Course Information

Course Title	Course Code Number	Credit Value
Calculus III - Multivariable	Math 200	3

Textbook:

- CLP-3 Multivariable Calculus online textbook (`https://www.math.ubc.ca/~CLP/CLP3/`) by J. Feldman, A. Rechnitzer, and E. Yeager.

- See the MATH 200 common Canvas page for additional references.

Prerequisites

One of MATH 101, MATH 103, MATH 105, MATH 121, SCIE 001.

Contact

Section	Course Instructor	Contact Details
101	Omer Angel	angel@math.ubc.ca
102	James Colliander	colliand@math.ubc.ca
103	Thomas Budzinski	budzinski@math.ubc.ca
104	Dylan Allegretti	allegretti@math.ubc.ca
105	Brian Freidin	bfreidin@math.ubc.ca
107	Ailana Fraser	afraser@math.ubc.ca
108	Dylan Allegretti	allegretti@math.ubc.ca
109	Ailana Fraser	afraser@math.ubc.ca

Office hours for each section will be posted on the individual section Canvas pages.

Course Structure

The instructional format for the course will consist of 2.5 hours of synchronous lectures per week at the scheduled times for each section. These live online lectures can be accessed from your section specific Canvas page or using the links provided by your section instructor. Students are expected to participate in the regularly scheduled synchronous lectures for their section. Class time will be spent on a mix of lectures and interactive problem-solving. There will be ample (challenging) WeBWorK to help you practice technical skills and also develop understanding of the main concepts. You are encouraged to be active on Piazza – asking questions and providing answers (and generally discussing mathematics with your friends) is an excellent way to learn!

Schedule of Topics

This is an approximate week-by-week outline of topics for the course.

Week	Topics	CLP-3 Sections
1	Three-dimensional coordinate systems, vectors, dot product	1.1, 1.2.1, 1.2.2
2	Dot product (cont.), cross product, equations of lines and planes	1.2.2, 1.2.5, 1.4, 1.5
3	Equations of lines and planes (cont.), cylinders and quadric surfaces, functions of several variables: domain, range, graphs, level curves/surfaces	1.7, 1.8, 1.9
4	Limits and continuity, partial derivatives	2.1, 2.2, 2.3
5	Tangent planes and linear approximations, chain rule	2.4, 2.5, 2.6
6	Chain rule (cont.), directional derivatives and the gradient vector	2.7
7	Directional derivatives and the gradient vector (cont.), maximum and minimum values, Lagrange multipliers	2.7, 2.9, 2.10
8	Lagrange multipliers (cont.), double integrals over rectangles	2.10, 3.1
9	Double integrals over general regions, double integrals in polar coordinates	3.1, 3.2
10	Double integrals in polar coordinates (cont.), applications of double integrals	3.2, 3.3
11	Applications of double integrals (cont.), triple integrals	3.3, 3.5
12	Triple integrals (cont.), triple integrals in cylindrical coordinates	3.5, 3.6
13	Triple integrals in spherical coordinates	3.7

Learning Outcomes

Multivariable calculus provides the language and tools to analyze the outcomes that depend on more than one parameter (which means, most situations in our world). Multivariable calculus is used in many fields of natural science, social science, computer science, and engineering. This course builds on single variable calculus, and its natural follow-up courses are Math 317 (Calculus IV), various courses on differential equations, courses in probability/statistics, etc. For some students, this may be their last mathematics course, as it teaches sufficient mathematics background for many applications.

The main goal of the course is to develop an understanding of the fundamental concepts of multivariable calculus and the skills necessary for its applications. Upon completion of this course, students should be able to:

1. Manipulate vectors to perform geometric calculations in three dimensions.
2. Calculate and interpret derivatives of functions of several variables.
3. Integrate functions of several variables.

Learning Activities and Assessments of Learning

Course mark will be based on homework (10%), three tests (50%), and the final exam (40%). The final exam will cover material from the entire course.

Homework and Piazza

There will be weekly WeBWork Homework which must be accessed from the MATH 200 common Canvas page. The main goal of WeBWorK Homework is to help you learn the material. You are encouraged to work in groups on the more difficult problems, but then complete your individualized problems yourself. Do post questions and answers about homework (and other parts of the course) on Piazza, but when posting the answers, refrain from solving the problem completely, instead, point out relevant ideas from the course.

Tests

There will be three tests hosted on WeBWorK, the dates of which will be announced at the start of the term and posted on the MATH 200 common Canvas page. The tests will be held during your scheduled class time, and must be accessed from your section-specific Canvas page. WeBWorK tests differ from traditional WeBWorK assignments in a few ways. Each test is timed, so you will only have a fixed amount of time to work once you begin. Please be aware of Student Conduct during Examinations.

Concessions

There will be no make-up tests, and no late homework will be accepted. Students with concessions (e.g. for medical emergencies) will have the weight of a test transferred to the other tests and/or the final exam; the weight of a WeBWorK assignment will be transferred to the other assignments. You can receive **one** concession during the term by submitting the Student Declaration of Academic Concession for Math Courses form to your instructor. Further concessions or missed final exams need to be discussed with the Academic Advisors of your Faculty. There cannot be any exception to this university-wide policy.

Final Exam

The final exam will be scheduled during the examination period December 7 - 22 inclusive. For a full description of the final exam regulations, see the UBC Calendar page on Student Conduct during Examinations. The same regulations apply for the term tests.

Specific details and requirements for the tests and final exam will be posted on Canvas. The tests and exam may be invigilated via Zoom and it is essential that every student have a webcam. Without a webcam, it will not be possible to complete the course.

Scaling

Grades may be scaled to be in line historical standards and to ensure fairness across the sections. No scaling will be decided upon until all assessments are completed.

Learning Materials

All course materials are available online and are free.

- Lectures will happen live online during scheduled class time. Course information, materials and resources for all sections can be found on the MATH 200 common Canvas page.
- In addition to the office hours of your instructor Piazza is available.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. Be sure you understand UBC's expectations: see the UBC Calendar entries on "Academic Honesty", "Academic Misconduct", and "Disciplinary Measures", and the Student Declaration and Responsibility.

University Policies

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 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 on the UBC Senate website.

Learning Analytics

This course will be using the following learning technologies: Canvas, Piazza, WeBWorK. Many of these tools capture data about your activity and provide information that can be used to improve the quality of teaching and learning. In this course, we plan to use analytics data to:

- View overall class progress
- Track your progress in order to provide you with personalized feedback

- Review statistics on course content being accessed to support improvements in the course
- Track participation in discussion forums
- Assess your participation in the course

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