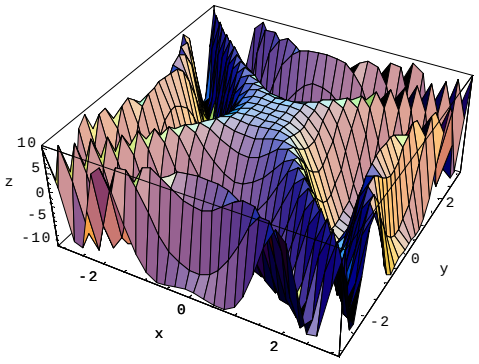
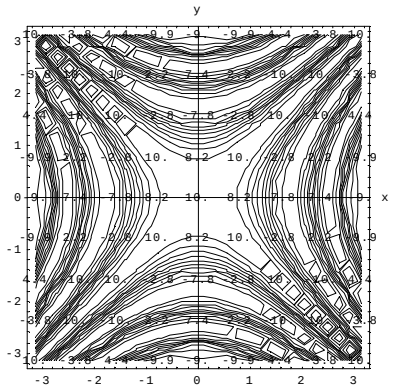
Carroll MONTANA

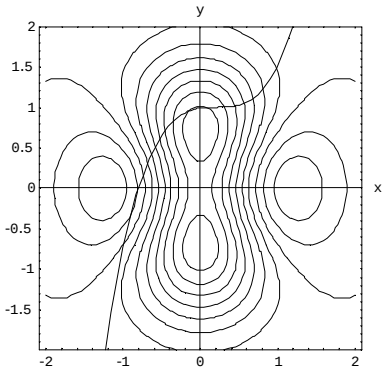
DEPARTMENT OF MATHEMATICS, ENGINEERING, and COMPUTER SCIENCE

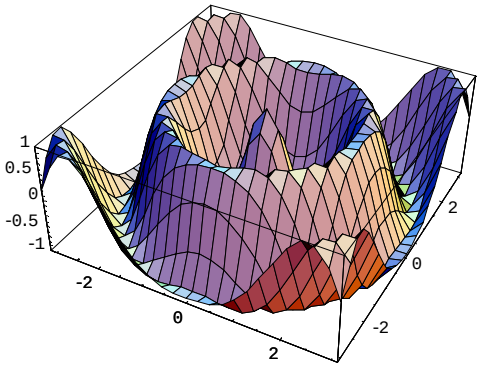
MULTIVARIABLE CALCULUS

MATH 233 FALL 2007









INSTRUCTOR: Dr. Mark Parker
OFFICE: 118 Simperman
E-MAIL: mparker@carroll.edu

WEB: http://www.carroll.edu/~mparker
OFFICE PHONE: 447-4572
HOME PHONE: 457-8289
(before 8 p.m., please)

OFFICE HOURS: MWF 3:00-5:00 TR 11:00-12:00 or by appointment

Welcome to Math 233! Up until now, your mathematics courses have mainly focused on functions of *one* variable, and this has meant essentially working in the *xy*-plane. Since the real world is three-dimensional, we need to consider functions of *more than a single variable*! Luckily everything you've learned in calculus up to now is important, since we will often reduce multi-dimensional problems to one-dimensional problems. But we will also go in the other direction, as we will expand the concepts of derivatives and integrals into higher dimensions. Because the world is multi-dimensional, this course has many real-world applications.

We will continue our threaded approach to learning mathematics by taking side tours from calculus to tie together concepts from your previous courses and demonstrate their applicability in our current setting. In our journey, we will make use of both the calculator and *Matlab*. Being comfortable with *both* technologies will help you when trying to solve problems on your own.

Prerequisites: You need to have a grade of C or better in Math 131, or in both Math 121 and Math 122, or have been placed here because of your calculus AP exam score.

My Goals for you:

- Extend your knowledge and understanding of mathematical concepts, specifically in the study of differential and integral calculus for multivariable and vector functions.
- Develop your geometric and analytical sense of multivariable and vector calculus concepts.
- Refine your skills in formulating and solving problems involving multivariable and vector functions, differential calculus, integral calculus, and optimization.
- Mature your skills in designing mathematical models using the tools of multivariable calculus to capture the essence of real-world patterns and phenomena.
- Classify, analyze, transform, and solve mathematical constructs involving multivariable functions.
- Interpret mathematical models and their solutions in the context of their real-world applications.
- Critique mathematical models to identify their strengths and weakness and modify them to make them better models.
- Expand your knowledge and understanding of the real world through mathematical analysis.
- Cultivate your skills to effectively use modern computing, information, and communication technologies

Textbook: The text is *Calculus: Multivariable*, by McCallum, Hughes-Hallett, Gleason, et al., © 2004, John Wiley and Sons, Inc (ISBN: 0-471-48480-6). This stand-alone text covers the same material as chapters 12 – 20 of *Calculus: Single and Multivariable*, by Hughes-Hallett, Gleason, McCallum, et al., © 2004, John Wiley and Sons, Inc (ISBN: 0-471-47245-X). I will supplement the text with handouts and other resources, as we need them.
The authors of our textbook motivate each topic through various real-world applications and analogies, and concepts are presented from several different points of view. There is a heavy emphasis on geometry and visualization. *Read the book!* An important part of being a technical major is learning *how* to read technical material. This will become more and more true as you get into your upper division courses.

