Mathematics 105 Vector Calculus Spring 2009

Section 2 Tu,Th 11:40 am - 12:55 pm Physics building 235

Professor: Lenny Ng
E-mail: ng AT math.duke.edu
Office: Physics 231
Office phone: 919-660-6972

Course web site: Assignments, announcements, grades, and other course material will be posted on Blackboard, `https://courses.duke.edu/` . There's also a rudimentary public web site at `http://www.math.duke.edu/~ng/math105/` .

Textbook: *Vector Calculus*, 5th edition, by J. E. Marsden and A. J. Tromba. It is *very important* that you read the relevant sections of the book as we cover them in class, as there will be topics that I don't have time to discuss in depth.

Office hours: TBA, and by appointment. Please take full advantage of office hours to resolve any questions you may have about course material or homework. To set up an appointment, e-mail me, but please keep in mind that I can't usually answer e-mail immediately; on occasion it may take a day for me to respond.

Course information (from the synopsis): Mathematics 105 is a course in vector calculus that uses linear algebra. Topics to be covered include: iterated integrals and partial derivatives, optimization (constrained and unconstrained) in multiple dimensions, the Implicit Function Theorem, cylindrical and spherical coordinate systems, vector fields, divergence and curl, parametrized curves and surfaces, arc length and surface area, and Green's, Stokes', and Gauss's Theorems.

Mathematics 104 is a prerequisite for this course. Prospective mathematics majors are encouraged to take Mathematics 104 followed by Mathematics 105 instead of Mathematics 103 followed by Mathematics 104. The 104/105 sequence will be accepted in lieu of the 103/104 sequence for the mathematics major.

Grading: Your grade will consist of a weighted average of homework (10%), quizzes (10%), two midterms (20% each), and the final (40%).

- **Homework:** Problem sets, usually composed of exercises from the textbook, will be due in class on Thursdays. I plan to announce a number of problems during each class, related to the topic from that class. *Always show work*—this helps you find mistakes in your solutions, and it helps with the assignment of partial credit. You may not receive full credit if steps are missing in your solution. For the sake of the grader, please make sure your problem sets are clearly marked with your name and stapled together. Box the answer to any problem that asks for a numerical answer.

  You are encouraged to work with other students in the class on the homework, but

you must write up the homework *by yourself* (no copying!), and acknowledge any collaborators. You may use calculators or computing programs where necessary; give any numerical answers to four significant figures. *No unexcused late homework will be accepted.* Your lowest homework score will be dropped.

- **Quizzes:** There will be weekly quizzes on Thursdays. They will consist of two questions designed to test your understanding of the homework due that week, and will be given in the last ten minutes of the class. For quizzes, midterms, and the final, no calculators, notes, or books are permitted.

- **Midterms:** There will be two in-class midterm exams, tentatively **February 12** and **March 19**. You will only be excused from a test if you have prior written authorization from your dean or you have a serious short-term illness; in the latter case, you need to fill out the Short-Term Illness Notification form (linked from the first-year information web page, see below).

- **Final examination:** The final exam will be held on **April 29** from **2:00–5:00 pm**.

Structure: The course will be divided into three sections. Here is an outline:

I. Multivariable differential calculus	
Vectors, inner products	1.1, 1.2
Functions of several variables, limits, partial derivatives	2.1, 2.2, 2.3, 2.4
Acceleration, arc lengths	4.1, 4.2
Chain rule, directional derivatives, gradient	2.5, 2.6
Taylor's Theorem, max/min problems, Lagrange multipliers	3.1, 3.2, 3.3, 3.4
Implicit Function Theorem	3.5
II. Multivariable integral calculus	
Double and triple integrals	5.1, 5.2, 5.3, 5.4, 5.5
Cylindrical/spherical coordinates, change of variables, Jacobian	1.4, 6.1, 6.2, 6.3
III. Vector calculus	
Vector fields, cross products, divergence/curl	1.3, 1.5, 4.3, 4.4
Path and line integrals on curves	7.1, 7.2
Scalar and vector integrals over surfaces	7.3, 7.4, 7.5, 7.6
Green's, Stokes', Gauss's Theorems, conservative vector fields	8.1, 8.2, 8.3, 8.4
Differential forms	8.6

Other information: `http://www.math.duke.edu/first_year/f_y_info.html` is a useful web site with general information about first-year math courses, the Help Room, what to do in case of illness, etc.