AS.110.405 section 88 Syllabus

Real Analysis I

Course Information

Course Information:

Real Analysis I
AS.110.405.88 (4.0 Credits)
AE Fall 2026 [AE Fall 2026]

Description
This course is designed to give a firm grounding in the basic tools of analysis. It is recommended as preparation (but may not be a prerequisite) for other advanced analysis courses and may be taken as an Introduction to Proofs (IP) course. Topics include the formal properties of real and complex number systems, topology of metric spaces, limits, continuity, infinite sequences and series, differentiation, Riemann-Stieltjes integration.
Prerequisites: Grade of C- or better in 110.201 or 110.212 and 110.202 or 110.211

AS Foundational Abilities

Ethics and Foundations (FA5), Science and Data (FA2), Writing and Communication (FA1)

Department: AS Mathematics
College: Krieger School of Arts and Sciences

Instructor Information :

Instructors

Alexa Gaines
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Lauren Ross
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Course Schedule:

AE Fall 2026 [AE Fall 2026]
Term Start Date: Monday, 31-Aug-2026 **Term End Date:** Wednesday, 23-Dec-2026

Location and Schedule:
Schedule Detail: [Lecture: 08-31-2026 to 12-11-2026, None Online]
CRN: AS.110.405.88.AE Fall 2026

Course Learning Outcomes

Course Learning Outcomes:

- Construct and communicate rigorous mathematical proofs using direct proof, contradiction, contrapositive arguments, induction, and epsilon-based reasoning.
- Analyze the properties of sequences and series of real numbers, including convergence, divergence, monotonicity, boundedness, completeness, and standard convergence tests.
- Apply the formal definitions of limits and continuity to determine and justify the behavior of functions on subsets of the real numbers.
- Use the completeness properties of the real numbers (including the least upper bound property, Bolzano–Weierstrass theorem, and Cauchy criterion) to prove foundational results in analysis.
- Investigate differentiation and integration from a theoretical perspective, proving and applying major results such as the Mean Value Theorem and the Fundamental Theorem of Calculus.
- Read, interpret, and critique mathematical arguments by identifying logical structure, hidden assumptions, and gaps in reasoning within analytical proofs.

Required Text and Other Materials

Textbooks:

Text: The Way of Analysis, Rev. Ed., Strichartz, R., Massachusetts: Jones and Bartlett, June 2000, ISBN-10: 0763714976, ISBN-13: 9780763714970.

Other Required Materials:

Optional, supplementary text: Understanding Analysis, Stephen Abbott, ISBN-10: 1493927116 ISBN-13: 978-1493927111

Course Outline

Use this section to provide students with information related to course topics, assignments and any other instructional information students might find helpful.

Course Outline:

Course Structure

This 15-week online course is divided into weekly modules. Modules and the course materials therein are released at Monday 12:01am ET of each week; students have until the following Sunday 11:59pm ET to complete the listed objectives. The following items appear in some or all of the modules.

Lecture Videos

Pre-recorded lectures motivate the week's material, discuss definitions and theorems, detail important proofs, and reinforce understanding with worked examples.

Lecture Notes

These notes contain the major definitions, theorems, ideas, and examples of the week. The student may, at their discretion, supplement the lecture notes with the proofs and completed examples that are worked in the lectures.

Office Hours

At these optional, synchronous meetings, the instructor will supplement the recorded lectures with more strategies and caveats. These sessions will be informal and tailored to the needs of the students; students who cannot attend live and provide instantaneous feedback to the instructor have the option of pre-submitting questions and comments which will be addressed at the meeting. All links to live meetings will be posted to Canvas, and the meetings will be recorded and posted for future reference.

Discussion and Reflection Forums

Students will interact with each other by use of the Canvas discussion board by answering prompts and responding to the answers of others. Each initial post is due by Thursday 11:59pm ET; two responses to classmates are due by Sunday 11:59pm ET. More details about this course element will follow in the first week of the course.

Quizzes

There is a timed, 30-minute online quiz each week that tests your understanding of the week's material. The multiple choice questions therein concern basic definitions, theorems, and examples and are closely linked to the material presented in the lectures. This assignment is administered via Canvas. You have two attempts to

complete the assignment; each attempt randomly pulls questions from a question bank, and your highest score counts toward your course grade.

Problem Sets

The weekly problem sets are a primary vehicle of instruction for the course. The questions that comprise the problem set are designed to supplement the lectures by highlighting key ideas, clarifying confusing passages, and exploring deeper concepts. The problem sets are designed to be difficult! Solutions to the assigned questions are to be neat, legible, and well-structured. It is not enough that you understand the solution strategy to a particular question; this understanding must be correctly formulated into a cogent mathematical argument. Usually, this requires that you revisit a problem set some time after you "solve the problem" to review your ideas and formalize them into a rigorous proof. At the start of the course, we will explore various proof strategies to help prepare you for this element of the course.

