Multivariable Calculus

MATH 241-01, Spring 2015

MTuWF 1:00 - 1:50 Swords 328

Professor Gareth Roberts

Contacting me: Office: Haberlin 305, e-mail: groberts@holycross.edu phone: x2350

Office hours: Mon., Wed. and Fri. 11:00 - 12:00, Tues. 10:00 - 11:30, or by appointment.

Required Text: *Multivariable Calculus: Concepts and Contexts*, Fourth ed., James Stewart. A copy of the text as well as two *Study Guides* will be placed on reserve in the Math/Science Library.

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

Prerequisites: MATH 134, MATH 136, or a score of 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 we will use computer simulations and graphics, as well as physical models, to help elucidate 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, from Chapter 9 through Chapter 13.

- Vectors: basis vectors, dot and cross products, equations of lines and planes (6 days)
- Surfaces: quadric surfaces, graph of a two-variable function (2 days)
- Vector Functions: tangent vectors, arc length, curvature, normal and binormal vectors, velocity and acceleration (5 days)
- Exam I – Feb. 18 (in class)
- Functions of Several Variables: graphing, contour plots, limits and continuity (4 days)
- Differentiation: partial derivatives, tangent planes, chain rule, directional derivative, gradient (6 days)
- Optimization: critical points (max, min, or saddle), Lagrange multipliers (4 days)
- Exam II – March 25 (in class)
- Integration: double and triple integrals, iterated integrals, changing variables, using polar, cylindrical, and spherical coordinates, surface area (10 days)
- Vector Fields: line integrals, conservative vector fields (4 days)
- Exam III – April 22 (in class)
- Vector Calculus: Green's Theorem, curl and divergence, Stokes' Theorem, Divergence Theorem (6 days)
- Calculus Jeopardy (last class)

Course Objectives:

- Develop an understanding for the techniques and theory of multivariable calculus.
- Explore some of the applications of multivariable calculus to other disciplines.
- Learn to use the computer to enhance and supplement your understanding.
- Work and communicate with your peers.
- Have FUN while learning multivariable calculus!

Homework: There will be written and online homework due every Wednesday at the START of class, except for weeks in which a midterm exam is scheduled. **Late homework will not be accepted.** The written problems will be posted on the course web page, while the online problems will be completed using the homework system **WebAssign**.

While you are allowed and encouraged to work on homework problems with your classmates, the solutions you present (or enter on the computer) should be your own work. Take care to write up solutions **in your own words**. No help from any Internet sources other than those offered by WebAssign is allowed. Plagiarism will not be tolerated and will be treated as a violation of the Departmental Policy on Academic Integrity.

In order to access WebAssign, you will need a **Class Key**. The Class Key for MATH 241-01 is holycross 4639 8672 . Use this key when enrolling in the course on WebAssign. If you purchased WebAssign last semester (or last year) for your calculus course, then your previous account should still be active. Otherwise, you will need to purchase an access code to use WebAssign. It can be purchased from the bookstore or online. You will have free access to WebAssign until Feb. 3.

Computer Projects: There will be three to four computer projects assigned during the semester. The goal of the projects is to use the computer software MAPLE to gain a better understanding of the subject material and to explore some of the applications of multivariable calculus. You are **required** to work on your projects in small groups of two or three members. One report is submitted for the entire group.

Exams: There will be three midterm exams as well as 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 the director of Disability Services in Hogan 215 (x3693) to obtain documentation of your disability.

Exam Schedule:

Exam 1	**Wed., Feb. 18**	**In Class**
Exam 2	**Wed., March 25**	**In Class**
Exam 3	**Wed., April 22**	**In Class**
Final	TBA	2.5 hours

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. A violation of the Departmental Policy on Academic Integrity will result in a 0 for that assignment or exam, and a letter describing the occurrence of academic dishonesty will be sent to your Class Dean.

Grade: Your course grade will be determined by the scores you receive for each of the following items:

- classroom participation/interest 5%
- homework and computer projects 25%
- midterm exams 45%
- 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 be able to follow and propose arguments as to why an algorithm is working or not working.

- 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.

- ASK FOR HELP WHEN NECESSARY.

  Ask for help when you need to. One of the stumbling blocks for many math students (particularly us guys) is being afraid to ask for help. Just do it! It is important to acknowledge that you don't understand something. Identifying areas of difficulty and seeking out the help necessary to improve in those areas is the key to being a good math student.

Never regard study as a duty, but as the enviable opportunity to learn.

— Albert Einstein