Other Resources: A graphing calculator: TI-89 or TI-Voyage 200

Grades: You have the opportunity to demonstrate your proficiencies in a variety of ways. Your final grade will be based upon the weightings in the table below:

ASSIGNMENT	**% OF TOTAL**
Homework and Computer Labs	25%
Project	15%
3 Exams (15% each)	45%
Final Exam (cumulative)	15%
	100%

Homework: To help you master the skills we are learning; homework will be assigned most regular (MWF) class periods. We will be using the internet-based WebWork homework system. Pay careful attention to the date and time when each homework assignment closes and is due, as you won't be able to work on it after this closing date. This of course means that late homework can't ordinarily be accepted. Since everyone has off days, at the end of the semester, I will drop your 3 lowest homework scores. Each homework will be weighted equally to determine your average.

Computer Labs: We will meet in the computer lab (Simperman 146) most Thursdays. The labs are an integral part of this course, and you should come prepared to work during the lab time we have reserved. My experience has been that labs work better when you have a partner to bounce ideas off of, so I prefer that you work in pairs. For those labs that are handed in, you should:

1. include comments on your work
2. include a summary sheet describing the lab in **your words**,
3. write using complete sentences.

In terms of grades, each lab will carry as much weight as three homework assignments.

Group Project: The project is designed to help you refine your analysis and reporting skills – whatever your chosen vocation, **no matter how great your technical skills, there will be little demand for them if you lack the skills to communicate your results to both your peers and those less technical than yourself.** You will be given a grading rubric for the project when it is assigned.

Exams: We will have three exams during the semester, as well as a cumulative final exam. All exams will be equally weighted, accounting for 45% of your final grade. Tentative exam dates are 14 September (Friday), 5 October (Friday), and 2 November (Friday). These exam dates will be confirmed in class **at least one week** prior to their occurrence. For each exam, you will be allowed an 8.5" x 11" sheet of notes and a calculator. Policies on academic integrity, as stated in the Carroll College catalog, are strictly enforced in this course. If you cheat on one of my exams, at a minimum I will give you an F for the entire course.

Final Exam: You will have the opportunity to demonstrate your mastery of the topics in the course on a cumulative final examination, which will account for 15% of your final grade. Your final exam will also replace your lowest midterm score (assuming it improves your grade). The final exam will take place on **Monday 12 December 2006, 8:00 – 9:45**.

Let me know as soon as possible if you have circumstances (health or personal) that will require extended absences so that we can work out an acceptable arrangement.

Help! I'm lost: Stop by if you need help! My office is always open; however, you may find that I'm not always the person in my office. I will be on campus MWF afternoons (1:00 – 5:00) and TR mornings (8:00 –12:00) only. If you stop by at other times, you will find my wife Holly inhabiting our shared office. If my office hours don't work for you, **let me know** and we can schedule another time to meet.

Other information: For your **success** in the class it is **crucial** that you attend regularly. If you are going to miss a class where we have an exam scheduled or an assignment due, it is *imperative* that you let me know *as soon as possible, preferably in advance*. As a general rule, I do **not** give make-up exams – if you have a legitimate extreme excuse, we can make other arrangements for missed assignments.

If you have special needs or problems, please be sure to speak to me or see Joan Stottlemyer in the Academic Resources Center about them as early as possible in the semester. There is additional information in the Carroll College catalog.

I welcome your constructive comments to help me make this the best course possible. The key to your success in this course depends mainly upon your attitude, your study habits, and your desire to learn. My role is to facilitate the process; but I can't do it alone! Good luck, I'm looking forward to a great semester!

Tentative Course Outline:

Multivariable Functions (1 week) Chapter 12

3-D coordinate systems
Multivariable Functions
Graphs and Contour Diagrams
Limits and Continuity

Vectors (2 weeks) Chapter 13

Vectors, vector operations

Multivariable Calculus (6 weeks) Chapters 14, 15, and 16

Partial Derivatives, gradient, directional derivatives
Tangent planes, local linearity
Optimization, LaGrange multipliers
Double and Triple integrals, applications
Polar, cylindrical, spherical coordinates

Vector Calculus (6 weeks) Chapter 17, 18, 19, and 20

Parameterizations
Line Integrals, Work, and Flux
Green's Theorem
Divergence
Curl