

# Winter 2023

## MAT187 – Calculus II – Syllabus

### Course Content

Roughly, the content of this course can be summarized as follows: first, we will talk about integration techniques; then, we will work with first and second order ordinary differential equations; next, we will talk about Taylor Polynomials and Taylor Series; and finally, we will talk about functions that depend on one variable (often: time) but give a vector as output (often: a position in space).

This description, however, gives only half the picture. We will study more than just techniques and procedures in this course; we will actually look at the concepts they are built on. What does that mean? It means that we will look into engineering applications and see how the concepts we learn in this class are abstractions of concepts we discover in real life models. We will use this connection to work on engineering problems using our newly expanded “math toolbox.”

A detailed overview of the course content can be found on the next page.

### Learning Goals

You should become fluent in various concepts related to Calculus as outlined in the list of modules on the next page. This means you should be able to ...

- ... understand the meaning of these concepts and see why they are applicable in certain situations.
- ... use these concepts to study the properties of a system in physical and engineering applications.
- ... critically analyze your results based on these concepts to check whether or not they make sense.

We want to train you in the **art of problem solving**. In your future career as an engineer, you will see problems that you have not seen before. We want you to be **able to figure out by yourself** how to adjust the methods you know to fit new situations and to be confident of your solutions. You can only achieve this by **understanding concepts** rather than memorizing formulas and methods.

We want to train you in the **art of team work and communication**. As future engineers, you will serve an important role at the boundary between science and its applications. You will **have to talk to** business partners, manufacturers, designers, construction workers, investors. You will need to be able not just to arrive at correct mathematical answers but **make others understand you, believe you, and trust you**.

### Textbooks

STRANG AND HERMAN: *OpenStax Calculus Volume 2*. (2016)

<https://openstax.org/details/books/calculus-volume-2>

STRANG AND HERMAN: *OpenStax Calculus Volume 3*. (2016)

<https://openstax.org/details/books/calculus-volume-3>

Available **for free** as...

...an interactive online textbook

...a downloadable PDF

...an app

If you prefer a printed copy, you can have the PDF printed (in part or in whole) at the U of T bookstore (or any other copyshop). No worries, doing so is completely legal according to the license of the book.

## Content Overview

The course content is divided in six modules based on the topic. The modules are labelled by A to F. We will not spend an equal amount of time on every module. The letters CV2 and CV3 refer to “OpenStax Calculus Volume 2” and “OpenStax Calculus Volume 3”

**Textbook**

### A Integration methods

A1	Integration by parts	CV2, 3.1
A2	Trigonometric Substitution	CV2, 3.3
A3	Partial Fractions	CV2, 3.4
A4	Numerical Integration	CV2, 1.1/3.6
A5	Improper Integrals	CV2, 3.7

### B Applications of Integration

B1	Riemann Sums	CV2, 1.1/1.2/2.*
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### C First order ODEs

C1	Introduction to ODEs	CV2, 4.1
C2	Separable ODEs	CV2, 4.3
C3	Linear First-Order ODEs	CV2, 4.5
C4	Qualitative Analysis of ODEs	CV2, 4.1/4.2
C5	Modelling with ODEs	CV2, 4.4

### D Second order ODEs

D1	Homogeneous Equations	CV3, 7.1
D2	Non-Homogeneous Equations	CV3, 7.2
D3	Applications	CV3, 7.3

### E Taylor Series

E1	Approximating with Taylor Polynomials	CV2, 6.3
E2	Taylor Series	CV2, 6.3
E3	Ratio Test for Convergence	CV2, 5.6/6.1
E4	Manipulating Power Series	CV2, 6.2/6.4

### F Vector Valued Calculus

F1	Parametric Equations	CV3, 7.1/7.2
F2	Polar Coordinates	CV2, 7.3
F3	Calculus in Polar Coordinates	CV2, 7.4
F4	Vector Valued Functions	CV3, 3.1/3.2
F5	Arc Length	CV3, 3.3
F6	Normal Vector and Curvature	CV3, 3.3
F7	Motion in Space	CV3, 3.4

## Teaching Team

Instructor	Section	Email
Sa'diyya Hendrickson	LEC0101/Lec0102	<a href="mailto:shendri@math.toronto.edu">shendri@math.toronto.edu</a>
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- See Quercus for the list of TA names and contact information.
- You can find the time and location of lectures and tutorials [here](#).
- Drop-in hours and their location for each instructor will be posted on Quercus.
- If you have a question about any aspect of the course, please follow the *Asking Questions* section in this document.

