Brown Math 350 Fall 2010 Syllabus

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Office hours: Mon. 11am-12pm, Wed. 1-2pm, Fri. 3-4pm, or by appointment. Subject to change if necessary.

Text: Vector Calculus, 5th Edition by Marsden and Tromba

Exams:

- Midterm: Friday, Oct. 1
- Midterm: Friday, Nov. 5
- Final: Friday Dec. 10

Description: This class is about calculus in more than one dimension. We'll study functions of several variables, with scalar and vector values; the two main operations of calculus (differentiation and integration) on such functions; and the big theorems which relate these: the Fundamental Theorem of Calculus for Line Integrals, Green's Theorem, The Divergence Theorem and Stokes' Theorem.

Vector calculus is a neat subject, harmoniously combining the analytical tools of calculus with the geometry of curves and surfaces in space. It has numerous applications in economics, engineering, and especially physics, where it is the very language of the theory of electricity and magnetism and fluid dynamics.

This is an honors course, which means the material will be covered in more depth and with a slightly more theoretical foundation than in Math 18 or 20. It also means you will be expected to spend more time studying the material and working on homework assignments. Challenging problems will be fair game on homework and exams!

Prerequisites: A solid understanding of single variable calculus, including limits, continuity, differentiation, integration, the Fundamental Theorem of Calculus, etc. We will develop all the necessary linear algebra (vectors, matrices, determinants) as we go along, so no prior exposure to this is required, though those who do have experience in this area will find it helpful. Motivation to work hard is probably also a good prerequisite!

Grading: Your final grade will depend on weekly homework scores and exams (2 midterms and 1 final), weighted as follows:

Homework	20%
Midterms	40%
Final	40%

The final will consist of roughly 50% cumulative material, and 50% new material (see the timeline below). Your lowest 2 homework scores will dropped. You are allowed (indeed, encouraged) to work on the homework assignments together, but must write up your answers separately. You will also need to cite your collaborators and any sources consulted on your homework assignments.

Tentative timeline: The course will consist of three units, roughly as follows (we'll pick up bits from Chapter 1 as we need them):

Unit	Chapters	Dates	Exam
Differentiation. Functions of several variables, partial derivatives, the derivative as a linear approximation, curves and velocity, the gradient and directional derivatives, higher derivatives and Taylor's theorem, maxima and minima with/without constraints and Lagrange multipliers, implicit/inverse function theorems.	Ch. 2-3	9/1-9/29	Oct. 1
Integration. Double and triple iterated integrals, integrals over regions bounded by graphs, the change of variables formula and special coordinates (polar, cylindrical, spherical), arc length, vector fields, line integrals and work, the fundamental theorem of calculus for line integrals and conservative vector fields, parametrized surfaces, surface integrals and flux.	Ch. 5,6,4.1-4.3, 7	10/4-11/3	Nov. 5
Main Theorems of Vector Calculus. Divergence and curl of vector fields, Green's Theorem in 2D (flux form and work form), the Divergence Theorem in 3D, Stokes' Theorem in 3D, the relationships between these, applications.	Ch. 4.4, 8	11/8-12/3	Dec. 10

Tips for success:

- **Read the relevant material before class.** I will put sections of the book corresponding to each lecture on the website a day or so beforehand. You do not need to fully understand everything, however, having some familiarity with the subject of the lectures beforehand is extremely valuable. You will definitely get more out of each lecture this way. This is possibly the most important tip I discovered learning math while I was an undergrad.
- **Come to office hours.** Identify anything you don't understand very well, and ask me about it. This is an invaluable time to address individual questions that you have; there are no stupid questions! Also, if you have any questions or interests that go beyond the scope of this course, I'm more than happy to discuss these in office hours as well. Office hours are pretty boring for me when nobody comes!
- **You are your own teacher.** In college, you are ultimately the best person to identify which things you understand well and which things you feel a little hazy about. Don't let yourself get away with the latter! While you're encouraged to work on homework assignments in groups, it is your responsibility to make sure you're not just leaning on your friends; make sure that by the time you hand the assignment in, you understand enough to be able to do the problems on your own.
- **Think about and do math!** Really understanding mathematics takes time and practice. The homework and reading assignments are not just for grading purposes, they're meant to give you an opportunity to dig into the material and develop your skills and intuition. While I'll drop your lowest 2 homework grades (because I know that every once in a while you'll have a bad and/or crazy week), not spending any time working on a particular assignment is a Very Bad Idea. Make sure you're able to solve the problems, even if you don't have time to get them all written down. It's also good just to think about mathematics from time to time, say when you're walking down the street, or in the shower. (Though probably not while having a conversation with a significant other – that usually goes over badly.)