dates will be posted on Quercus. Your lowest *six* scores will be dropped.

Midterm 38%

There are two equally weighted midterms scheduled as well as a Universal Makeup. The dates are Tuesday, Feb. 04 and Thursday, Mar. 06 and Thursday, Mar. 27.

The Universal Makeup will serve as a makeup test for any midterms you may have missed with an approved petition. However, you may *optionally* write the Universal Makeup even if you didn't miss a test. If you do so, the score of your lowest midterm will be replaced by a 50/50 mix of your lowest midterm score and your score on the Universal Makeup.

Final Exam 50%

A comprehensive final exam will take place during the final exam period. The date and time will be determined by FASE.

Your course mark will be computed as a weighted average of your mark in each category. (See the left column for the weights.)

Missed Assessments

The petition policy of the Faculty of Applied Science and Engineering can be found at `http://uoft.me/petitions`. Petitions must be filed for all missed work unless stated otherwise.

Any foreseeable circumstances must be reported at least three weeks in advance. For example, "I had a varsity sports game yesterday" is not acceptable since sports games are scheduled weeks ahead. As soon as you know about scheduled events you should look at your academic obligations and notify the coordinator of conflicts.

Pre-Class Essentials (PCEs)

Since the lowest *six* PCE scores are dropped, if you miss at most six PCEs, you do not need to submit a petition. If you miss more than six PCEs, you must submit a petition for every missed PCE.

For example, if you missed 5 PCEs, you do not need to submit any petitions. If you missed 8 PCEs, you must submit 8 peititions.

Tests

If you submit a petition for a missed test and it is accepted, the weight of your missed test will be redistributed to your final exam.

Email & Etiquette

We will try to respond to emails as soon as possible, but during busy times (like before an exam) it might take several days to respond. If your situation is urgent, talk to a professor after class or in office hours.

When writing an email:

- **Put MAT187 in the subject line, use your `utoronto.ca` email, and identify yourself by name and UTORid**.
- **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 come to office hours to discuss it.
- **Check the syllabus and course webpage first**. If your question is answered on the syllabus or the course webpage, we may not respond to your email.
- **Be professional**. Please use appropriate tone and level of formality in your emails. Do not use slang or texting abbreviations. 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.

Lectures & Contacts

There are several lecture sections. (R means Thursday)

Section	Time	Room	Instructor	Email	Office
LEC0101	MW4–5, F1–2	MY 150	J. Siefken G. McGregor	admin187@math.toronto.edu geoffrey.mcgregor@utoronto.ca	PG 101C
LEC0102	TR4–5, F2–3	MY 150	S. Cohen I. Beach	sh.cohen@utoronto.ca isabel.beach@mail.utoronto.ca	GB 148 1/3
LEC0103	MW5–6, F5–6	MY 150	J. Siefken A. Pannu	admin187@math.toronto.edu arman.pannu@mail.utoronto.ca	PG 101C

The course coordinator is Professor J. Siefken. Please email any administrative concerns to admin187@math.toronto.edu.

Office hours for each instructor will be posted on the course webpage.

Tutorials

You must register in a tutorial section through ROSI/ACORN by the end of the first week of classes. Tutorials will begin Monday, Jan. 20.

Attendance in tutorials is mandatory. During tutorials, you will be working on solving complex and novel problems and additionally practicing your mathematical writing. Tutorials are *not about answers* to problems. They are about *practice*. Thus, you shouldn't expect to go over every tutorial problem during a tutorial.

Academic Resources

Accessibility Needs

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 http://www.studentlife.utoronto.ca as soon as possible.

English Language Instruction

For information on campus writing centres and writing courses, please visit http://www.writing.utoronto.ca

Other Resources

Student Life Programs and Services http://www.studentlife.utoronto.ca
Academic Success Centre http://www.studentlife.utoronto.ca/asc
Health and Wellness Centre http://www.studentlife.utoronto.ca/hwc

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 University of Toronto's Code of Behaviour on Academic Matters. 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 the First Year Office.

Schedule

Below is a preliminary schedule for the course. Textbook sections that are prefixed with "V3" refer to *OpenStax Calculus Volume 3*. Otherwise, sections reference *OpenStax Calculus Volume 2*.

Week 1 January 6–12	(A1) Polar Coordinates, (A2) Complex Numbers Textbook: §7.3
Week 2 January 13–19	(B1) Polynomail Interpolation, (B2) Approximating with Taylor Polynomials
Week 3 January 20–26	(B3) Numerical Integration, (B4) Sequences and Series Textbook: §3.6, §5.1–5.2 Tutorials begin.
Week 4 January 27– February 2	(B5-1) Taylor Series, (B5-2) Manipulating Power Series Textbook: §6.3–6.4
Week 5 February 3–9	(B6) Power Series Convergence Textbook: §5.4 **Midterm I: Tuesday, February 4 at 10:10am to 12:00pm**
Week 6 February 10–16	(C1) Integration by Parts, (C2) Trigonometric Substitution Textbook: §3.1, §3.3
Week 7 February 17–23	**Family Day Monday, February 17 (no classes)** **Reading break February 17–22 (no classes)**
Week 8 February 24– March 2	(C3) Partial Fractions, (C4) Improper Integrals Textbook: §3.4, §3.7
Week 9 March 3–9	(D1) Parametric Equations, (D2) Calculus in Polar Coordinates Textbook: §7.1–7.2, §7.4 **Midterm II: Thursday, March 6 at 7:10pm to 9:00pm**
Week 10 March 10–16	(E1) Introduction to ODEs, (E2) Modelling with ODEs Textbook: §4.1
Week 11 March 17–23	(E3) Separable ODEs, (E4) Linear First-Order ODEs Textbook: §4.3, §4.5
Week 12 March 24–30	(E5) Homogeneous Equations Textbook: V3 §7.1 **Universal Makeup Midterm: Thursday, March 27 at 7:10pm to 9:00pm**
Week 13 March 31– April 6	(E6) Non-Homogeneous Equations (E7) Applications of ODEs Textbook: V3 §7.2, §7.3