Course Outline: Math H53
Honors Multivariable Calculus
University of California, Berkeley, Spring 2012

Course instructor:	Sean Fitzpatrick
Office:	749 Evans
Email address:	sean@math.berkeley.edu
Office hours:	Tuesday 5-6 pm, Thursday 1-3 pm (subject to change).
Course website:	`http://math.berkeley.edu/~sean/H53/`
Lectures:	Tuesday and Thursday, 3:30 - 5:00 pm in 106 Wheeler.

Course GSI:	Benoît Jubin
Office:	745 Evans
Office hours:	TBA.
Discussion:	Monday, Wednesday and Friday, 3:00 - 4:00 pm in 101 Wheeler.

Course Description

This is a first course in multivariable calculus. The focus will be on functions of two and three variables, and using calculus to analyze the geometry of curves and surfaces in three-dimensional space. The official description from the Department of Mathematics is as follows:

> Parametric equations and polar coordinates. Vectors in 2- and 3-dimensional Euclidean spaces. Partial derivatives. Multiple integrals. Vector Calculus. Theorems of Green, Gauss, and Stokes.

Prerequisite: Math 1B

Course textbook: Stewart, Multivariable Calculus, Early Transcendentals for UC Berkeley (Custom edition).

The text is available either for purchase or rent at the UC bookstore.

Students wanting a secondary resource may want to consider the "open source" textbook *Vector Calculus* by Michael Corral, which is available for free online at http://www.mecmath.net.

Course Objectives

Above all, in this course our goal will be to master the techniques of calculus in two and three variables, such as finding and analyzing critical points, and evaluating multiple integrals. More broadly, we will attempt to develop an underlying geometric intuition that will allow us to understand the problems on a qualitative (as well as quantitative) level.

Throughout the course we will emphasize mathematical writing and proof: we want to ensure that our solutions are presented in a manner that is clear, concise, and complete. Although we will officially cover the same material as Math 53 (non-honors), the coverage will at times be more theoretical and in-depth, with the goal of preparing you for upper-division mathematics courses.

Evaluation

Your grade in this course will be determined as follows:

Component	Number	Total value
Assignments	$5 \times 4\%$	20%
Midterm Tests	$2\times 20\%$	40%
Final exam	1	40%

The grade on the final exam may replace the score on **one** of the midterm tests, in the event that the final exam score is higher, or a student is forced to miss one of the midterms with a valid reason.

Course policies

Lecture: Lectures will be used to present course material, highlight important points, and clarify areas of difficulty. Material to be covered will be announced in advance (see the tentative schedule below) and students will be assumed to have read the relevant chapters in the text in advance.
Discussion Section: Since this is an honors course, there are three hours of discussion per week, in addition to both instructor and GSI office hours. You are strongly encouraged to make use of the available contact time.
Quizzes: Each Friday (except for midterm test days) in discussion section there will be a short 15-20 minute quiz. The quizzes do not affect your grade - their purpose is to allow each student to monitor their own progress in the course. Quizzes will be peer-graded, based on the solutions provided by the GSI.
Homework: Suggested homework problems will be assigned at the end of every lecture. These will be problems from the sections of the course textbook to be covered in the *following* lecture; students are encouraged to attempt the problems in advance. Quiz questions will be chosen from the suggested problems, and similar problems may appear on the midterms and final exam.

Tests: There will be two 50 minute term tests, written in the discussion section. The test dates are as follows:

- Test #1: Monday, 13$^{\text{th}}$ February. Test covers Chapters 10, 12 and 13.1-13.2.
- Test #2: Friday, 23$^{\text{rd}}$ March. Test Covers Chapters 14 and 15.1-15.5.

Assignments: There will be five written assignments to be handed in for grading. Assignment problems will be more challenging than the routine exercises from the text. The assignments will be graded based on both the validity of the solutions and the quality of the writing - solutions should be clear and fully explained. (Assume that your target audience is a classmate, not the instructor.) Students should submit a good copy of their work for grading. It does not have to be typed, but should be neat and legible.
NOTE: It is acceptable, and in fact encouraged, for you to discuss the assignment problems with classmates. However, students **must** take care to avoid plagiarism. To avoid the temptation for outright copying, students are advised to write up their good copy on their own, and will be required to list any sources (persons or texts) used to compete the assignment.

Grading errors: Graded tests and assignments will be returned in lecture. If a student notices an error in the grading (such as an addition error) they must bring it to the attention of the instructor at the end of class, before leaving the classroom. Subjective grading decisions will generally not be reviewed, and no grading errors will be considered once the returned work has left the classroom.

Special arrangements: If you are a student with a disability registered by the Disabled Student Services (DSS) on UCB campus and if you require special arrangements during exams or lectures, please inform the instructor as soon as possible.

Tentative course schedule

January 17th January 19th	Introduction, 10.5 10.1, 10.2	Conic sections Parametric curves
January 24th January 26th	10.3, 10.4 12.1, 12.2	Polar coordinates Coordinate systems, vectors
January 31st February 2nd	12.3, 12.4 12.5, 12.6	The dot and cross products Lines, planes and quadric surfaces
February 7th February 9th	13.1, 13.2 13.3, 13.4	Calculus with vector-valued functions Arc length, curvature, velocity and acceleration
Monday, February 13th: **Midterm no. 1** (discussion section)		
February 14th February 16th	14.1, 14.2 14.3	Functions of several variables; limits and continuity Partial derivatives
February 21st February 23rd	14.4 14.5, 14.6	Tangent planes and linear approximations; differentiability Chain rule, gradient, directional derivatives
February 28th March 1st	14.7, 14.8	Maxima, minima, and optimization Chapter 14 catch-up and review
March 6th March 8th	15.1, 15.2 15.3	Double integrals Double integrals, continued
March 13th March 15th	15.4, 15.5 15.6	Polar coordinates, applications Triple integrals
March 20th March 22nd	15.7, 15.8 15.9	Triple integrals in cylindrical and spherical coordinates Change of variables in multiple integrals
Friday, March 23rd: **Midterm no. 2** (discussion section)		
March 26th-30th: Spring Break		
April 3rd April 5th	 16.1, 16.5	Chapter 15 catch-up and review Vector fields, Div, Grad and Curl
April 10th April 12th	16.2 16.3, 16.4	Line integrals Fundamental theorem for line integrals, Green's theorem
April 17th April 19th	16.6 16.7	Parametric surfaces Surface integrals
April 24th April 26th	16.8 16.9	Stokes' Theorem Divergence Theorem
RRR Week: April 30th - May 4th		
Final Exam: Friday, May 11th, 7-10 pm		