MATH 202: VECTOR CALCULUS

SPRING 2018

Place:	Lib 389
Time:	MWF, 11:00-11:50A.M.
Instructor:	Kyle Ormsby (ormsbyk@reed.edu)
Office Hours:	Library 306, MWF 1:30–2:30P.M.
Textbook:	*Calculus and Analysis in Euclidean Space*
Website:	people.reed.edu/~ormsbyk/202/

Summary. This course is a rigorous exploration of differential and integeral vector calculus (also know as multivariable calculus) emphasizing theoretical, geometric, and calculational aspects of the subject. The first portion of the course introduces derivatives of multivariable real functions in terms of best linear approximations and Jacobians, and then applies these concepts to optimization problems. The second portion develops multivariable integration, proving results fundamental to understanding geometric content and computational techniques such as the Fubini theorem and change of variables. The course culminates in a treatment of differential forms, deducing a generalized version of Stokes theorem that specializes to the classical Green, Stokes, and Gauss theorems.

Students should leave the course with an appreciation for how rigorous theory is brought to bear on fundamental geometric and computational problems. They will improve their geometric intuition, learn how to develop complex proofs, and gain computational facility with the objects of vector calculus.

Course design. Nearly all of our meetings will break down into three components:

» *Reading*. Every class will have an assigned reading which you must complete and engage with before we meet. At the start of class, you will turn in answers to several simple reading questions. You are also encouraged to submit questions on the text or requests for review of a topic (accompanied by an explanation of what you find confusing).

» *Active class sessions*. Our 50-minute meetings will include mini-lectures delivered by the instructor and group work with your peers. The mini-lectures will delve deeper into reading topics and attempt to answer your questions. The group work will allow you to interact with and truly understand the material through problem-solving. There will be many opportunities for presenting solutions and proofs to your peers.

» *Homework*. I will assign two or three harder homework problems for you to complete after class. These are due at the start of the next class meeting (along with your reading responses for the upcoming meeting).

Texts. The course will use *Calculus and Analysis in Euclidean Space* by Jerry Shurman as its primary text. Copies are available in the campus bookstore, and will additionally be on reserve in the library. You can also download a free pdf of the book via a Reed proxy link available on the course website. (You also have the option of purchasing a $25 softcover edition of the book via that link.) We will supplement the text with a number of computational interludes.

Date: 22.I.18.

Reading assignments. The required reading is essential to the course and provides a leaping off point for each of our class meetings. The reading questions are intended to ensure that you are following the text at an appropriate level; they should not be particularly hard, though some will be nontrivial. They will be assessed primarily for completion on a $\checkmark+/\checkmark/\checkmark-$ scale.

Homework. Homework is due at the start of (nearly) every class meeting. Excellent solutions take many forms, but they all have the following characteristics:

- » they are written as explanations for other students in the course; in particular, they fully explain all of their reasoning and do not assume that the reader will fill in details;
- » they include a paraphrasing of the problem;
- » when graphical reasoning is called for, they include large, carefully drawn and labelled diagrams;
- » they are neatly written or typeset;[1] and
- » they use complete sentences, even when formulas or symbols are involved.

Each homework problem can earn up to **eight points**, **five** of them awarded for mathematical insight into the problem and **three** for written communication. Late assignments *will not be accepted* in any form, but your two lowest homework assignment scores will be dropped.

Collaboration. You are permitted and encouraged to work with your peers on homework problems. You must cite those with whom you worked, and you must write up solutions independently. **Duplicated solutions will not be accepted and constitute a violation of the Honor Principle.**

Revisions. You may revise any homework problem after receiving comments, and you will sometimes be encouraged to revise problems. This will allow you the opportunity to perfect the skills required to solve the problems. You may revise multiple times, and will receive the average of all of your scores. You may not revise a problem which was originally turned in late. Revisions must be turned in at most one week after you receive comments on the previous version of a solution. There are no revisions of answers to reading questions.

Tests. We will have two timed take-home midterms and a final exam. You may reference one two-sided US Letter or A4-size page of notes during each exam. Calculators, collaboration, books, and the Internet are prohibited during exams.

- » Midterm 1: two hours, distributed Friday, 2 March, due Monday, 5 March
- » Midterm 2: two hours, distributed Friday, 6 April, due Monday, 9 April
- » Final Exam: three hours, as scheduled by the registrar

Joint expectations. As members of a communal learning environment, we should all expect consideration, fairness, patience, and curiosity from each other. Our aim is to all learn more through cooperation and genuine listening and sharing, not to compete or show off. I expect diligence and academic and intellectual honesty from each of you. You should expect that I will do my best to focus the course on interesting, pertinent topics, and that I will provide feedback and guidance which will help you excel as a student.

[1] Interested students are encouraged to prepare solutions in the LaTeX document preparation system. A guide to LaTeX resources is available on the course website. Nearly all of the `.pdf` files on the course website are produced by LaTeX; you can find their associated source files by changing the `.pdf` suffix to `.tex`.

Help. There are a number of resources you can access for help with this course's content. Everyone is welcome and encouraged to attend my office hours, Monday, Wednesday, and Friday 1:30–2:30P.M. in Library 306. If you are unable to make these times, I am happy to schedule alternate times at which to meet with you.

The math department also hosts drop-in tutoring in Library 387 Sunday–Thursday 7–9P.M. Upperclass tutors will be available to clarify concepts and help you with homework problems.

Finally, every Reed student is entitled to one hour of free individual tutoring per week. Use the tutoring app in IRIS to arrange to work with a student tutor.

Piazza. Our section has a Piazza page on which you can ask and answer questions. Sign up at `piazza.com/reed/spring2018/math202s02`. Please do not discuss homework solutions on Piazza, although it is fine to ask for problem clarification or a specific conceptual or technical question whose answer is related to a problem. The Piazza page is an extension of our classroom and Reed, and the Honor Principle and our joint expectations govern our conversations there.

Technology. The use of electronic devices (cell phones, computers, tablets, calculators, *&c*) is strictly prohibited in the classroom without prior authorization from the instructor. That said, legitimate uses of technology (*e.g.*, note-taking) will be accommodated — just talk to me first.

The Internet. You are welcome to use Internet resources to supplement content we cover in this course, with the exception of solutions to homework problems. **Copying solutions from the Internet is an Honor Principle violation and will result in an academic misconduct report.**

Academic accommodations. If you have a documented disability requiring academic accommodation, please let me know during the first week of class and provide a copy of your letter from Disability Support Services (DSS). If you believe you have an undocumented disability and that accommodations would ensure equal access to your Reed education, I would be happy to help you contact DSS

Grades. Your grade will reflect a composite assessment of the work you produce for the class, weighted in the following fashion: 40% homework, 20% final exam, 15% midterm 1, 15% midterm 2, 5% class participation, 5% reading assignments.

Remember: *Math is hard, but we're going to get through this together!*