# MATH 227 201 2020W Advanced Calculus II

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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.
- **Email**: ilaba@math.ubc.ca
- **Office hours:** Wednesday 12-12:50 during the problem session, 15-20 minutes after each class as needed, additional times TBA.
- If you cannot attend regular office hours due to schedule conflict, you can request an appointment. 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.
- The best way to contact the instructor is by email. Please note that email received on evenings and weekends will be answered on the next business day. (If you are not sure how to email a professor, **see here for templates and recommendations. (http://www.math.ubc.ca/~ilaba/teaching/email.html)** )

**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.

**Required learning materials:**

- **Textbook:** Robert A. Adams and Christopher Essex, MyLab Math with Pearson eText - Standalone Access Card - for Calculus: A Complete Course, 9/e, Pearson, ISBN 9780134528724. This package should be available through the UBC bookstore, and gives you

access to the textbook and the additional features* (such as quizzes) for one year. This is the same textbook that was used in Math 226. (*The additional features should be useful to you as additional practice, but will not be required for credit.)

- **The Pearson course ID is** laba92168 . You will need this to register your e-text. For more detailed registration instructions, **see here**.
- **The hard copy version of the textbook:** Robert A. Adams and Christopher Essex, Calculus: Several Variables (or Calculus: A Complete Course), 9th ed., Pearson, ISBN 9780134579788. This is the paper version of the required textbook above, with only minor differences. Used copies and older editions are acceptable alternatives and may be less expensive.
- **Alternative textbooks:** Most multivariable calculus textbooks cover a large part of the material required in this class. Some are available free of charge, see for example **here. (https://aimath.org/textbooks/approved-textbooks/)** However, please be mindful that this is a proof-based course, and that many 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. In particular, this course ends with differential forms (Chapter 17), which most other calculus books do not cover.
- **Homework assignments** (will be posted on Canvas)
- **WebWork** (must be accessed through Canvas)

**Course topics and tentative schedule:**

- **Vector-valued functions and curves (Chapter 11)**: curves, velocity, acceleration, arc length, curvature, tangent, normal, binormal.
- **Vector fields and line integrals (Sections 15.1-15.4):** vector fields, field lines, conservative fields, line integrals.
- **Surface integrals (Sections 15.5-15.6):** surfaces, surface area, flux integrals.
- **Integral theorems (Chapter 16):** gradient, divergence and curl, vector identities, divergence theorem , Green's theorem, Stokes' theorem, applications.
- **Differential forms (Chapter 17):** differential forms, exterior derivative, generalized Stokes' Theorem.

A more detailed tentative schedule of class topics and textbook sections covered each week **is posted here**. Recommended practice problems for the semester **are posted here.**

**Course structure and learning activities:**

- **Textbook:** The required textbook has full and complete explanations of all topics covered in class, as well as a broad selection of practice problems for you to work on (specific recommendations will be posted on a regular basis). For more on the textbook and possible alternatives, see below. Lectures and class notes are intended to supplement the textbook. They will not duplicate or replace it.

- **Lectures and Q&A, Mondays and Fridays 12-12:50, Zoom:** the lectures will provide an introduction to the material (the main points, frequently asked questions about the material, problem-solving techniques, issues related to good mathematical writing). Questions in class are encouraged and I will try to address them as we go. The lecture and Q&A will be recorded and available for asynchronous viewing after class. Prepared class notes will be uploaded to Canvas in advance.

- **Problem-solving sessions and office hours, Wednesdays 12-12:50, Zoom:** normally, I will start these sessions with a presentation of a few worked examples and exercises (about 15-20 minutes). This part will be recorded for later viewing. For the rest of the hour, you will be divided in groups, with the instructor and TA circulating between the breakout rooms and answering questions. You are welcome to use that time any way you like: work in groups on the problem sets assigned for that session, ask questions when the instructor or TA joins your group, etc. **All course-related questions, not necessarily just about the problem set for that day, are welcome in the problem sessions**.

- **Discussion boards:** Both Piazza and Discussions on Canvas will be available. Additionally, the Course Room on Collaborate Ultra is open by default, for those of you who would like to use it to work together online.

- **Homework (WebWork and Longform): WebWork** will be assigned every 1-2 weeks. These are usually short questions, graded automatically, where you only have to provide the correct answer and (sometimes) selected intermediate steps. **Longform assignments** will be due biweekly. They will have only 2-4 questions, but that will include proofs, and 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.

- **Verification by Videoconferencing:** From time to time, I may ask selected students to explain their homework solutions to me, either live or via a recording, with the webcam on.

- **Additional practice:** Recommended textbook problems and additional suggested WebWork (not for credit) will be posted as needed.

- **Engagement:** Your course participation can include live class attendance, participation in the Q&A, watching the recordings of class videos, reading course notes, participation in problem sessions, 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 (see below). However, *sufficient* engagement is essential. Therefore, as part of your course work for credit, I will ask you to describe and reflect on your engagement in this class.

**Suggested learning strategies:** My goal is to try to meet you where you are and be flexible with the learning options available to you. Some possible ways to plan and organize your work are as

follows.

