Syllabus for MAT 2220: Multivariable Calculus
Spring 2024

Lecture 1: MWF 11:15am - 12:05pm, Rockefeller 103
Lecture 2: MWF 12:20pm - 1:10pm, Rockefeller 103

January 21, 2024

Instructor:
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Prerequisites:
MATH 2210 (we will use some linear algebra, but 2210 also is important for background in proofs and helps with "mathematical maturity").

Course Description:
From the Course Bulletin: "Differential and integral calculus of functions in several variables, line and surface integrals as well as the theorems of Green, Stokes, and Gauss."

In single variable calculus, one understands general functions of one variable by approximating them by *linear* functions. Linear functions of one variable are simple to understand. In multivariable calculus, at least one of the domain or range of the functions considered has dimension larger than one. Such functions appear all over mathematics, as well as physical and social sciences, since many natural phenomenon are modeled by functions with multiple inputs or outputs. These functions can also be approximated by higher-dimensional linear functions. Such linear functions are the subject of linear algebra, and having taken that course, you have a good understanding of them. They can be considerably more complicated than the linear functions that appear in single variable calculus. So multivariable calculus can be thought of as adapting the techniques of single variable calculus to higher dimensions, using the tools of linear algebra.

Some highlights of the differential part of multivariable calculus include the general Chain Rule and optimization, in particular the technique of Lagrange multipliers for constrained optimization. In the integral part of the course, we will first develop notions of integration in higher dimension. This will build up to the theorems of Green, Stokes, and Gauss, which in some sense generalize the fundamental theorem of (single variable) calculus.

Some general mathematical skills that you will practice and develop in this course:

- Visualization, in dimensions 2,3, and using this to get a feel for higher dimensions
- Using specific examples to understand general theorems
- Balancing concrete, computational understanding with more geometric, conceptual perception
- Proving some results rigorously, and getting a sense of how this corresponds to conceptual intuition for why things are true

- Writing mathematics in a clear, precise, organized manner

Textbook:

- *Multivariable Calculus*, by Don Shimamoto. Electronic copy available for free at
  `https://open.umn.edu/opentextbooks/textbooks/780`.
  You can also order a paper copy for around $45 (I'd recommend this, since reading on devices often leads to distraction).

Canvas: Course announcements will be made via the Canvas site, so please check it regularly. Homework will be submitted via Gradescope, which is linked to from Canvas.

Contacting instructors and discussion: You can ask me quick questions immediately after class; I'll typically stay a few extra minutes. Most other mathematical and administrative issues should be addressed in office hours or via the course's *Ed Discussion* page, accessible via a link on the Navigation pane in Canvas. This is also a good place to have discussions with other students about the course.

Homework: There will be homework assigned every week (with some adjustments around holidays and exams), due on Friday at 10pm. You will receive two 48 hour extensions, with no grade penalty. Other than this, no homework will be accepted late. Your lowest score (even if it is zero) will be dropped.

Notecards: In lecture and TA section, we will hand out blank notecards at the beginning of most sessions. On it, you will write your name and one mathematical question, comment, idea, example, diagram, application etc you think of during that class/section, and hand it in at the end of the session. This will be the major component of the participation grade.

Exams:

- Prelims. If for either of these dates you have a conflict with another course or with religious observance, you must contact me about it by February 2.
  - Prelim 1: Tue March 12 from 7:30-9pm, location TBA
  - Prelim 2: Tue April 16 from 7:30-9pm, location TBA.
- Final: Sometime between May 11 and 18. Date and location set by registrar in early/mid March.

Grading:

- Homework: 30% (average of all but lowest score)
- Exams: 66% (Prelim 1: 18%, Prelim 2: 18%, Final: 30%)
- Participation (including notecards): 4%

Academic Integrity: Discussing homework problems with others is encouraged, but *you must write up your solutions on your own* (without the aid of people, or Artificial Intelligence tools such as GPT).
Cornell's code of academic integrity, available below, applies to this course.
`https://provost.cornell.edu/leadership/vp-undergrad-ed/academic-integrity/`.

Accommodations: Cornell University is committed to ensuring access to learning opportunities for all students. If you are registered with (Student Disability Services) SDS and have a faculty notification letter dated for this semester, please ask SDS to send me a copy early in the semester and we will discuss how the accommodations will be applied in the course.

Resources: In addition to lecture, TA section, and office hours, the following resources may be helpful.

- *Math Support Center.* Provides free student-led tutoring for all math courses:
  `https://math.cornell.edu/math-support-center-msc`
- *Study partners.* The Learning Strategies Center has a service for finding study partners:
  `https://lsc.cornell.edu/studying-together/find-study-partners/`
- *Book A Library Study Space:*
  `https://it.cornell.edu/studyspace`