# Introduction to Analysis
# Syllabus
# Fall 2025

## Contents

# Basic Course Information

- Introduction to Analysis, Department of Mathematics, Math 4101 Sections 1 and 2
- Number of credits awarded: 3
- Fall 2025
- In-person course
- Cupples II room 230
- Assigned Meeting Days: Tuesday/Thursday and
- Assigned Meeting Times:
    - Section 1: 10am-11:20am,
    - Section 2: 11:30am-12:50pm
- Course prerequisites: Foundations of Higher Mathematics, Honors Math I, or permission
- Course Instructor: Greg Knese
- Instructor email: geknese@wustl.edu
- Office hours: Tu 9-10am, W 12-1pm, Th 9-10am, or by appointment.
- Office location: Cupples I room 214

# Course Description

- Official description: The real number system and the least upper bound property; metric spaces (completeness, compactness, and connectedness); continuous functions (in R^n; on compact spaces; on connected spaces); C(X) (pointwise and uniform convergence; Weierstrass approximation theorem); differentiation (mean value theorem; Taylor's theorem); the contraction mapping theorem; the inverse and implicit function theorems.
- This course is about the rigorous study of the real numbers, functions of the real numbers, and functions of functions of the real numbers. The topics of study were originally developed as the foundation for calculus (and differential equations) but have gone on to be important throughout mathematics, science, and engineering

# Learning Objectives

- (Continue to) Learn to read, hear, digest, write, speak, and produce rigorous definitions, theorems, and proofs.
- Learn to think on a sliding scale of intuitive to rigorous/detail oriented.
- Understand the completeness property of the real numbers and its equivalent statements.
- Understand the motivations, statements, proofs, and applications of the theorems in the course description.
- Learn to ask questions and be skeptical of mathematical arguments and motivations for topics discussed.

# Texts

- “The Way of Analysis”, revised edition, by Robert Strichartz. I will discuss where to obtain a copy.
- Other standard texts for this course (not required!) are:
    - “Principles of Mathematical Analysis” by Walter Rudin,

- "Real Mathematical Analysis" by Charles Pugh
  https://link.springer.com/book/10.1007/978-3-319-17771-7
- "Elementary Analysis" by Kenneth Ross

  https://link.springer.com/book/10.1007/978-1-4614-6271-2
- "Understanding Analysis" by Stephen Abbott
  https://link.springer.com/book/10.1007/978-1-4939-2712-8
- "Analysis 1" by Terence Tao
  https://link.springer.com/book/10.1007/978-981-10-1789-6
- "The Real Analysis Lifesaver" by Raffi Grinberg
  https://ebookcentral-proquest-com.libproxy.wustl.edu/lib/wustl/detail.action?docID=4776834

# Course Requirements & Grading

- The course requires active engagement: attending and participating in lectures, writing/rewriting notes, reading the textbook, solving challenging problems and writing up solutions carefully. Expect to spend 2 hours of work outside of class for every hour inside of class. The course grade will be determined by homework, 2 midterm exams, and a final exam.

## Grading

- Letter grade breakdown: A+=(97,100], A=(93,97], A-=[90,93], similar for B,C,D. F=[0,60).
- The Pass/Fail policy is that you must get at least a C- to earn a "Pass".
- Final Grade Breakdown:

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| Exam 1 | 25% of final grade |
| Exam 2 | 25% of final grade |
| Homework | 20% of final grade |
| Final Exam | 30% of final grade |

- Dropping/Late policy: Your two lowest homework scores will be dropped. This policy is designed to take care of all instances where a student cannot complete an assignment on time so that the instructor does not need to make subjective judgement calls. Late homework will not be accepted so that solutions can be posted in a timely manner.
- Regrading: If you think there is a mistake in grading, ask me!
- Academic Integrity: You may discuss the homework verbally with other students provided you have already given the homework a serious attempt. If you have already solved a problem and someone asks you about it, then any help you provide should consist of hints or suggestions and never complete solutions. In particular, homework should be written up independently and it should not be possible to tell who worked with whom. Do not search or post requests for solutions to HW on forums, using AI, or anywhere else. Do not post any course materials online or offline. When in doubt, always cite a source when you use an idea that you did not come up with.

- Grading philosophy: We are learning to do rigorous mathematics. Our goal is to write iron-clad logical and understandable proofs. In previous computational math courses, one may receive partial credit for having some idea correct or you may get the benefit of the doubt on certain mistakes. In proof writing, the writer does not get the benefit of the doubt. It is much better to confess that you do not how to write something rigorous than to pretend that you can. Obviously when learning something new you may not have complete awareness of when you are doing something wrong—but the goal we strive for is to attain this awareness.

### Homework

- We will have weekly homework assignments. These will be submitted via gradescope.com.
- Most of your time in this course will be spent on homework as well as recommended problems. Homework is essential for the course and is where most of the learning takes place in terms of learning to read and write rigorous proofs about new/difficult concepts.
- The textbook has excellent advice in broad strokes on how to write proofs (see Section 1.3).
- Do not use generative AI for homework problems. You are welcome to ask AI to explain concepts to you; however, if you don't know what you don't know, you could come out of the experience with flawed knowledge.

