

University of Toronto
MAT291H1F - Calculus III
Fall 2009

Brief Course Description

This is a first course in multivariable calculus, covering: functions of several variables and the gradient, multiple integrals and the Jacobian, line integrals, Green's theorem, divergence, gradient, and curl of a vector field, surface integrals (and some applications from electromagnetics,) Stokes' theorem and the Divergence theorem, constrained max/min problems and the method of Lagrange multipliers. Students will be required to be able to solve problems and understand the main concepts, definitions, and theorems in each section covered. To learn and understand the material and perform well in the course, you must work through the assigned homework problems.

Developing your ability to think precisely and mathematically is an important objective – you will be rewarded with a more complete understanding of the material in this course, and a greater chance for success in any mathematically-oriented task you encounter in the future.

All announcements and handouts will be posted on the Blackboard portal. Please visit the website regularly. From time to time, your instructors or TAs may wish to contact you with announcements via email. To this end, you are required to maintain a working email address for this course and to check it regularly.

Textbook

Salas, Hille, and Etgen: *Calculus: One and Several Variables*, 10th edition.

Tutorials and Quizzes

Every student is registered in one tutorial section. Tutorials will begin the week of Sept.21. During your tutorials your TA will discuss some problems from the suggested homework problems. Consequently, to get the most out of your tutorial you must keep up to date with the homework and come prepared to ask questions, should you have any. This is a relatively fast-paced course, and regular attendance in your tutorial is an **essential** component of your performance in this course.

There will be four quizzes given in tutorials. The tentative schedule for the quizzes is as follows. (Please make sure to check the course website for updates.)

| | |
|--------|-----------------|
| Quiz 1 | Week of Oct. 5 |
| Quiz 2 | Week of Oct. 19 |
| Quiz 3 | Week of Nov 16 |
| Quiz 4 | Week of Nov 30 |

Each quiz will consist of 2 or 3 questions based on the suggested homework problems and will be graded out of 8. You must write your quiz in the tutorial section you are registered. **There are to be no make-up quizzes offered.**

Midterm Exam

There will be one 110 minute midterm to be held on Monday November 2 , from 6:00pm until 8:00pm. Exact details will be posted on the website roughly two weeks before the test date. **There will be no make-up exam.**

Marking Scheme

Your final mark will be calculated as follows:

| Share of Final Mark | |
|---------------------|--------------|
| 24% | Quizzes* |
| 30% | Midterm Exam |
| 46% | Final Exam |

*Your best three quizzes will each count for 8% of the final grade.

Schedule and Suggested Problems

Your instructor may be slightly ahead or behind this schedule. Your ability to correctly and completely solve the problems listed below is a very good indicator of your progress with the material. You are expected to solve at the very minimum *all* of the problems on this list. From time to time, supplementary problem sheets may be handed out by your instructor. Please check this website for revisions this schedule.

Week 1 beginning September 14.

Lecture: Functions of Several variables, Quadric Surfaces, Graphs and Level Sets, Open and closed sets

Section 15.1: 5, 8, 9, 11, 12, 17, 19, 22, 23, 25, 29, 32, 35.

Section 15.2: 2, 6, 9, 11, 15, 23, 30, 38, 39, 41, 46, 50, 51.

Section 15.3: 5, 6, 9, 15, 16, 21, 22, 23, 30, 32, 38, 40, 41, 43.

Section 15.5: 3, 5, 6, 7, 8, 9, 10, 11, 20.

Week 2 beginning September 21. **Tutorials begin.**

Lecture: Limits and Continuity, Partial Derivatives.

Section 15.4: 3, 11, 12, 19, 21, 27, 30, 36, 39, 41, 42, 45, 46, 49, 50, 53, 58, 60, 62.

Section 15.6: 7, 10, 12, 19, 21, 23, 26, 27, 29, 30, 31, 33, and supplementary problems on limits.

Week 3 beginning September 28.

Lecture: Differentiability and Gradients, Directional Derivatives.

Section 16.1: 13, 15, 21, 35, 36, 37.

Section 16.2: 7, 8, 13, 16, 19, 21, 25, 26, 28, 29, 32, 33, 36, 37.