## Course Website

- The official course page is <https://q.utoronto.ca/courses/291463>

Quercus is our main communication platform. All course material and information, including announcements, tutorial information, TA and instructor drop-in hours (aka office hours or question hours), homework and solutions, pre-class essential readings and in-class reflection surveys, exam details, and all the relevant deadlines and announcements are done via Quercus. Quercus will get updated frequently as the semester progresses. It is **your responsibility** to check it regularly.

- Find our **Piazza** class page [here](#). Piazza is also accessible directly from the course page on Quercus.

We will be using Piazza for class discussions. If you have a math question or a logistic question you should ask it in Piazza (and **not** over email). See the *Asking Questions* section in this document for more instructions. The earlier you start using Piazza, the happier you will be!

## Assessments

Assessment	Weight
Reflections	2%
Tutorial Teamwork	18%
Online Homework	10%
Pre-Class Essentials	10%
Midterms	25%
Final Exam	35%

- **Lecture Reflections.** 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 asked to work on problems with help of your peers, and share your ideas with the class. Some lectures will end with a reflection activity. The content and format will vary and depends on the activities you done in class that week.
- **Tutorial Teamwork.** Tutorials are weekly sessions facilitated by your TAs. During tutorials you will work in groups on a tutorial worksheet. The worksheet will cover a variety of standards such as basic computations, core concepts, analysis of ideas, and mathematical language. The specifics for each worksheet will vary. In tutorials, time will be dedicated to working on tutorial worksheets, including giving and receiving feedback from TAs and classmates. At the end of each tutorial, you will submit your work, as a group. There may be a re-submission chance for some of the worksheets. You will receive feedback and a grade on your submission. **Worksheets will be graded with a focus on the demonstration of the understanding of the learning objectives (standards) covered in each question. You can demonstrate your understanding by explaining your steps.** For example, you would receive full points if you explain the issue that you are facing or explain what you tried to solve the question but didn't work and your explanation demonstrates your understanding of the learning objectives, and you can receive no mark if you only submit a correct final answer without a clean explanation of what took you there. If you, together with your group decide to resubmit a worksheet you should meet as a group outside of the tutorial to work on the re-submission. At the end of the semester, your best nine submissions are worth 2% each.

**Don't skip LECTures and TUTorials.** Each *one* hour of attending LEC and TUT easily saves you *several* hours of studying by yourself.

- **Online Homework (WeBwork).** There will be five WeBWork assignments. Your lowest score will be dropped. Please see the WebWork page (accessible from our Quercus site) to see the due dates and your grades. WeBWork due dates and grades will not be reflected accurately on Quercus.
- **Pre-Class Essentials (PCE).** PCEs are assigned readings or videos, followed by a quiz. You are expected to do the PCE before each lecture. There will be about 30 Pre-Class Essentials (PCEs). Your lowest six scores will be dropped. See our Quercus page for the due dates.
- **Exams.** There will be two midterms and a final exam. Details on the exams will be announced later.

## Missed Evaluations

The petition policy of the Faculty of Applied Science and Engineering can be found at <http://uoft.me/petitions>. Do not wait to read these rules until an issue (like illness) arises. Read them now so that if things actually happen, you already know how to proceed.

**It is an academic offence to feign illness to skip any coursework.**

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.

TAs are not authorized to give any kind of accommodation.

### Missing PCEs

We are dropping your lowest six PCE marks. Therefore, **you do not need to submit petitions** unless you had a legitimate reason to miss more than six PCEs. In that case, you need to submit a petition for **all** occasions that you missed. If you receive a zero on a PCE due to having committed an academic offence, that zero will not be dropped.

If you miss more than six PCEs and have a valid petition for *all* occasions (including the “first six missed” PCEs), the remaining PCEs will be reweighted accordingly.

**To clarify again:** Filing up to six petitions for PCEs will have no effect since the lowest six scores, including zeros, are dropped anyways, with or without petition. The rules described above are supposed to **save you from the hassle of filing petitions**. They are not an additional way to excuse missed work. Of course, if you have more than six valid PCE petitions, all of them will be honoured.

