

Math 3500/3500H Syllabus

1. COURSE INFORMATION

Dr. Jason Cantarella	Our classroom: Boyd 322
Office: Boyd 448	11:10-12:25 TR, 11:30-12:20 W
Office phone: 542-2595	The course webpage is linked here.
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Book: **Shifrin, Multivariable Mathematics**

2. COURSE SCHEDULE

Topics	Sections	Course Meetings (planned)
Vectors	1.1	8/18
The Dot Product and Subspaces of \mathbb{R}^n	1.2-1.3	8/19, 8/24
Linear Transformations	1.4	8/25
Determinants and the Cross Product	1.5	8/26
Scalar and Vector Valued Functions	2.1	8/31
Topology of \mathbb{R}^n	2.2	9/1, 9/2
Limits and Continuity	2.3	9/7
Partial and Directional Derivatives	3.1	9/8
Differentiability	3.2	9/9
Differentiation Rules	3.3	9/14, 9/15
Backpropagation, ML, and the Chain Rule	(extra)	9/16
The Gradient	3.4	9/21
Curves	3.5	9/22, 9/23
Higher partials	3.6	9/28
Gaussian Elimination and Linear Systems	4.1	9/29, 9/30
Exam 1	Chap. 1-3	10/5
Elementary Matrices and Inverse Matrices	4.2	10/6
Discussion of Exam 1		10/7
Linear Independence, Basis, Dimension	4.3	10/12
The Four Fundamental Subspaces	4.4	10/13, 10/14
Large matrices and computation	(extra)	10/19, 10/20
Introduction to Manifolds	4.5	10/21
Compactness and Maximum Values	5.1	10/26
Maximum and Minimum Problems	5.2	10/27, 10/28
Gradient Descent and ML	(extra)	11/2, 11/3
Quadratic Forms and the 2nd Derivative Test	5.3	11/4
The Multivariable Taylor Theorem	(extra)	11/9
Lagrange Multipliers	5.4	11/10, 11/11
Projections, least squares	5.5	11/16, 11/17, 11/18
The Contraction Mapping Principle	6.1	11/23
Inverse and Implicit Functions	6.2	11/30, 12/1
Manifolds Revisited	6.3	12/2
Final Exam (12:00pm-3:00pm), Boyd 322	Chapters 1-6	12/9 (Thursday)

3. PREREQUISITES

Students are expected to have a very solid foundation in single-variable calculus, equivalent to that offered in the MATH 2250 and MATH 2260 courses in order to enroll in the course. Students should be prepared for a very challenging and fast-paced theoretical course. Computer skills in Mathematica or similar symbolic computation environment (Sage or Maple) will also be helpful.

4. COURSE GOALS

Students will develop a deep understanding of differential multivariable calculus and elementary linear algebra. Students will understand the definitions of continuity and differentiability for functions of many variables and be able to apply them. Students will learn to take partial derivatives and differentials of functions of several variables, and approximate these functions by linear and polynomial functions. Students will also learn to handle max/min problems involving multiple variables, including the case where additional constraints are imposed. Students will be able to apply the 2nd derivative test in the multivariable case, both theoretically and with computer assistance. Students will be prepared to set up and solve linear algebra problems of the form $Ax = b$ both in an exact and in a least-squares sense. Students will understand matrix rank, kernel, and image and be able to use the rank-nullity theorem.

5. DISCLAIMER

The syllabus is a general course plan, but deviations may become necessary over the course of the semester.

6. PRINCIPAL COURSE ASSIGNMENTS

The course will have a midterm and a final exam. Homework will be assigned using Gradescope, with course entry code JB22BP. Reading assignments will be an integral part of the course, with quizzes on the reading assignments given in class. These quizzes may be marked “excused”, but cannot be made up. Students with excused absences have the “homework and quiz” portion of their grade computed as if fewer quizzes had been assigned.

7. GRADING AND POLICIES, PEDAGOGY

This course mixes reading, lecture, and active learning instructional styles. Each class will be preceded by a reading assignment (with a quiz at the start of class designed to assess what you’ve learned from the reading). Class will mostly consist of an interactive lecture, with some group and individual in-class exercises. Out-of-class homework will complete the process, giving you harder problems to think and write about.

The overall course grade is computed from homework, exam, and final grades by the formula:

- (1) 25% for the midterm.
- (2) 35% for the final exam.
- (3) 40% for the homework assignments and quizzes.

After grades are calculated for each student using these weights, the instructor will rank the students by average and determine thresholds for grades of A, B, C, D, and F. Generally, these are somewhat lower than 90%, 80%, 70%, and 60% of the total points in the course. Though improvement and other circumstances are taken into account in deciding thresholds for letter grades, students with a higher numerical average almost always receive higher letter grades than those with lower numerical averages.

In order to receive a grade of “WP”, you must have attended class regularly and turned in homework assignments representing a good faith effort for all homework assignments due before the date of withdrawal.

8. ATTENDANCE POLICY

Students are expected to attend class regularly unless they have a medical or pandemic-related reason to miss class. Students who miss more than 3 classes (one full week of class) with no excuse may be withdrawn from the course by the instructor.

9. ACADEMIC HONESTY

As a University of Georgia student, you have agreed to abide by the University’s academic honesty policy, “A Culture of Honesty,” and the Student Honor Code. All academic work must meet the standards described in A Culture of Honesty found at: www.uga.edu/honesty. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

It is perfectly acceptable to work on homework problems in groups in this course. However, the help you should get from your fellow students should enable you to complete the problem on your own. Recruiting another student to complete the homework for you, or to simply provide answers to the problems, is a violation of the honesty policy.

10. MAKE-UP EXAMINATIONS

No makeup examinations will be given in the course. You may be marked “excused” from an exam if you have an acceptable excuse for missing the exam (generally, these are medical or legal in nature). In this case, your grade on the other exam will count for 60% of the course grade. Students who are excused from both the midterm and the final will receive a course grade of “Incomplete”.

11. TENTATIVE PANDEMIC BACK-UP PLAN(S)

If the University must pivot away from in-class instruction mid-semester and the instructor is neither ill nor caring for ill family members, we will try to film and upload lectures with as many students present as are allowed in the room. Exams will still be given in person if possible, though we may have to schedule multiple seatings in order to meet room capacity requirements.