Week 4 beginning October 5. **Quiz 1**

Lecture: Chain Rule, Tangent Lines and Tangent Planes, Double Integrals.

Section 16.3: 1, 3, 17, 23, 25, 27, 29, 36, 37, 43, 45.

Section 16.4: 5, 7, 9, 11, 15, 19, 25, 27, 29, 31, 33, 35.

Section 17.2: 1, 5, 7a, 8a, 10, 17.

Week 5 beginning October 12.

Lecture: Iterated Integrals, Integration Using Polar Coordinates, Mass, Centre of Mass, Triple Integrals.

Section 17.3: 5, 7, 11, 13, 15, 17, 19, 21, 23, 25, 29, 31, 32, 33, 35, 37, 39, 45, 46, 47, 49, 51.

Section 17.4: 13, 14, 16, 17, 19, 21, 23, 25, 27, 32, 33, 34.

Section 17.5: 3, 5, 9, 10, 31.

Section 17.6: 1, 7.

Week 6 beginning October 19. **Quiz 2**

Lecture: Calculation of Triple Integrals, Cylindrical and Spherical Coordinates.

Section 17.7: 5, 7, 9, 13, 14, 15, 17, 18, 19, 25, 29, 41, 43, 47, 51.

Section 17.8: 3, 5, 11, 13, 15, 17, 21, 23, 25, 27, 29, 30, 31, 32.

Section 17.9: 3, 5, 9, 10, 11, 12, 13, 14, 18, 19, 21, 25, 26, 27, 33, 34, 35, 37.

Week 7 beginning October 26.

Lecture: Change of Variables in Multiple Integration, Jacobians, Line Integrals.

Section 17.10: 3, 11, 13, 15, 17, 19, 22, 23, 24, 25, 26, 27, 28, 30.

Section 18.1: 7, 9, 13, 15, 17, 19, 21, 22, 25, 26, 27, 28, 30, 31, 33.

Section 18.2: 6, 7, 9, 11, 13, 15, 21, 22, 24, 25, 27, 28, 29.

Week 8 beginning November 2. **Midterm Test: November 2**

Lecture: Integrals with Respect to Arclength, Green's Theorem, Surface Area.

Section 18.4: 9, 10, 11, 12, 13, 14, 15, 21, 22, 23, 25, 26, 27, 29a, 32, 33ab, 35.

Section 18.5: 2, 3, 7, 9, 20, 21, 22, 23, 24, 27, 29, 31, 32, 34, 35.

Section 18.6: 5, 7, 11, 12, 15, 16, 17, 21, 25, 27, 30, 31, 36, 37.

Week 9 beginning November 9.

Lecture: Green's Theorem (continued), Surface Area, Surface Integrals, Flux of a Vector Field.

Section 18.6: 5, 7, 11, 12, 15, 16, 17, 21, 25, 27, 30, 31, 36, 37.

Section 18.7: 5, 9, 11, 13, 17, 21, 25, 31, 32, 35, 37, 38, 39, 45, 47, 48.

Week 10 beginning November 16. **Quiz 3**

Lecture: Divergence, Curl, The Divergence Theorem.

Section 18.8: 7, 11, 16, 17, 19, 21, 25, 29, 30, 31, 34.

Section 18.9: 1, 5, 7, 9, 11, 13, 15, 16, 17, 18, 19, 20, 21, 22 .

Week 11 beginning November 23.

Lecture: Stokes' Theorem , Local Extrema, Absolute Extrema.

Section 18.10: 3, 5, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18.

Section 16.5: 5, 7, 9, 11, 15, 21, 23, 25, 28, 29, 30.

Section 16.6: 1, 7, 13, 19, 23, 25, 26, 27, 29, 31, 34, 35, 37.

Week 12 beginning November 30. **Quiz 4**

Lecture: Maxima and Minima with constraints, Differentials .

Section 16.7: 5, 9, 11, 15, 17, 20, 29, 31, 33, 38, 41.

Section 16.8: 3, 5, 9, 11, 17, 19, 20, 21, 23, 25, 26, 27, 36, 37.

Week 13 December 7-9 .

Lecture: Reconstructing a Function from its Gradient, Review.

Section 16.9: 5, 7, 14, 17, 25, 28, 29, 32.