Course Syllabus

Edit

Section 101: MWF 11:00-11:50. 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.
- If you're not sure what you should call me, please use "Professor".
- **Online office hours:** Tuesdays 10:30-11:30 starting Sept. 12, or by appointment. See the Zoom link on the course sidebar. I will also be available for questions after each scheduled class.
- 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 13):** graphs, limits, continuity, derivatives and differentiability, gradients and directional derivatives, implicit functions (approx. 5 weeks)

- **Applications of partial derivatives (Chapter 14):** extreme values of functions, minimization and maximization problems (approx. 2-3 weeks)
- **Multiple integration (Chapter 15):** 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, MWF 11-11:50:** I will provide an introduction to the material, outline the main points, and discuss problem-solving techniques. I will also talk about issues related to good mathematical writing and, specifically, writing of formal mathematical proofs. Typically, 2 classes each week will focus on new material, and 1 on additional examples and problems. Questions are welcome in class, and I will try to have a dedicated Q&A period on a regular basis. Prepared lecture notes will be uploaded to Canvas in advance.
- **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. I will try to check Piazza at least once a day, and will also ask the TA to monitor it.
- **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 have only 2-4 questions each, 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.
- **Midterm and final exam: see below.**
- **Verification by Videoconferencing:** After each Longform assignment, I may select a small number of 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 (not for credit).
- **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. However, *sufficient* engagement is essential.

Required learning materials:

- **Textbook:** Robert A. Adams and Christopher Essex, Calculus: A Complete Course, 10th edition, Pearson, ISBN-13: 9780135766781. The e-text costs $64.99 (12 months access) and can be purchased here directly from Pearson: **https://www.pearson.com/en-ca/subject-catalog/p/calculus-a-complete-course/P200000002479/9780135766781 (https://www.pearson.com/en-ca/subject-catalog/p/calculus-a-complete-course/P200000002479/9780135766781)** . If you are also planning to take Math 227, the same textbook will be used there, so I strongly recommend getting either this e-text or the paper book (see below). 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.

- **The hard copy version of the textbook:** Robert A. Adams and Christopher Essex, either Calculus: A Complete Course or Calculus: Several Variables, 10th edition, Pearson. 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://personal.math.ubc.ca/~CLP/)** and **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 that we will cover (the epsilon-delta definition of the limit, the rigorous definition of differentiability of multivariable functions, the inverse or implicit function theorems). 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 18), which most other calculus books do not cover.
- **Lecture notes:** This year, we have a pilot project to provide a set of typed course notes with exercises and solutions. The notes will be based on my lectures and problem sets from the last several years, and will be typeset by one of our TAs (Caleb Marshall) and me. This is a project in progress, meaning that we cannot post the full set of notes for the semester in advance because this is not available yet. However, we will try to post each week's installment before the material in question is covered in class.
- **Homework assignments** (will be posted on Canvas)
- **WebWork** (must be accessed through Canvas)

Your term grade (out of 50%) will be based on WebWork (15%), Longform assignments (15%), midterm (15%), and two engagement surveys (participation grade, 5%). Your **course grade** will be calculated in two ways: (A) 50% term grade + 50% final exam, (B) 60% term grade + 40% final exam. Your grade will be the **higher** of (A) and (B). 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 issues (such as 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:** 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 assignments that are required for credit, 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 due, tentatively, on Wednesdays, Sept. 20, Oct 4, Nov. 1, and Nov. 22. 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 midterm** will be held tentatively on **Wednesday, October 18, in class** (same time, but we may move it to a larger classroom if one is available). 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's 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 December, The date of the final examination will be announced by the Registar later in the term. The current plan is for the final exam to be written in person, as a closed-book exam with no books, notes, or electronic devices allowed. Attendance is mandatory, so you should not make any travel plans before the exam date is announced.
- **Engagement surveys:** twice during the semester, tentatively in late September and again in early November, there will be short surveys of your engagement in the course. I will use the results to fine-tune the course structure and follow up on any concerns. These will be worth 5% of your grade. Completing the surveys (regardless of your answers) is sufficient for full credit.

Academic concession: The rules and procedures for obtaining academic concession are governed by **UBC Policy on Academic Concession (https://vancouver.calendar.ubc.ca/campus-wide-policies-and-regulations/academic-concession)** . 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 may be allowed extended deadlines on the first WebWork and Longform assignments. If this is your situation, please contact me 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 (https://canvas.ubc.ca/courses/125184/files/28323639?wrap=1)** **(https://canvas.ubc.ca/courses/125184/files/28323639/download?download_frd=1)** 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. (https://vancouver.calendar.ubc.ca/campus-wide-policies-and-regulations/student-conduct-and-discipline/discipline-non-academic-misconduct-student-code-conduct)**

- 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. You may use AI tools to improve your writing, but please be aware that such tools do not usually generate correct mathematical content. Your final write-up should be your own and you are responsible for the work you submit.
- 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)**
- **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). If you need to make an appointment with me outside of these hours, 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 we can use the meeting time efficiently.

- **Additional resources for proof writing:**
  - **Richard Hammack, *Book of Proof* (https://www.people.vcu.edu/~rhammack/BookOfProof/)** : This textbook, available for free, is specifically dedicated to mathematical logic, proof techniques, and proof writing. It has been used in MATH 220 (the proof writing course) 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.)
- **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. The MLC schedule will be posted here when available.

  In the MLC, students may join the study groups if they wish so. Please note that while students are encouraged to seek help with homework, the MLC is not a place to check answers or receive solutions, rather, our aim is to aid students in becoming better learners and to develop critical thinking in a mathematical setting. For additional information please visit our website and/or the MLC Canvas Page:

  https://www.math.ubc.ca/undergraduate/advising-and-resources/drop-help (https://www.math.ubc.ca/undergraduate/advising-and-resources/drop-help)

  https://canvas.ubc.ca/courses/70821 (https://canvas.ubc.ca/courses/70821)

- **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)** .

UBC statement on potential restrictions to international students' online learning: During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including

changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to the laws of your local jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,33,86,0 for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom). Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find substitute courses. For further information and support, please visit:**http://academic.ubc.ca/support-resources/freedom-expression (http://academic.ubc.ca/support-resources/freedom-expression)**