MATH 285, HONORS CALCULUS III

Instructor: Rohan Kadakia, kadakia@umich.edu. E-mail me from your @umich account.

Office Hours: I will hold office hours on Mondays, Tuesdays, and Fridays (except 9/18), 1:15–2:30 pm, in East Hall 3827. If you can't make any of these, or if you prefer to meet with me separately, let me know. Please don't hesitate to send me an e-mail or talk to me after class, so that we can schedule an appointment. While I enjoy lecturing, I think I'm most effective as a teacher when I'm communicating with students in small groups, or one-on-one.

Course Assistant: Molly Logue, **Office Hours:** Wednesdays 10–11 am in 3096 East Hall

Class Time and Location: MoTuWeFr 12:00–1:00 pm in Mason Hall 2347. Class will start at 12:10 pm, on Michigan time.

Textbook: *Vector Calculus*, by J. Marsden and A. Tromba, 6$^{\text{th}}$ edition. Our goal is to cover the entire book, Chapters 1–8, in order. If you like, there is a *(optional)* study guide for students that accompanies this book, ISBN-13: 978-1429231091. I don't know if the study guide is available at the University bookstore, but it can certainly be purchased off Amazon. Again, it's totally optional.

Course Website: The course website is on Canvas. I will post homework assignments here, and most likely I will post sample exams as well.

Course Description: This is a course on multivariable calculus. It will cover higher dimensional variants of the techniques of single variable calculus (limits, differentiation, integration), culminating in higher dimensional analogues of the Fundamental Theorem of Calculus. Emphasis will be on what takes place in two and three dimensions (so that we have a chance of visualizing!). I will ask you to do some proofs, so that you can begin to develop a theoretical understanding of and appreciation for calculus. At the same time, problem-solving will remain a large component of the class, and solving problems will still be the best way to prepare for exams.

The best—in fact, the only—way to learn mathematics is by doing mathematics. Regularly over the course of the semester, I will ask you to do math in class. Most often this will take the form of group work. In groups of four, students will work on a handout. One member of each group (a different person each time!) will write up solutions for that group. Then, at the end of class (or the start of the next class), we will have student presentations of solutions to problems from the worksheet, followed by a brief class-wide discussion.

Date: Fall 2015.

Some worksheet problems will be applications of material already covered, some will be more theoretical, and still others will be designed to introduce new material. It is important that each member of the group contributes to the efforts of the group; therefore, group participation (which I will monitor) will factor into the grading scheme (see below).

Prerequisites: Math 185–186, or equivalent. See me if you're unsure.

Pre-reading: You should read sections of the book ahead of the day they will be covered in class. This is especially important for group work. In some sections of the book, you'll come across notes recounting the history behind the content of the section; these are optional reading. One final comment about lecture: I will not simply regurgitate the material in the book. I may choose to put emphasis on certain points and possibly leave out other points. This is further motivation for you to read the book.

Exams: The final exam will take place on **Friday, December 18$^{\text{th}}$, 4:00 pm – 6:00 pm**, location TBD (starting sharply at 4:00, *not* on Michigan time). The final will be cumulative, or at least you should expect it to be. In addition, there will be two midterm exams. The first midterm will take place after we've finished Chapter 3, and will cover Chapters 1–3. Midterm 1 will take place on **Friday, October 16$^{\text{th}}$** in class. The second midterm will take place after Chapter 6, and will cover Chapters 1–6 (mostly 4–6). The date for the second midterm is TBD, and I will inform you well in advance. Exams are closed to notes, the book, electronic devices, etc. Note that class will not be held October 19–20 due to the fall study break.

Evaluation: Grades will be determined according to the percent-wise breakdown below.

Group Worksheets, Solutions & Participation 5%
Homework 15%
Midterms ..... 20% each
Final Exam 40%

I promise: If you earn at least 90% of the points, after weighting, you will get no lower than an A-. If you earn at least 80% of the points, after weighting, you will get no lower than an B-. And so on.

Homework: There will be a weekly problem set, which will be due at the beginning of class each Tuesday. My recommendation is that you attempt problems the day we cover that material in class. That way, if you struggle with a problem, there's still plenty of time to ask for help, prior to the due date. I urge you not to wait until Monday night (or Tuesday morning) to do the assigned problems. I will return graded homeworks by the following Tuesday at the latest, possibly sooner. You may work on these problem sets together, but unlike in-class group work, *you must submit your own solutions.* Show your work! Beware: I will know if you've just copied someone else's work. When writing up your solutions, whenever possible, use complete English sentences, especially when writing proofs; and please write up your solutions in order. No late homework will be accepted, and your lowest homework score will de dropped.

Attendance: This is an honors course, so I will assume that you're excited about the material, and therefore won't be inclined to miss class. If you are absent from class, and we happen to be doing group work that day, your absence will affect your group! If you have a reason for not being able to attend class, send me an e-mail at least one hour prior to the start of class. Frequent absences, and particularly frequent unexcused absences, may adversely impact the participation component of your grade.

Technology: Some objects in multivariable calculus can be hard to visualize, and this can make the mathematics more difficult. Various Mathematica demonstrations have been created for Math 215, and you might find these to be useful. They are available at instruct.math.lsa.umich.edu/lecturedemos/ma215/docs.

Course Content: *Important:* read the short section "Prerequisites and Notation" starting on page xxiii. To minimize confusion, I will try to be consistent with the notation used in the book.

Generally, we will cover one section of the book in one class meeting, but some sections will demand more time. I will tell you, or it should be clear, which section you should read for the next day's class. Below is a list of chapters; following each title I've provided a bit of commentary.

Chapter 1: The Geometry of Euclidean Space. This course has a strong geometric flavor underlying the calculus, so we begin with a condensed introduction to the geometry of lines and planes, mainly in three dimensional space. Also, this chapter covers some of the fundamentals in linear algebra.
Chapter 2: Differentiation. Limits of functions of multiple variables, partial derivatives, and differentiability.
Chapter 3: Higher-Order Derivatives: Maxima and Minima. Higher dimensional versions of the optimization results from single variable calculus, and the method of Lagrange multipliers.
Chapter 4: Vector-Valued Functions. Vector fields are introduced.
Chapter 5: Double and Triple Integrals. The hardest part for these is visualizing the region over which you're integrating and then determining the limits of integration. Don't worry, we won't be doing quadruple integrals.
Chapter 6: The Change of Variables Formula and Applications of Integration. Higher dimensional analogue of u-substitution. Applications will be covered time-permitting, and choice of applications will depend on student interest.
Chapter 7: Integrals Over Paths and Surfaces. Line integrals and integrals to calculate surface area.
Chapter 8: The Integral Theorems of Vector Analysis. This is what we've been building to.