Multivariable Calculus

MATH 241-02, MTWF 8:00 - 8:50, Swords 359, Spring 2005

Dr. Gareth Roberts

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Office hours: Mon., Wed. and Fri. 9:00 - 10:00, Tues. 9:00 - 11:00 or by appointment.

Required Text: *Multivariable Calculus*, 3rd Edition, by William G. McCallum, Deborah Hughes-Hallett, Andrew M. Gleason, et al. It is suggested, but not required, that you also purchase the *Student Solutions Manual* which is directly linked to the textbook. A copy of this manual will be placed on reserve in the Math/Sci Library.

Web page: http://mathcs.holycross.edu/~groberts/Courses/MA241/homepage.html Homework assignments, computer projects, exam materials, schedule changes, useful links and other important information will be posted at this site. Please bookmark it!

Prerequisites: MATH 132, MATH 134, MATH 136 or a 4 or 5 on the Calculus BC AP Exam.

Syllabus: This course focuses on the calculus of multivariable functions. It is traditionally thought of as the third semester of calculus. The ideas from the calculus of one-variable functions (such as the derivative and integral) will be generalized to higher dimensions. This can be challenging but with visual assistance from the computer and various models, you will come to appreciate and understand the beauty and complexity of this fascinating subject. Applications of multivariable calculus can be found in physics, engineering, economics, chemistry, biology, astronomy and the social sciences.

A **tentative** outline of the course is given below, organized by chapters of the text. We will cover most of the material in the text, Chapters 12 through 20.

- Functions of several variables (graphing, contour diagrams, linear functions) 9 days
- Vectors (standard vectors, dot and cross products) 5 days
- Exam I – Feb. 23 (in class)
- Differentiation (partial derivatives, directional derivative, gradient, chain rule) 9 days
- Optimization (local extrema, Lagrange multipliers) 5 days
- Integration (iterated integrals, changing variables, polar, cylindrical coordinates) 8 days
- Exam II – April 13 (in class)
- Parameterization and Vector Fields (velocity, acceleration, flow of a vector field) 4 days
- Line Integrals (conservative vector fields, Green's Theorem) 4 days
- Flux Integrals and the Calculus of Vector Fields (Divergence Theorem, curl) 5 days
- Calculus Jeopardy (last class)
- Final Exam – May 10 (2:30 - 5:30)

Course objectives:

- Develop an understanding for the techniques and theory of multivariable calculus.
- Become proficient at making clear and coherent mathematical arguments.
- Learn to use the computer to enhance and supplement your learning.
- Work with your peers and communicate your knowledge effectively.

Homework: There will be homework due every Wednesday at the START of class. Assignments will be posted on the course web page. There will be a list of problems for you to hand in, a nonempty subset of which will be graded. While you are allowed and encouraged to work on homework problems with your classmates, the solutions you turn in to be graded should be your own. Take care to write up solutions **in your own words**. Plagiarism will not be tolerated and will be treated as a violation of the Departmental Policy on Academic Integrity.

NOTE: LATE homework will NOT be accepted. The only excused homework which is late will be accompanied by a letter from your Class Dean. However, you will be allowed ONE "mulligan" over the course of the semester where you can turn in the assignment up to one week after the original due date.

Computer Labs: There will be approximately 3 to 4 computer projects assigned during the semester. The goal of the projects is to use computers to gain a better understanding of the subject material and/or to explore some of the applications of multivariable calculus. We will make use of the software package MAPLE. You are **required** to work on your projects in small groups of two or three members. One report is turned in for the entire group.

Exams: There will be 2 in class exams and a comprehensive final at the end of the semester. The exam schedule is given below. Please make a note of these dates and plan accordingly. Any conflicts must be legitimate and brought to my attention well before the exam is scheduled. If you have any specific learning disabilities or special needs and require accommodations, please let me know early in the semester so that your learning needs may be appropriately met. You will need to contact Dr. Matthew Toth of Disability Services in Hogan 207 (x 3693) to obtain documentation of your disability.

	Exam 1	**Wed., Feb. 23**	**In Class**
Exam Schedule:	**Exam 2**	**Wed., April 13**	**In Class**
	Final	**Tue., May 10**	**2:30 - 5:30**

Academic Integrity: The Department of Mathematics and Computer Science has drafted a policy on academic integrity to precisely state our expectations of both students and faculty with regards to cheating, plagiarism, academic honesty, etc. You are required to read this policy and sign a pledge agreeing to uphold it. Anyone who violates the Departmental Policy on Academic Integrity will receive a 0 for that assignment or exam as well as possible further disciplinary action involving your Class Dean.

Grade : Your course grade will be based on your scores on the homework 25% , computer projects 15% , classroom participation/interest 5%, two in-class exams 30% and final exam 25% .

How to do well in this course :

- ATTEND THE LECTURES, PARTICIPATE and ASK QUESTIONS

  I take pride in my lectures and will work hard to get you to master the course material. However, this will not be of much use to you if you don't attend class. Furthermore, certain class periods will involve your participation in activities designed to get you to think. These days should be fun, with me lecturing little and you participating greatly. Do not take for granted the privilege you have of attending college. Value your time here and I will make it worth your while.

- DO YOUR HOMEWORK REGULARLY.

  The best way to learn mathematics is to *do* mathematics. This means mastering the material to the point where you could explain it to your classmates and your friends. "You don't really learn the subject until you teach it," is a common adage amongst mathematicians. It is not enough to know how to mimic an algorithm. A strong student should have a good conceptual understanding of an algorithm, why it works and when to apply it.

- WORK WITH YOUR CLASSMATES.

  Some of the best assets available to you are the knowledge and abilities of your peers. Learn to explain mathematics to your classmates. Mathematics can be fun and rewarding when there are people around you who enjoy figuring out problems as much as you do. Take advantage of this opportunity and organize study groups.