

Course Syllabus

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Section 201: MWF 12:00-12:50. Credit value: 3 credits.

Instructor: Professor I. Laba

- **Bio:** Ph.D. 1994 (University of Toronto). At UBC since 2000. Full Professor since 2005.
- **If you're not sure what you should call me**, please use "Professor".
- **Online office hours:** Tuesdays 10:30-11:30 starting Jan. 13. See the Zoom link on the course sidebar. Usually, I will also be available for questions after each scheduled class.
- **TA office hours:** schedule will be posted soon.
- **Contact information:** For **general questions** about course material and homework, please use Piazza or Discussions on Canvas. For **individual and confidential matters** such as academic concession, please use Inbox -> Conversations on Canvas. Inquiries submitted on evenings and weekends will be answered on the next business day.

Prerequisites: A score of 68% or higher in MATH 226.

Course-level learning objectives:

- Learn advanced concepts of multivariable calculus, including differential geometry of curves and surfaces, line and surface integrals, the fundamental integral theorems, and the general framework of differential forms.
- Explore the connections between "visible" geometric features of objects and their mathematical expressions.
- Use multivariate calculus to solve mathematical questions related to motion in space, force fields, electromagnetism and fluid dynamics.
- Practice high quality mathematical writing, including constructing and writing formal mathematical proofs.

Course topics and corresponding textbook chapters:

- **Vector-valued functions and curves (Chapter 12):** curves, velocity, acceleration, arc length, curvature, tangent, normal, binormal.
- **Vector fields and line integrals (Sections 16.1-16.4):** vector fields, field lines, conservative fields, line integrals.
- **Surface integrals (Sections 16.5-16.6):** surfaces, surface area, flux integrals.
- **Integral theorems (Chapter 17):** gradient, divergence and curl, vector identities, divergence theorem, Green's theorem, Stokes' theorem, applications.

- **Differential forms (Chapter 18):** differential forms, exterior derivative, generalized Stokes's Theorem.

A more detailed tentative schedule of class topics covered each week [is posted here \(https://canvas.ubc.ca/courses/176974/pages/tentative-course-schedule\)](https://canvas.ubc.ca/courses/176974/pages/tentative-course-schedule). Recommended practice problems for the semester are [posted here \(https://canvas.ubc.ca/courses/176974/pages/recommended-practice-problems\)](https://canvas.ubc.ca/courses/176974/pages/recommended-practice-problems).

Course structure and learning activities:

- **Lectures, MWF 12-12:50:** the lectures will provide an introduction to the material (the main points, frequently asked questions, problem-solving techniques, mathematical proof, issues related to good mathematical writing). Questions in class are encouraged and I will try to address them as we go.
- **Course notes and textbook:** see below.
- **Online discussion boards:** If you have questions about the course material or homework, your best option is to make a post on Piazza. The TA and/or I will check Piazza at least once every business day, and many questions are answered quickly by other students before we even see them. Discussions on Canvas are also available.
- **Homework (WebWork and Longform):** **WebWork** will be assigned weekly. These are usually short questions, graded automatically, where you only have to provide the correct answer and (sometimes) selected intermediate steps. **Longform assignments** will focus on proofs. They will have only 2-3 questions each, but you will have to include complete, correct, and clearly written explanations and justifications for your work. You will be graded both on the correctness of your mathematics and on the quality of your mathematical writing. The correct answer alone will **not** be sufficient.
- **Midterm and final exam:** see below.
- **Additional practice:** see the [r \(https://canvas.ubc.ca/courses/176974/pages/recommended-practice-problems\)](https://canvas.ubc.ca/courses/176974/pages/recommended-practice-problems) [ecomended textbook problems \(https://canvas.ubc.ca/courses/176974/pages/recommended-practice-problems\)](https://canvas.ubc.ca/courses/176974/pages/recommended-practice-problems) or the practice problems from course notes.
- **Engagement:** Your course participation can include class attendance, reading course notes, posting and answering questions on discussion boards, textbook reading, doing homework (individually or as group work), doing additional practice problems, researching and consulting additional materials, and so on. It is not mandatory to do *all* of this, so that you can participate in class in flexible ways depending on your circumstances and preferences. However, *sufficient* engagement is essential.

Required learning materials

- **Course Notes:** the [notes linked here \(https://canvas.ubc.ca/courses/176974/pages/course-notes\)](https://canvas.ubc.ca/courses/176974/pages/course-notes) were developed specifically for this course and we will follow them closely in class. The notes are based on my lectures and problem sets from the last several years, and were typeset by Caleb Marshall (a former TA in this course) and myself.
- **Textbook:** Robert A. Adams and Christopher Essex, *Calculus: A Complete Course*, 10th edition, Pearson, ISBN-13: 9780135766781. The e-text costs \$67.99 and can be purchased here directly

from Pearson ([see here for instructions \(https://canvas.ubc.ca/courses/176974/pages/pearson-registration-instructions\)](https://canvas.ubc.ca/courses/176974/pages/pearson-registration-instructions).) This is the same textbook that we used for Math 226. Other e-text options are also available, for example some Pearson packages include MyLab coursework. These features could be useful to you as additional practice, but will not be required for credit. **Print textbooks**, including used copies and older editions, are acceptable alternatives and may be less expensive.


