Course Outline: Math 53
Multivariable Calculus
University of California, Berkeley, Spring 2013

Course instructor:	Sean Fitzpatrick
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Email address:	sean@math.berkeley.edu
Office hours:	MWF 2:30 - 3:30 pm and TT 12:00 - 1:00 pm, or by appointment.
Course website:	Available via bSpace.berkeley.edu
Lectures:	Monday, Wednesday and Friday 12:00 - 1:00 pm in 155 Dwinelle.
Discussion:	Please consult the Online Schedule of Classes for your section.

Note: Lectures and discussion sections begin at ten minutes **after** the hour, following the "Berkeley time" convention.

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. Note that a new edition is out; I'll try to accommodate those of you who already own the previous edition.

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. It's not the greatest book, but it's free. A quick Google search will also lead you to a several other options of varying degrees of difficulty.

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. For the most part our focus will be more on the practical than the theoretical, in that we will not spend a lot of time on rigorous proofs of theorems. We will spend a bit of time discussing applications but will be more concerned with ensuring that we've developed the necessary mathematical toolkit to understand such problems whenever they are encountered outside of this course.

Evaluation

Your grade in this course will be determined as follows:

Component	Number	Total value
Assignments	12	20%
Quizzes	10	10%
Midterms	3	30%
Final exam	1	40%

Note: the assignment grade will be based on the **best 10 out of 12** assignments. I will also drop your worst midterm grade. **If you miss a midterm** you must inform me immediately. Any student who misses a midterm and does not contact me to explain their absence will forfeit the right to drop the missed midterm from their score.

Course policies

Lecture:

Lectures will be used to present course material, highlight important points, and clarify areas of difficulty. Lectures will focus primarily on concepts rather than mechanics. Material to be covered will be announced in advance (see the tentative schedule below). Students will derive maximum benefit from both lectures and discussion section if they have read the corresponding textbook section in advance.

Discussion Section:

The discussion section will consist mainly of worked examples from the material covered in class, and will focus more on computations. Students will be expected to *participate* in solving these problems, and are strongly encouraged to ask questions about any of the lecture content they wish to have clarified.

Quizzes:

Each Friday (except for test days) in discussion section there will be a short 15-20 minute quiz. The purpose of the quizzes is to allow each student to monitor their own progress in the course, and your quiz grade will be based according to the following guideline: a score of 0 for those who do not write the quiz or do not indicate any understanding of the material, and a score of 1 for those who write the quiz and come reasonably close to the correct solution. (A score of 0.5 may sometimes be awarded at the discretion of your GSI.) There will be 11 quizzes in total, so everyone gets to miss one for free.

Homework:

There are both suggested homework problems (which you do not hand in) and assignment problems (which you do hand in) for this course. The list of suggested homework problems (for both the 6^{th} and 7^{th} editions) is available on bSpace. Assignments will be most Mondays, and will usually be posted two weeks in advance.

Tests:

There will be three 45-minute term tests, to be written in lecture. The test dates and (tentative) topics are as follows:

- Test #1: Friday, 15th February. Test covers Chapters 10, 12, and 13.
- Test #2: Friday, 15th March. Test covers Chapter 14.
- Test #3: Friday, 12th April. Test covers Chapter 15.

Assignments:

Every Monday[1], students will be required to submit a set of 12-15 problems for grading. These problems will be assigned on bSpace roughly two weeks in advance of the due date. Among all solutions submitted each week, two or three will be graded. There will be no make-up opportunities for missed homework; however, only the best ten out of twelve problem sets will count towards your grade.

Submission of assignments: Assignments should be submitted directly to your GSI during discussion. If for some reason you miss discussion on the due date, each GSI has a mailbox on the 9th floor of Evans Hall. Note however that the GSI mailboxes are **not** secure. Assignments submitted later than 5 pm on the due date will be considered late. Late assignments will be penalized by 25%, and will be accepted until the following Friday. Assignments submitted any later will not be accepted unless you have made prior arrangements.

Note: I will usually post solutions at the end of the week. Once solutions have been posted, no further assignments can be accepted. If you are submitting an assignment late for a valid reason, I must be informed ahead of time.

Preparation of assignments: 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. All multiple-page assignments must be **stapled**. **All assignments must include a cover page.** A cover page form will be made available on bSpace.

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. Instances of copying tend to be more obvious than students might think, and once detected, result in all sorts of trouble for both the students involved and the instructor. Accordingly, everyone generally ends up happier if copying is avoided in the first place.

Special arrangements:

Students with recognized disabilities will be accommodated as best as possible. If you require accommodations, please make arrangements through the Disabled Students Program office.

[1] **Exceptions:** there is no assignment due on the first Monday, January 28th. Due to the Presidents' Day holiday on February 18th, Assignment 3 will be due on Wednesday, February 20th. Also, there will be no assignment due on Monday, April 15th, since you might need a break by then. The final assignment will be due on May 6th, the first day of RRR week.

Tentative course schedule

Jan. 23rd	Handout	Introduction and some notation
Jan. 25th	12.1, 12.2	Coordinates and vectors in three dimensions
Jan. 28th	12.3	Dot products
Jan. 30th	12.4	Cross products
Feb. 1st	12.5	Lines and planes in $\mathbb{R}^3$
Feb. 4th	10.5, 12.6	Conic sections and quadric surfaces
Feb. 6th	10.1, 13.1	Parametric curves
Feb. 8th	10.2, 13.2	Calculus with parametric curves
Feb. 11th	10.2, 13.2	More examples with parametric curves
Feb. 13th	10.3, 10.4	Polar curves
Feb. 15th	Midterm #1	Midterm covers Chapters 10, 12, and 13
Feb. 18th	Holiday	No class
Feb. 20th	14.1, 14.2	Functions of several variables
Feb. 22nd	14.3	Partial derivatives
Feb. 25th	14.4	Tangent planes and differentiability
Feb. 27th	14.5	The Chain Rule
Mar. 1st	14.6	The gradient and directional derivatives
Mar. 4th	14.7	Local maxima and minima
Mar. 6th	14.7, 14.8	Global maxima and minima
Mar. 8th	14.8	Lagrange multipliers
Mar. 11th	15.1, 15.2	Double integrals over rectangles
Mar. 13th	15.3	Double integrals over general regions
Mar. 15th	Midterm #2	Midterm covers Chapter 14
Mar. 18th	15.4	Double integrals in polar coordinates
Mar. 20th	15.5	Applications of double integrals
Mar. 22nd	15.7	Triple integrals
Mar. 25-29th	Spring Break	No classes
Apr. 1st	15.8, 15.9	Cylindrical and Spherical coordinates
Apr. 3rd	15.10	Change of variables I
Apr. 5th	15.10	Change of variables II
Apr. 8th	16.1	Vector fields
Apr. 10th	16.5	Curl and Divergence
Apr. 12th	Midterm #3	Midterm covers Chapter 15
Apr. 15th	16.2	Line integrals I
Apr. 17th	16.2, 16.3	Line integrals II
Apr. 19th	16.3	Line integrals III
Apr. 22nd	16.4	Green's Theorem
Apr. 24th	16.6	Parameterized surfaces
Apr. 26th	16.7	Surface integrals I
Apr. 29th	16.7	Surface integrals II
May 1st	16.8, 16.9	Stokes' and Divergence Theorems I
May 3rd	16.8, 16.9	Stokes' and Divergence Theorems II
May 6-10: RRR Week (Review sessions)		