# MATH 226 101 2020W Advanced Calculus I

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**Section 101: MF 11:00-11:50, Wed 11-11:50 or 18-18:50. 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
- **Contact information:** The best way to contact me is (a) by email, or (b) on Canvas. For questions that would likely be of interest to other students (e.g. homework question clarifications), please use Discussions on Canvas. For individual and confidential matters (your homework grades, academic concession), please use either email or Inbox -> Conversations on Canvas.
- Please note that email or other inquiries 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:** Either (a) a score of 68% or higher in MATH 121 or (b) a score of 80% or higher in one of MATH 101, MATH 103 , MATH 105, SCIE 001.

**Corequisites:** One of MATH 152, MATH 221, MATH 223.

**Course-level learning objectives:**

- Learn the basic concepts of multivariable calculus, including analytic geometry in 3 dimensions, continuity, differentiation and integration of multivariate functions.
- Understand the differences between the multivariate calculus concepts and their analogues for functions of one variable.
- Use multivariate calculus to solve mathematical questions with several variables, such as optimization problems, questions from geometry and statistics.
- Learn clear and correct mathematical writing, including constructing and writing formal mathematical proofs.

**Course topics and tentative schedule:**

- **Vectors in 3-space (Chapter 10)**: vectors, dot and cross product, planes and lines, quadric surfaces, cylindrical and spherical coordinates (approx. 2 weeks)
- **Functions of several variables (Chapter 12):** graphs, limits, continuity, derivatives and differentiability, gradients and directional derivatives, implicit functions (approx. 5 weeks)

- **Applications of partial derivatives (Chapter 13):** extreme values of functions, minimization and maximization problems (approx. 2-3 weeks)
- **Multiple integration (Chapter 14):** double and triple integrals, changing variables, applications (approx. 3 weeks)

Detailed updates on class topics covered each week will be posted regularly on Canvas.

**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 lecture notes are intended to supplement the textbook. They will not duplicate or replace it.
- **Lectures and Q&A, Mondays and Fridays 11-11:50, Collaborate Ultra on Canvas: I**n these classes, I will start with a mini-lecture (15-20 min) providing an introduction to the material, outlining the main points, and discussing problem-solving techniques. I will also talk about issues related to good mathematical writing and, specifically, writing of formal mathematical proofs. This will be followed by a Q&A period, ending at 11:50 am or when you run out of questions, whichever comes first. The lecture and Q&A will be recorded and available for asynchronous viewing after class. Prepared lecture notes will be uploaded to Canvas in advance.
- **Problem-solving sessions, Wednesdays 11-11:50 or 18-18:50, Collaborate Ultra on Canvas:** in these sessions, you will work in groups (breakout rooms in Collaborate Ultra) on a problem sets assigned at the beginning of the session. In the 11 am session, both I and the TA will be attending, and we will be circulating between the breakout rooms and answering questions. In the 6 pm session, only the TA will be available. These sessions will not be recorded. For those of you who prefer quiet group work through chat, I have set up folders for that in Piazza.
- **Discussion boards:** Both Piazza and Discussions on Canvas will be available. I recommend that you use Discussions for questions you would like me to monitor and/or answer, and Piazza for your own group work. Generally, I will monitor Discussions, but not Piazza except for the problem sessions and when I'm specifically asked to check on something. I will ask a TA to monitor Piazza.
- **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 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:** After each Longform assignment, I will randomly select 5-10 students who will be asked to explain their solutions to me, either live or via a recording, with the webcam on.
- **Additional practice:** the required homework assignments represent the *minimum* amount of practice you need. For additional practice, I will be posting recommended textbook problems and additional WebWork (not for credit).
- **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 (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 your own videoconferencing accounts, or I may be able to set up additional sessions here on Canvas for that purpose).
- **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 the Piazza chat group, check the posted solution sets afterwards, check with me and/or a TA afterwards 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 the Piazza chat group, check the posted solution sets afterwards, check with me and/or a TA afterwards 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.

**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. If you are also planning to take Math 227, the same textbook will be used there, so I strongly recommend getting either this package or the paper version (see below). If you are *not* planning to take Math 227, a cheaper 180-day access card for the same textbook may be available through other resellers. (*The additional features should be useful to you as additional practice, but will not be required for credit.)

- **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 some textbooks omit proofs and/or more advanced topics (such as the epsilon-delta definition of the limit, the rigorous definition of differentiability of multivariable functions, or the inverse or implicit function theorems) 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. If you plan to take Math 227, that course ends with differential forms (Adams-Essex, Chapter 17), which most other calculus books do not cover.
- **Homework assignments** (will be posted on Canvas)
- **WebWork** (must be accessed through Canvas)

**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 al most 10% of WebWork and still get full credit. (*If this is more than 20 points, your WebWork score will be 20.)

- **Additional WebWork practice:** 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, ... . The first additional practice set (AP1, not graded) will be an introduction to WebWork, for those who have not used it previously.
- **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 December, 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 submission 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 late September and again in early November, 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 if I have concerns about your level of engagement. These will be worth 5% of your grade. For full credit, you need to be engaged in the course (any of the "suggested learning strategies" described above would be sufficient) and you need to complete the surveys.

**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 see the respective assignments for details.
- **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. 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:**

- **You are welcome to contact me by email or on Canvas,** see above. **(http://www.math.ubc.ca/~ilaba/teaching/email.html)**
- **Individual videoconferencing consultations** are available (a) at the end of each scheduled class, (b) by appointment, 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 discuss) 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 Sep 21, 2020 | **Longform HW 1** (https://canvas.ubc.ca/courses/55290/assignments/628932) | due by 11:59pm |
| Mon Oct 5, 2020 | **Longform HW2** (https://canvas.ubc.ca/courses/55290/assignments/628934) | due by 11:59pm |
| Mon Oct 19, 2020 | **Longform HW3** (https://canvas.ubc.ca/courses/55290/assignments/628936) | due by 11:59pm |
| Mon Nov 2, 2020 | **Longform HW4** (https://canvas.ubc.ca/courses/55290/assignments/628938) | due by 11:59pm |
| Mon Nov 16, 2020 | **Longform HW5** (https://canvas.ubc.ca/courses/55290/assignments/635812) | due by 11:59pm |

| Date | Details | |
|---|---|---|
| Mon Nov 30, 2020 | **Longform HW6** (https://canvas.ubc.ca/courses/55290/assignments/635852) | due by 11:59pm |
| | **WebWork link** (https://canvas.ubc.ca/courses/55290/assignments/628942) | |