- **Alternative textbooks:** Most multivariable calculus textbooks cover a large part of our course material. Some are available freely online, for example the [CLP-4 Multivariable Calculus \(https://personal.math.ubc.ca/~CLP/CLP4/\)](https://personal.math.ubc.ca/~CLP/CLP4/) textbook developed at UBC. Please be mindful that this is a proof-based course, and that some textbooks omit proofs and/or more advanced topics that we will cover. You may have to pay more attention in class and/or have to look up other materials if you are using such textbooks. Please note that this course ends with differential forms (Adams-Essex, Chapter 18), which is not included in most calculus books.
- **Homework assignments** (will be posted on Canvas)
- **WebWork** (must be accessed through Canvas)

Your course grade will be based on homework (30%) and exams (70%). Your **homework grade (out of 30%)** will be based on WebWork (15%) and Longform assignments (15%). Your **exam grade (out of 70%)** will be calculated in two ways: (A) 5% lower midterm score + 15% higher midterm score + 50% final exam, (B) 20% each midterm + 30% final exam. Your exam grade will be the **higher** of (A) and (B). Course grades may be **slightly** scaled at the end of the term.

- **WebWork:** problem sets will be assigned weekly. In order for your grades to be recorded properly, you have to access problem sets through Canvas. To allow for minor issues (such as short illnesses, technical difficulties with WebWork, etc.), the WebWork part of your grade will be 110% of your total WebWork score*, so that you can miss up to 10% of WebWork and still get full credit. (*If this is more than 15 points, your WebWork score will be 15.)
- **Additional WebWork practice:** From time to time, WebWork may also be used for prerequisite review questions, additional practice problems, etc. These are for your own practice and will not be graded. To distinguish them from the required for credit assignments, any additional practice sets will be labelled AP1, AP2, ... , and the required homework sets will be labelled HW1, HW2,
- **Longform homework assignments** will be due tentatively in late January, late February, and late March. Each assignment will be posted at least a week in advance. Your solutions are to be uploaded to Canvas and will be graded online. Late assignments will not be accepted. To allow for minor illnesses and other emergencies, the **lowest Longform score will be dropped** with no questions asked.
- **Midterms** will be held tentatively on **Wednesdays, February 11 and March 11, in class** (same time, tentatively the same classroom). If there are significant scheduling issues (e.g. students writing 3 or more midterms on the same day), please let me know and I can try to reschedule. Please be aware, however, that the UBC exam hardship policy applies only to final exams (not midterms), and that it is not always possible to avoid situations such as having multiple midterms on the same day.

- **The final examination** will be held in April. The date of the final examination will be announced by the Registrar later in the term. Attendance is mandatory, so you should not make any travel plans before the exam date is announced.

Academic concession: The rules and procedures for obtaining academic concession are governed by [UBC Policy V-135 on Academic Concession](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0) (<http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0>). The details in this course are as follows.

- **Late or missed homework:** Late Longform assignments will not be accepted, in order to discourage pile-ups of overdue work, respect the TA's work schedule, and allow the timely posting of solution sets for everyone. To account for minor illnesses and emergencies, the homework grading scheme (see above) allows for one Longform assignment and about 10% of WebWork to be missed with no penalty.
- **WebWork:** All WebWork assignments will have a one-week extension built in. I recommend working on each set as soon as the relevant material has been covered in class, but each set will remain open for at least one more week in case of delays (minor illnesses, technical difficulties, and the like).
- Academic concession requests involving **a missed midterm, two or more missed Longform assignments, or more than 10% of WebWork**, should be submitted as soon as reasonably possible using the [Department of Mathematics Academic Concession self-declaration form](https://canvas.ubc.ca/courses/176974/files/43495580?wrap=1) (<https://canvas.ubc.ca/courses/176974/files/43495580?wrap=1>)  (https://canvas.ubc.ca/courses/176974/files/43495580/download?download_frd=1), and submitted as soon as reasonably possible. The usual remedy will be to have your course grade based on your remaining work.
- Please note that academic concession for certain reasons, such as valid schedule conflicts that can be foreseen, must be requested in advance and may require additional documentation. Personal travel plans and conflicts with work schedule are not valid reasons for academic concession.
- Normally, the self-declaration form can be used only once in a course. Repeated requests for academic concession should be accompanied by supporting documentation and may require a referral to the appropriate advising office.
- **Missing the final exam::** If you miss the final exam for a valid reason such as a medical emergency, you will need to present your situation to the Dean's Office of your Faculty to be considered for a deferred exam. [See the Academic Calendar for detailed regulations.](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,41,94,0) (<http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,41,94,0>) Your performance in a course up to the exam is taken into consideration in granting a deferred exam status (e.g. failing badly generally means you will not be granted a deferred exam). In Mathematics, students usually sit the next available exam for the course they are taking, which could be several months after the original exam was scheduled.

