

Lecture: Monday-Tuesday-Wednesday-Thursday, 9:50am–11:30am, Richards 253.

Instructor: Evan Dummit, Lake Hall 571, edummit@northeastern.edu.

Office Hours: Tuesday 12:05pm-1:15pm + Thursday 3:30pm–5:30pm, Lake 571 or online via Zoom.

Problem Sessions: Friday, noon–2:30pm, Richards 253.

Course Webpage: https://web.northeastern.edu/dummit/teaching_su23_2321.html.

Course Textbook: The instructor will write lecture notes for the course (in lieu of an official textbook) as the semester progresses. If an actual textbook is desired, essentially all multivariable calculus books cover the same material in the same way.

Course Topics: This course is an introduction to multivariable calculus, which extends the familiar notions of derivatives and integrals to higher-dimensional settings. Specifically, the course covers functions of multiple variables, vectors, dot and cross products, lines and planes in 3-space, parametrization of curves and surfaces, partial derivatives, directional derivatives and gradients, tangent lines and planes, the chain rule, linearization, minima and maxima, optimization, Lagrange multipliers, double and triple integrals in rectangular/polar/cylindrical/spherical coordinates, applications of multivariable integration, line and surface integrals, work, circulation, flux, conservative vector fields, the fundamental theorem of line integrals, Green's theorem, divergence and curl, Stokes's theorem, Gauss's divergence theorem, and applications of vector calculus.

Success in this course will require facility with the basic concepts and with computational applications.

Grades: Your course grade consists of **20% WeBWorK** and **80% exams**. There are four exams: three 90-minute midterms and a final. You may elect to take the **2-hour comprehensive final**, covering material from the whole semester, or the **50-minute short final**, covering only material after the third midterm.

If you select the comprehensive final: your score is the greater of (20% WeBWorK, 15% each midterm, 35% final) and (20% WeBWorK, 20% each best two midterms, 40% final).

If you select the short final: your score is 20% WeBWorK, 23% each midterm, and 11% final.

The homework score consists of your total WeBWorK points divided by the total number of problems assigned.

An overall raw score of 92% will be **at least** an A, 90% will be **at least** an A-, 88% will be **at least** a B+, 82% will be **at least** a B, 80% will be **at least** a B-, 78% will be **at least** a C+, 70% will be **at least** a C, and 68% will be **at least** a C-.

If you feel that an assignment or exam has been misgraded, please talk to the instructor directly. Requests for regrading will not be considered more than two days past the date the assignment or exam was returned.

Exams: There will be three 90-minute in-class midterm exams, along with a 2-hour or 50-minute final exam.

If you miss an examination for any reason, you will receive a 0; make-up exams will not be given except at the instructor's discretion.

The midterms will be held on the following dates: Mon July 17th (week 3), Mon July 31st (week 5), Mon August 14th (week 7).

The final exam is scheduled during the final exam period: Mon August 21st or Tue August 22nd.

WeBWorK: WeBWorK is an electronic homework-assessment system that is free for students and has been designed specifically for courses in mathematics. Weekly WeBWorK assignments are due at 5am Eastern on Saturdays. **You are encouraged to consider the homeworks as being due "Friday evening".**

Problem sessions will be held weekly on Fridays. The problem sessions provide you a place to work collaboratively on the WeBWorK problems while getting assistance from the TA. It is highly recommended to start work on the assignments early, because some problems are quite lengthy. Many students like to work on the problems as soon as the corresponding material is covered in lecture. Do not fall into the trap of only starting the assignment the evening before it is due! **In particular, the midterm exams on Mondays will cover the material on the WeBWorK assignment due immediately before.** This is a summer course, and as such moves very quickly, so even a short delay in completing an assignment will make it very difficult for you to catch up.