### Attendance, Participation, and Classroom Climate

- Attendance is not required or taken, but I do like to hear from students if they cannot attend for some reason. Do not attend if you have a contagious illness; contact me and we can figure out what to do.
- It is good to participate in class but this is not everyone's strong suit. Do your best to participate but I will not keep track or grade anyone based on participation.
- Policy for students using technology in the classroom: don't cause a distraction or get distracted.
- Ground rules for appropriate classroom interactions: classroom interactions will remain civil, respectful, and supportive OR ELSE!
- Speak with me, the department chair, or your advisors about any concerns you have about classroom dynamics and/or classroom climate.

## Canvas and gradescope.com

- Announcements, files, and grades will be posted on the course Canvas page.
- Note about grades on Canvas: Canvas does all sorts of random computations with the grades that get entered into the gradebook. Do not take any sort of "final grade" entry in the gradebook seriously unless you do the computation yourself.
- Homework will be assigned and posted on gradescope.com

## Course Schedule

Include dates you plan to cover specific topics (with reading assignments), the due dates for major assignments, and the due date for the final exam. Consult relevant academic calendars and keep in mind religious holidays and significant campus events.

For synchronous courses in which the instructor has a planned absence or cancellation (e.g., conference conflict), ensure the schedule includes an explanation of how the contact time will be made up. Examples include: inviting a guest instructor to meet with students during class time, pre-recording a lecture for students to watch asynchronously coupled with a short assignment, or scheduling a learning activity outside of scheduled class times.

| **Date** | **Topics/Assigned Readings/Homework** | **Major Assignments and Deadlines** |
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| Sunday nights | Weekly homework | Weekly homework |
| Sept 18 | Topics to be determine based on what we cover. | Midterm Exam 1. In class (in your section!) |
| Oct 23 | Topics to be determine based on what we cover. The exam will be non-cumulative to the extent that it is possible. | Midterm Exam 2. In class (in your section!) |
| Dec 12 | Topics to be determine based on what we cover. The exam will be non-cumulative to the extent that it is possible. | **Final Exam 8:30-10:30pm** |

# Required Policies

*INSTRUCTIONS FOR REQUIRED POLICIES*
The following is the minimum set of policies that should be included verbatim in each syllabus. After the required policy and resource statement, please feel free to add links to resources or provide explanations that you think are appropriate to students in your course. Programs with specialized accreditation may have additional policy statements.

**ACADEMIC INTEGRITY**
In all academic work, the ideas and contributions of others (including generative artificial intelligence) must be appropriately acknowledged and work that is presented as original must be, in fact, original. You should familiarize yourself with the appropriate academic integrity policies of your academic program(s).

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| Please provide a statement with examples of acceptable/unacceptable instances of collaboration in this course, the acceptable/unacceptable uses of Generative AI in this course, and whether you will utilize TurnItIn functionality. Please see the Navigating Artificial Intelligence Resource webpage for examples. |

**UNAUTHORIZED RECORDING AND DISTRIBUTION OF CLASSROOM ACTIVITIES & MATERIALS**
The following applies to all students in my class: "Except as otherwise expressly authorized by the instructor or the university, students may not record, stream, reproduce, display, publish or further distribute any classroom activities or course materials. This includes lectures, class discussions, advising meetings, office hours, assessments, problems, answers, presentations, slides, screenshots or other materials presented as part of the course. If a student with a disability wishes to request the use of assistive technology as a reasonable accommodation, the student must first contact the Office of Disability Resources to seek approval. If recording is permitted, unauthorized use or distribution of recordings is also prohibited."

**DISABILITY RESOURCES (DR)**
WashU supports the right of all enrolled students to an equitable educational opportunity and strives to create an inclusive learning environment. In the event the physical or online environment results in barriers to your inclusion due to a disability, please contact WashU's Disability Resources (DR) as soon as possible and engage in a process for determining and communicating reasonable accommodations. As soon as possible after receiving an accommodation from DR, send me your WashU Accommodation Letter. Remember that accommodations cannot be applied retroactively. https://disability.wustl.edu/

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| Please feel free to describe how common accommodations might be regularly met or instruct students to meet with you to identify the approach for accommodations. For example, "Students should sign up for proctored exams with DR." or, "I will schedule a separate proctored exam." |

**SEXUAL HARASSMENT AND ASSAULT**
If you are a victim of sexual discrimination, harassment or violence, we encourage you to speak with someone as soon as possible. Understand that if you choose to speak to me as an instructor, I must report your disclosure to my department chair, dean, or the Gender Equity and Title IX Compliance Officer, which may trigger an investigation into the incident. You may also reach out to the Relationship & Sexual Violence Prevention (RSVP) Center to discuss your rights and your options with individuals who are not mandatory reporters. https://titleix.wustl.edu/students/confidentiality-resources-support/

**RELIGIOUS HOLIDAYS**

To ensure that accommodations may be made for students who miss class, assignments, or exams to observe a religious holiday, you must inform me in writing before the end of the third week of class, or as soon as possible if the holiday occurs during the first three weeks of the semester. For more information, please see the university's Religious Holiday Class Absence Policy.

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| Provide details to students regarding how you would like them to notify you of any religious accommodations needed. |

**EMERGENCY PREPAREDNESS**

Before an emergency affects our class, students can take steps to be prepared by downloading the WashU SAFE App. In addition, each classroom contains a "Quick Guide for Emergencies" near the door.

**RESOURCES FOR STUDENTS**

WashU provides a wealth of support services that address academic, personal, and professional needs. To start exploring resources that can help you along the way, please visit: Resources for Students.