The Theory of Single Variable Calculus

Math 421–003, 3 credits

UW – Madison

Fall 2025

Instructor Info

Grace Work

W: 12:00 – 1:00 pm (VV 311)
Th: 9:00 – 11:00 am (VV B205)
By Appointment & Open Door

Van Vleck 311

grace.work@wisc.edu

Course Info

Prereq: MATH 234

Mon/Wed/Fri

11:00 am - 11:50 am

Van Vleck B135

Important Dates

Oct 15: Midterm 1

Nov 12: Midterm 2

Nov 27 – 30: Thanksgiving

Dec 15: Final Exam

Course Description

Covers material in first and second semester calculus but it is intended to teach math majors to write and understand proofs in mathematics in general and in calculus in particular. Prerequisites: Math 234 or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program

How the Credit Hours are Met

This class meets for three 50-minute class periods each week during the fall semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc.) for about 3 hours outside of the classroom for every class period.

Grading

Your grade in the class will be assigned based on the weighted average of four categories. Each of these categories are described in more detail below. Cutoffs for each letter grade may be adjusted at the end of the semester, but if this happens, it will only be in favor of the students.

30%	**Written Weekly Homework**
5%	**Reading Quizzes**
40%	**Midterm Exams, 20% each**
25%	**Final Exam**

Grade	A	AB	B	BC	C	D
% Needed	93%	90%	83%	80%	70%	60%

Learning Objectives

1. Understand and use the standard methods and tools of mathematical argument (e.g direct and indirect methods, the construction of examples and counterexamples, induction arguments, first-order logic, set theory, and quantifiers)
2. Recall and state the formal definitions of mathematical objects (e.g. sets, functions, and graphs) and their properties used in calculus.
3. Distinguish if a mathematical construct does or does not have the condition of having a particular property formally (e.g. limits, continuity, differentiability, and integrability)
4. Recall and state standard calculus theorems (e.g. Intermediate Value Theorem, Mean Value Theorems, and Fundamental Theorem of Calculus), and recall arguments for these theorems and the underlying logic of their proofs.
5. The student will be able to verify the premises of standard theorems in calculus in order to apply their conclusions in the context of longer arguments. For example: verifying that a function on a compact set is continuous in order to claim it achieves a maximum value.
6. Prove or disprove statements related to the definitions, properties, and theorems of calculus using the techniques of mathematical argument.
7. Write mathematical proofs and concepts in logical, reasonable, and concise ways using appropriate mathematical terminology.

Material

Required Text: *Elementary Analysis*, 2^{nd} edition by Kenneth A. Ross

Digital Instructional Tools:

- Canvas - https://canvas.wisc.edu/courses/475732
- Piazza - a forum to discuss the material of this class with other students and your instructor.
- Zoom - some instructor office hours or student meetings may be held remotely.

Drop-In Hours

I will hold 3 scheduled drop-in hours per week. Wednesdays from 12:00 pm - 1:00 pm in my office, Van Vleck 311, and Thursdays from 9:00 am - 11:00 am in Van Vleck B205. Anyone is welcome to stop by at any time during drop-in hours.

The 2 hour block on Thursdays is held in a room with collaborative working tables and white boards and you are encouraged to come to work on and discuss the course content and homework problems either individually or with your peers.

If you are unable to make any of the regularly scheduled office hours, I encourage you to make use of the Math Learning Center's resources and the assigned Course Assistant's office hours.

Assessments

Written Weekly Homework

Homework will be submitted electronically and is due by 11:59 pm (almost) every Friday. Your lowest homework grade will be dropped at the end of the semester.

You are encouraged to discuss the assigned problems and other coursework with your classmates, including posting and answering questions on Piazza, and to use whatever outside resources you wish to deepen your understanding of the material. However, the solutions you submit must be your own and written in your own words.

Reading Assignments

Each week, you will be tasked with reading portions of the textbook and/or proof resources, and taking (short, repeatable) Canvas quizzes about what you read. The goal of these assignments is to help you familiarize yourself with the definitions and theorems that we'll be working with in class.

Midterm Exams

You will take two evening midterm exams on October 15 and November 12, 5:45 pm – 7:45 pm.

Final Exam

Your final exam will be cumulative and is scheduled (by the registrar's office) for Monday, December 15, 5:05 pm – 7:05 pm.

Make-up Policy

I expect you to make every effort to submit each assignment by its due date. However, life and other classes can get in the way and interfere with your ability to complete the assignments on time. Because of this, you have a 24 hour grace period to submit homework assignments with *no questions asked* and no grade penalty. If you feel you need more time beyond this, reach out to me as soon as you can, or as soon as you feel comfortable, and we can discuss it. In general, no late reading quizzes will be accepted. Make-up midterm exams will only be allowed for students who have a substantiated excuse approved by the instructor *before the date of the midterm*. In the event that a make-up midterm cannot be arranged within a reasonable time frame, the final exam grade will be used in lieu of the missed midterm grade.

Use of Generative Artificial Intelligence (AI)

The use of artificial intelligence (AI) tools and applications (including, but not limited to, Copilot, DALL-E, and others) for course assignments and assessments does not support the learning objectives of this course and is prohibited. Using them in any way for this course is a violation of the course's expectations and will be addressed through UW–Madison's academic misconduct policy, specifically UWS 14.03(1)b (b) Uses unauthorized materials or fabricated data in any academic exercise.

Academic Integrity Statement

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin–Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary sanctions include, but are not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension or expulsion.

Teaching & Learning Data Transparency Statement

The privacy and security of faculty, staff and students' personal information is a top priority for UW–Madison. The university carefully reviews and vets all campus-supported digital tools used for teaching and learning, including those that support data empowered educational practices and proctoring. View more information about teaching and learning data transparency at UW–Madison.

Privacy of Student Records & the Use of Audio Recorded Lectures Statement

View more information about FERPA. Lecture materials and recordings for this course are protected intellectual property at UW-Madison. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record my lectures without my permission unless you are considered by the university to be a qualified student with a disability requiring accommodation. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities. Students are also prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

Course Evaluations

Students at the University of Wisconsin–Madison have the opportunity to evaluate their learning experiences and the courses they are enrolled in through course evaluations. Many instructors use a digital course evaluation tool to collect feedback from students. Students typically receive notifications two weeks prior to the end of the semester requesting that they complete course evaluations. Student participation is an integral component of course development, and confidential feedback is important. UW–Madison strongly encourages student participation in course evaluations.

Students' Rules, Rights, and Responsibilities

View more information about student rules, rights and responsibilities such as student privacy rights, sharing of academic record information, academic integrity and grievances.

Diversity & Inclusion Statement

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world. (Source: Institutional Statement on Diversity)

Mental Health & Well-Being

Students often experience stressors that can impact both their academic experience and personal well-being. These may include mental health concerns, substance misuse, sexual or relationship violence, family circumstances, campus climate, financial matters, among others.

UW–Madison students are encouraged to learn about and utilize the university's mental health services and/or other resources as needed. Student can visit uhs.wisc.edu or call University Health Services at (608) 265-5600 to learn more.

Accommodations for Students with Disabilities

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (UW-855) require the university to provide reasonable accommodations to students with disabilities to access and participate in its academic programs and educational services. Faculty and students share responsibility in the accommodation process. Students are expected to inform faculty [me] of their need for instructional accommodations during the beginning of the semester, or as soon as possible after being approved for accommodations. Faculty will work either directly with the student or in coordination with the McBurney Disability Resource Center to provide reasonable instructional and course-related accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

Academic Calendar & Religious Observances

Academic Calendar & Religious Observances