All problems on all assignments will be counted (no assignments or problems will be dropped), so you should do as much as you can on each assignment even if you cannot completely finish it. **There is a 24-hour grace period after the official due time during which problems can continue to be submitted for 80% credit. Additional extensions cannot be granted other than in extreme circumstances, and are at the sole discretion of the instructor.**

Course Schedule: The course and lecture notes are organized into four chapters, as follows:

Week 1: Chapter 1 ~ Vectors and 3D Coordinates: Functions of several variables, 3d graphing, vectors, dot and cross products, lines and planes in 3-space, vector-valued functions, curves and motion in 3-space.

Weeks 1-3: Chapter 2 ~ Partial Derivatives: Limits and continuity, partial derivatives, directional derivatives, gradients, tangent planes, the chain rule, linearization, critical points, minima / maxima / saddle points, applied optimization, Lagrange multipliers.

Week 3: Midterm 1, covers chapter 1 and portions of chapter 2.

Weeks 3-4: Chapter 3 ~ Multiple Integration: Double integrals in rectangular and polar coordinates, triple integrals in rectangular coordinates, changes of variable in multiple integrals, triple integrals in cylindrical and spherical coordinates, applications of multiple integration

Week 5: Midterm 2, covers portions of chapter 2 and chapter 3.

Weeks 5-7: Chapter 4 ~ Vector Calculus: Line integrals, surfaces and surface integrals, vector fields, work, circulation, flux, conservative vector fields and potential functions, Green's theorem, divergence and curl, Gauss's divergence theorem, Stokes's theorem, applications.

Week 7: Midterm 3, covers portions of chapter 4.

Week 8: Final exam, covers all course material (comprehensive final) or the end of chapter 4 (short final).

Collaboration Policy: You are free to use calculators and computer technology for homework problems, and calculators are allowed on exams.

Mathematics is fundamentally a collaborative endeavor, and discussing the course material with others is an excellent way to solidify your own understanding. In particular, you are allowed to work on, and discuss, homework assignments together, as long as the actual submissions are your own work.

A warning: it is critical not to outsource your learning! You cannot expect to retain knowledge if you do not solve your homework problems yourself, whether because you relied on other people to explain to you how to do the problems, or because you relied too heavily on technological assistance.

Please also note that 80% of your course grade is determined by the exams, on which collaboration is not allowed.

Attendance Policy: It is expected that you will attend every class. This course moves very fast, and it is quite possible to fall behind even if you only miss one day. If you miss class for any reason, it is highly advisable to consult the course lecture notes and to watch the recording of the lecture you missed. It is your responsibility to be aware of all information announced in class, including modifications to the course syllabus or schedule, even if you are absent.

If you will be absent from a class activity due to a religious observance or practice, or for participation in a university-sanctioned event (e.g., university athletics), it is your responsibility to inform the instructor during the first week of class and provide appropriate documentation if required.

Statement on Academic Integrity: A commitment to the principles of academic integrity is essential to the mission of Northeastern University. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University. Violations of academic integrity include (but are not limited to) cheating on assignments or exams, fabrication or misrepresentation of data or other work, plagiarism, unauthorized collaboration, and facilitation of others' dishonesty. Possible sanctions include (but are not limited to) warnings, grade penalties, course failure, suspension, and expulsion.

Statement on Accommodations: Any student with a disability is encouraged to meet with or otherwise contact the instructor during the first week of classes to discuss accommodations. The student must bring a current Memorandum of Accommodations from the Office of Student Disability Services.

Statement on Classroom Behavior: Disruptive classroom behavior will not be tolerated. In general, any behavior that impedes the ability of your fellow students to learn will be viewed as disruptive.

Statement on Inclusivity: Faculty are encouraged to address students by their preferred name and gender pronoun. If you would like to be addressed using a specific name or pronoun, please let your instructor know.

Statement on Evaluations: Students are requested to complete the TRACE evaluations at the end of the course.

Miscellaneous Disclaimer: The instructor reserves the right to change course policies, including the evaluation scheme of the course. Notice will be given in the event of any substantial changes.