### Missing WeBWork

The same rules as for PCEs apply, by replacing “six PCEs” with “one WeBWork set”.

### Missing a Test or the Exam

If you miss a test without a valid petition, you will receive a grade of zero.

If you miss a test and a petition for it is deemed valid, we will redistribute your marking scheme at the discretion of the course coordinator.

Regarding the final exam, there are dedicated faculty policies around petitions. Please refer to the faculty rules.

### Missing Teamwork (tutorial)

If you have a petitionable reason to miss teamwork during tutorial, you must do two things: File a petition in the system **and inform all your teammates in an email CCed to [admin187@math.toronto.edu](mailto:admin187@math.toronto.edu)** and **your TAs** at least one hour before your tutorial. You only need to inform us *that* you filed a petition. You do not need to explain *why* you did so.

### “Ghosting” your team

Generally, keep in mind that your team members depend on you. Be nice to each other and considerate of each other’s study schedule and workload. You are considered to have “ghosted” your team if you don’t show up to your tutorial and you don’t send a petition notification email as explained above, or at any time you don’t reply to an email from one of your teammates regarding a worksheet re-submission within 36h.

If you “ghosted” your team, you will be removed from the team for at least one subsequent tutorial, that is you won’t be able to submit your tutorial work for at least one subsequent tutorial. You can still attend your tutorial to work individually and ask questions from your TA, however your work will not be accepted for grading.

## Asking Questions

Our goal is to have all of your questions answered in a timely manner and to encourage you to ask more math questions. If your situation is urgent, talk to your professor during their drop-in hours (office hours), or come to the course coordinator’s drop-in hours (office hours). You can find details about time and location of drop-in hours on Quercus. In all other cases, if you have a question please follow the following procedure:

- All mathematical and administrative questions about the course should be asked on Piazza. Your question and the responses will be visible to all students and the teaching team. You should choose the most relevant folder in Piazza for your question.
- If you do not get an answer to your posted question on Piazza or, if your question contains personal information that cannot be shared with the rest of the class (for instance, if you have a question about your grade), then ask your question directly by emailing one of our head TAs. Your TA will either respond directly or will forward your question to another member of the teaching team who can address it.
- If, after emailing your TA, you still do not have an answer to your question, forward the email you sent to your TA to [admin187@math.toronto.edu](mailto:admin187@math.toronto.edu), or directly to your professor. Your course coordinator will check [admin187@math.toronto.edu](mailto:admin187@math.toronto.edu) on a weekly basis.
- Once again, if your situation is urgent, talk to your professor after class or in their drop-in hours (office hours), or come to the course coordinator’s drop-in hours (office hours). Note that [admin187@math.toronto.edu](mailto:admin187@math.toronto.edu) is not suitable for urgent emails.

### Emailing Etiquette:

- You should always use your utoronto email address for all university related communication, including MAT187.
- Put MAT187 in the subject line followed by the subject of your email. For example “MAT187-Midterm 1 regrade request”.
- Include your full name and your utorid in your email.
- Always check the course syllabus, Quercus, and Piazza for the answer to your question. If your question is answered on the syllabus, Quercus, or Piazza, we may not respond to your email.
- Your email is a professional conversation between you and a member of the teaching team of course administration. Please use an appropriate tone and level of formality in your emails. We reserve the right to not consider an email that is written unprofessionally.
- Note that we will not answer any math questions over email. All such questions should be publicly asked on Piazza or during drop-in hours.

## How to Succeed

This course is arranged along modules. You will encounter each module in five different stages, gaining more and more independence.