Academic misconduct: UBC takes cheating incidents very seriously. After due investigation, students found guilty of cheating on tests and examinations are usually given a final grade of 0 in the course and

suspended from UBC for one year. [See here for more information.](#)

(<http://www.calendar.ubc.ca/vancouver/?tree=3,54,111,959>)

- While students are encouraged to study together, you should be aware that blatant copying of another student's work is a serious breach of academic integrity. If you use AI tools, please be aware that such tools tend to generate plausible-looking language rather than correct mathematical content. Your final write-up should be your own.
- Academic misconduct includes misrepresenting a medical excuse or other personal situation for the purposes of postponing an examination or quiz or otherwise obtaining an academic concession.

Sharing course materials: We are working hard to provide all the materials you need to succeed in this course. In return, please respect our work. All class notes, assignment instructions, midterm questions and answers, and any other materials provided here are for the students currently enrolled in this course. It is unacceptable to share any of these materials beyond our course, including by posting on file-sharing websites (e.g., CourseHero, Google Docs). Respect our intellectual property and follow [copyright law](#). (<https://copyright.ubc.ca/students/?login>)

Electronic devices in class: I recognize that there are legitimate reasons to use electronic devices in class, for example some students use laptops to take notes. This is permitted, on condition that it should not disrupt the class for everyone else. You may occasionally take photos of the screen or board instead of taking notes. **Recording any part of my classes (audio or video) is not permitted**, except as an accommodation with supporting documentation from the Centre for Accessibility.

(<https://copyright.ubc.ca/students/?login>)

Using generative AI is neither required nor recommended in this course. "GenAI" is a predictive text generator that quotes sentences frequently used in similar-looking contexts, but does not know whether these sentences are true statements in regard to your specific assignment. It might give you the correct answer, or, equally likely, it might give you the exact opposite of it. It does provide mathematical writing templates, but then so do textbooks and the course notes posted here, and they do that without GenAI's impact on the environment.

(<https://copyright.ubc.ca/students/?login>)

Additional help:

- **Piazza and Discussions on Canvas**, see above.
- **I will be available for questions** (a) after each scheduled class, (b) online (Zoom) on Tuesdays 10:30-11:30. There will also be **TA office hours** (schedule to be posted).
- Occasionally, a student may need to make an individual appointment with me or the TA outside of these hours. If this is the case, please make your request at least one day in advance. Our schedules can fill up, so that drop-ins and same-day requests for appointments can be difficult or impossible to accommodate. Please also let me know in advance what you would like to discuss so that we can use the meeting time efficiently.

- **The Mathematics Learning Centre** is a space for undergraduate students to study math together, with friendly support from tutors, who are graduate students in the math department. Details will be posted when they become available.
- **Additional resources for proof writing:**
 - **PLP: An Introduction to Mathematical Proof**, (<https://personal.math.ubc.ca/~PLP/>) by Seckin Demirbas and Andrew Rechnitzer, is a free online textbook that has been used in Math 220 at UBC.
 - **Francis Su's handouts on mathematical writing** (<https://math.hmc.edu/su/writing-math-well/>) include good examples and recommendations. Please don't treat these as strict rules that you have to follow 100% of the time. (Some level of informality is OK in homework assignments, for example you don't have to end every calculation with a punctuation sign. My posted lecture notes are a little bit informal. But this should give you a good idea of how you can make your mathematical writing clear and easy to understand.)
- **Past final exam database** (<http://www.math.ubc.ca/Ugrad/pastExams/index.shtml>), maintained by the Mathematics department.
- **UBC Math Club** (<https://www.facebook.com/ubcmathclub>) sells math exam packages (old exams together with solution sets) for a nominal price before each final exam session.

Weather Contingency Plan for Class Sessions, Midterms, and Exams: Please check ubc.ca (<http://ubc.ca/>) often during bad weather or snow. If a class session is cancelled, the default contingency plan will be to have an online class on Zoom. For those who cannot attend an online class at short notice, a recording will be posted on Canvas. Please check Canvas for information. If a cancellation impacts a midterm exam, we will reschedule to another class time - usually, the next class session that takes place in person. If the final exam is impacted, it will be rescheduled by student services. If you are registered to write exams at the Centre for Accessibility, I encourage you to contact your CFA advisor to discuss the weather contingency plan for this course.

Statement about the University's values and policies, mandated by [UBC Policy V-130](http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,328,0,0) (<http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,328,0,0>): UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available [here](http://senate.ubc.ca/policies-resources-support-student-success) (<http://senate.ubc.ca/policies-resources-support-student-success>).

Course Summary:

Date	Details	Due
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