- **If you enjoy live group work and videoconferencing:** Attend the online live lectures and problem sessions. Try to read course notes and/or the corresponding textbook section in advance, so that you are ready to ask questions during the session. Work on your assignments in groups, either on the discussion boards or via videoconferencing (use either your own videoconferencing accounts or the Course Room on Collaborate Ultra).

- **If you prefer working with written materials and/or have low bandwidth:** Read the course notes I will post, work through the textbook following the guidelines in the notes (I strongly recommend that you should have the Adams-Essex textbook, either the e-book or a hard copy, so that it will be easier to be on the same page), participate in discussion boards, download the problem sets for each problem session, try to work through them on your own or in a Piazza chat group, check the posted solution sets afterwards, check with me and/or a TA if you have questions.

- **If you cannot participate synchronously (e.g. time zone conflict) but would still like to take advantage of video resources and group work where possible:** Watch the recorded lectures and Q&A. If there is a question you would like me to answer on video, you can post it on Canvas or email it to me in advance. Otherwise, work with written materials (read the textbook, participate in discussion boards, download the problem sets for each problem session, try to work through them on your own or in a Piazza chat group, check the posted solution sets afterwards, check with me and/or a TA if you have questions).

- **In all of these strategies**, you should also do the assigned homework, download all posted solution sets and compare them to your solutions, and work on additional practice problems as needed.

**Your course mark** will be based on WebWork (30%), Longform homework assignments (40%), the final exam (25%), and two engagement surveys (5%). The grades may be **slightly** scaled at the end of the course.

- **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 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 30 points, your WebWork score will be 30.)

- **Additional WebWork practice:** From time to time, WebWork will 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, the additional practice sets will be labelled AP1, AP2, ... , and the required homework sets will be labelled HW1, HW2, ... .

- **Longform homework assignments** will be assigned biweekly (so that there should be 6 such assignments in total). 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.

- **The final examination** will be held in April. The date of the final examination will be announced by the Registar later in the term. The final exam will be open-book. The length and difficulty level of the exam will be about the same as is customary in this course, so that you should be able to complete it in the 2.5 hour period assigned by the Registar. However, I plan to extend the exam writing period to 24 hours, to allow for issues such as time zone conflicts and internet connectivity problems.

- **Engagement surveys:** twice during the semester, tentatively in early February and again in March, I will ask you to describe your engagement in the course. I will use the results to fine-tune the course structure, and will follow up with you as needed. These will be worth 5% of your grade, with 2.5% given for *participation* in each survey (regardless of your answers).

**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)**. The details in this course are as follows.

- **Late or missed homework**: Late assignments will not be accepted, in order to discourage pile-ups of overdue workload, keep the TA's work schedule consistent, and allow the timely posting of solution sets for everyone. (If you cannot complete an assignment before the deadline for a valid reason, see below.) The only exception is that students who register late in the course will be allowed extended deadlines on the first WebWork and Longform assignments. Please contact me if that is your situation.

- **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. Academic concession requests involving two or more missed Longform assignments, or more than 10% of WebWork, should be accompanied by the **Department of Mathematics Academic Concession self-declaration form (http://www.math.ubc.ca/Ugrad/ugradForm/Student_Declaration_Academic_Concession_MATH.pdf)** and submitted as soon as reasonably possible. The Academic Concession form can be used for medical issues involving you or your family members, as well as other circumstances such as a "challenging emergency/unanticipated situation". I will be interpreting this liberally, and will only require a general description of the situation without personal detail (for example, it suffices to say that you were sick without providing medical details). 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.
- **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)** 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. 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.

**Additional help:**

- **Individual videoconferencing consultations by appointment** are available, on a limited basis, during normal business hours (M-F 9-5, Vancouver time). 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 (e.g. the general nature of your inquiry, the homework or textbook question you'd like to talk about) so that I can look it up before the appointment and we can use the videoconferencing time efficiently.
- **Mathematics Learning Centre** **(http://www.math.ubc.ca/~MLC)** : Usually, the MLC is a space for undergraduate students to study math together, with friendly support from tutors who are graduate and undergraduate students in the math department. More information about MLC operation this year will be posted here once it becomes available.
- **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.

**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)** : 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)** .

# Course Summary:

| Date | Details | |
|---|---|---|
| Mon Jan 25, 2021 | **Longform HW1** (https://canvas.ubc.ca/courses/60621/assignments/735769) | due by 11:59pm |
| Mon Feb 8, 2021 | **Longform HW2** (https://canvas.ubc.ca/courses/60621/assignments/735770) | due by 11:59pm |
| Mon Mar 1, 2021 | **Longform HW3** (https://canvas.ubc.ca/courses/60621/assignments/735771) | due by 11:59pm |
| Mon Mar 15, 2021 | **Longform HW4** (https://canvas.ubc.ca/courses/60621/assignments/735772) | due by 11:59pm |
| Mon Mar 29, 2021 | **Longform HW5** (https://canvas.ubc.ca/courses/60621/assignments/767863) | due by 11:59pm |
| Mon Apr 12, 2021 | **Longform HW6** (https://canvas.ubc.ca/courses/60621/assignments/767868) | due by 11:59pm |
| | **WebWork link** (https://canvas.ubc.ca/courses/60621/assignments/735778) | |