	hours/week	
	contact	self-study
<b>1. Pre-class essentials. Learning the basics through self-study.</b> Before each class you will spend about 30 minutes learning about the elementary concepts of the module. Afterwards, there will be a short quiz with one or two questions. The quiz is designed so that it is straightforward if you have studied the pre-class essentials. <i>Essentials are essential.</i> In class, we will assume that you have done the pre-class essentials. If you did not do so, you will quite likely not be able to follow class.	0	1.5
<b>2. Classroom. Applying the basics and diving in deeper.</b> Class takes place in MY150 in an active classroom setting. It will be a mix of the instructors introducing concepts and everyone working in groups. Each class will be supported by at least two instructors and three TAs. <i>Lecture slides.</i> When possible, we will publish lecture slides before class on Quercus. <i>Assigned seating</i> will be used in the classroom. You will be able to elect to sit in a “No Distraction Zone” if you prefer. In this zone, snacks, phones and other distractions are not allowed.	3	0
<b>3. Tutorials. Working in teams on tutorial worksheets.</b> Weekly tutorials are facilitated by TAs. Every week, you will work on a worksheet in groups. You will then receive feedback on those worksheets. This is intended to be a <i>formative</i> assessment. This means: You will not be assessed for only correctness. Instead, the worksheets are intended to help you learn and grow. What matters most is that you explain your approach, no matter if it is correct or not. Presentation counts! In the tests, part of the marking will be based on how well you present and explain your solutions; tutorial worksheets provide good practice for you. There will be a few re submission opportunities. As a team, you can decide whether you wish to resubmit a worksheet that is open for re-submission. If you decide to do so, you will be working on your re-submission outside of the tutorial time. <i>Tutorial time is question time.</i> As you are working on the tutorial worksheet, use it as a chance to talk to TAs and ask any questions about the course material. <i>Check your tutorial assignment.</i> You must attend the tutorial that you are assigned to according to ACORN. Otherwise you won't be able to receive credit for teamwork.	1	1
<b>4. Studying. Solidifying your knowledge with on-demand support.</b> Based on the classroom and tutorial experience, you will now have an idea which concepts are clear to you and which you should work on. There are many resources at your disposal to help you study. You can ask questions on the course's Piazza page and all instructors offer designated “Drop in hours” for your support. <i>Suggested problems</i> can be found on Quercus. Note that the textbook exercises are very basic exercises and that the tutorial worksheet exercises are more indicative of what is expected in a term test. <i>Study smart.</i> Your learning experience in this course will improve dramatically if you follow a schedule that distributes the load across your thirteen weeks, rather than falling behind and trying to catch up right before exams. Study math at least two or three times a week, every week.	mileage varies*	
<b>5. Assessments. WeBWork, Teamwork, Tests.</b> You can find more details on the assessments in this course under “Assessments” in this document.	mileage varies*	

\* The time you need depends on your own learning experience. However, in addition to the 1.5 hours for the essentials, you should spend at least 3.5 hours per week studying for this course.



## Important Tools



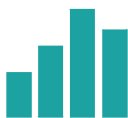
**Quercus** is the central repository from which all course content can be reached. It is where we will post the PCEs, the lecture material, Zoom links, PDF copies of all assessments, study advice, drop-in hour info, this syllabus, etc. Whatever you are looking for, you can probably find it here.



**Zoom** is our meeting software that we may use for office hours or other virtual sessions.



**Piazza** is our discussion board. Do not hesitate to ask questions on here. It's a great place to both ask questions and to help each other out. Instructors and TAs will also be available to answer questions.



**Gradescope** is our assessment submission and grading software. All Team Worksheets and Tests will be administered via gradescope.

Make sure that you use [gradescope.ca](https://gradescope.ca)  and not [gradescope.com](https://gradescope.com) (different servers).



**Wolframalpha** is a computational tool that can solve many math (and other) problems thanks to its vast *procedural* knowledge. On the other hand, it can not *conceptualize*. The fact that computers can't do that is one of the reasons why MAT187 focusses on concepts instead of procedures.



**Desmos** is a free online plotting tool that can be a great help when you are trying to visualize functions and their graphs. It can visualize derivatives, Riemann sums, integrals, tangents, intersections, and many more things. You can even create art with it, in particular when plotting polar curves! You can start with  $r = \sin(8\theta)$ .

## Accessibility Needs

The University of Toronto is committed to accessibility and making MAT187 accessible to everyone is very important to us. If you require accommodations, or have any accessibility concerns about the course, the classroom, or course materials, please contact Accessibility Services as soon as possible at <http://www.studentlife.utoronto.ca/as>.

You are welcome, but are in no way obliged, to speak directly with us about any accommodations you require. You can rest assured of our confidentiality.



## Copyright Notice

You must not take audio recordings or video recordings of lectures or tutorials unless you received the *written* consent of the person whose work you are recording (consent will normally be given for accessibility reasons).

There are on-campus and off-campus enterprises out there that offer so called “course preparation” and that will ask you to provide course material to them, sometimes in exchange for money, sometimes in exchange for “free help”, sometimes without any direct benefit to you. You must not share the material of this course with such enterprises. There are two main reasons for this:

1. You would help companies to **rip off students** by making money from selling our material. Material that we provide for free to the students of our course.
2. **Think about how you would feel** if you wrote a book and then someone else sold it for money for their gain. That’s how we feel when you give them our material.

For these reasons the copyright holders hereby **explicitly deny the right** to share the course material with anyone who is not enrolled in the course. If you do so, you will get into legal trouble, and depending how you shared what material you will also face academic disciplinary action.

## Mental Health and Wellness

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. I encourage you to seek out these resources early and often.

You can find resources at <http://studentlife.utoronto.ca/hwc>

If, at some point during the year, you find yourself in need of immediate support, visit the **Feeling Distressed Webpage**: <http://www.studentlife.utoronto.ca/feeling-distressed>, for more campus resources.

Immediate help is available 24/7 through U of T’s My Student Support Program in 35 languages. You can call via phone or wifi or even chat using the app. Details can be found at <https://studentlife.utoronto.ca/service/myssp/>

All students in the Faculty of Engineering have an Academic Advisor who can advise on academic and personal matters. You can find your department’s Academic Advisor here: <http://undergrad.engineering.utoronto.ca/advising-support-services/academic-advising/>

## Academic Integrity: Why It Matters

We at U of T want you to feel proud of what you accomplish as a student. Please respect all of the hard work you're doing this term by making sure that the work you do is your own.

We don't expect you to score perfectly on the assessments and there will be some things that you may not know. Using an unauthorized resource or asking someone else for the answer robs you of the chance to later feel proud of how well you did because you'll know that it wasn't really your work that got you there.

Success in university isn't about getting a certain mark, it's about becoming the very best person you can by enriching yourself with knowledge, strengthening yourself with skills, and building a healthy self-esteem based on how much you've grown and achieved. No one assessment captures that but your conscience will stay with you forever. Make yourself and your loved ones proud of the student that you are by conducting yourself honestly at all times.

The text above outlines why academic integrity is so important to us, to the university, and to the professional engineering society, and why it should also be important to you. We know that the vast majority of students are honest. If you are one of them, we want to say that we appreciate this and thank you for your commitment to learning! Honouring the achievements of hardworking students like you is one of the major reasons why we implement the policies below. Honesty always pays off in the long run!

**If you are experiencing personal challenges that are having an impact on your academic work, please do NOT commit an academic offence. Instead, talk to us or your academic advisor. We are very understanding and happy to help if you are facing any issues. There is never a valid reason for committing an academic offence. Please talk to us!**

## Academic Integrity: The Fine Print

Familiarize yourself with the University of Toronto's Code of Behaviour on Academic Matters, available at <https://www.academicintegrity.utoronto.ca/>.

You are expected to know the rules. Not being aware of a rule is not an acceptable excuse for not having followed it (just as in "real life").

If you have any questions about what is or is not permitted in this course, please do not hesitate to contact us.

As specified on the first page, usually your lowest PCE and WeBWorK scores are dropped. These rules do **not** apply for assessments in which you committed an academic offence and received a sanction of "zero on the assessment". Such an assessment will always receive the highest weight possible according to the rules of the syllabus.

Potential offences include, but are not limited to:

- Posting assessment questions on any kind of website/online forum to solicit help,
- Using someone else's ideas or words without appropriate acknowledgement,
- Looking at someone else's answers during an exam or test,
- Misrepresenting your identity,

- Obtaining or providing unauthorized assistance on any assignment (this includes working in groups on assignments that are supposed to be individual work),
- Falsifying or altering any documentation required by the University, including (but not limited to) forms related to a petition.

**It is an Academic Offence both to receive or to provide unauthorized assistance.** It does not matter if you “helped” or “were helped”.

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. Every year, students get expelled from the University of Toronto for academic offences.

Remember that you enrolled in University to learn something.