Project

There is an independent project in the second half of the course that enriches your understanding of topics developed in the lectures. The project focuses on problem solving and mathematical communication. More details about the project will follow as the course gets underway.

Midterm Exam (Module 7)

There will be one 180-minute midterm exam. The date ranges are given in the .pdf syllabus unique to each iteration of the course. The exams are online and use Respondus Lockdown Browser and Webcam. Notes, books, calculators, and electronic devices are prohibited during exams. Attendance to exams is mandatory; you must provide a letter from the Office of Academic Advising if you have a valid reason to miss an exam.

Final Exam (Module 15)

There is a cumulative final exam distributed in week 15 of the course. More details about the final will follow as the course gets underway.

Evaluation and Grading

Note that the final course syllabus may differ from the information below.

Grading Breakdown:

Graded Elements: Your final grade for the course will be calculated using the following weighted average:

- Discussion Forums: 5%
- Reflection Forums: 5%
- Quizzes: 10%
- Problem sets: 25%

• Project: 15%
• Midterm Exam: 20%
• Final Exam: 20%

In the event of an excused exam absence, your score for that exam will be calculated using a weighted average of your scores on the other exams. Unexcused exam absences will result in a score of zero.

Grading Scale:

The letter grades are as follows based on your final weighted average:

A+:	100
A	93 - 99
A-	90 - 92
B+	87 - 89
B	83 - 86
B-	80 - 82
C+	77 - 79
C	73 - 76
C-	70 - 72
D+	67 - 69
D	55 - 66
F	< 55

Course Policies

Additional Course Policies:

Late Work

Unless otherwise specified, work will be due on the date given on the Canvas course webpage. A late penalty of 10% will be applied each day after the original due date has passed for assignments turned in late. After 7 calendar days of the original due date, late work will not be accepted. Additional points may be deducted for errors. Any exceptions to this will be solely at the instructor's discretion.

Collaboration

Collaboration on homework is allowed and encouraged. However, each individual must write up their solutions to the problems in their own words - copying from another individual's paper is prohibited. Homework is an essential part of learning the course material. Failing to give it proper attention will significantly harm your performance on the exams and your overall grade for the class.

Anonymous Feedback

I value all feedback about the course, including anonymous feedback. Additionally, I'm committed to ensuring that our course meetings value everyone's inherent dignity. If you have academic suggestions or feel like you've been mistreated in this course, please contact me; if you feel uncomfortable doing so or prefer to remain anonymous, you can reach out to the Director of Online Programs (Joseph Cutrone), the Director of Undergraduate Studies (Richard Brown), or the Department Chair (David Savitt).

Support

If you become stuck on a problem or concept, ask a classmate! I am also available for office hour consultation on a per-appointment basis; please do not hesitate to get in touch and set up a meeting. There are many other sources of help and support if you encounter difficulty with the material. These include The Learning Den (http://www.advising.jhu.edu) and the Office of Academic Support (htpp: //www.academicsupport.jhu.edu).

KSAS Academic Policies

The policies below are regularly updated to reflect KSAS teaching policies and guidelines.

Academic Policies:

AS Foundational Abilities

Students in the Krieger School of Arts and Sciences develop six Fouincational Abilities (FAs) through undergraduate coursework: in multiple courses over many semesters, in lower-level and upper-level contexts, in their major and outside of it.

These abilities reflect broad capacities that students build across disciplines:

- FA 1: Writing and Communication
- FA 2: Sciences and Data
- FA 3: Culture and Aesthetics
- FA 4: Citizens and Society, FA 4.1: Democracy
- FA 5: Ethics and Foundations
- FA 6: Projects and Methods

The FAs requirement is designed to ensure that students develop skills for both academic success and adaptability beyond college. All FA course tags are visible in SIS and additional details are available in the Academic Catalogue.

Academic Policies and Deadlines

Drop Deadline

The last day a student may drop a class is at the end of the sixth full week of classes. Specific drop and withdrawal dates are published each semester in the Academic Calendar maintained by the University Registrar.

Incomplete Grades

Policies related to incomplete grades are outlined in the Grades section of the Academic Catalogue. Students should consult the Catalogue for the most up-to-date information on eligibility, deadlines, and the process for requesting an incomplete.

Final Examinations

Final examinations are governed by university policy as outlined in the Academic Catalogue. Final exam schedules are published each semester by the Registrar and are available under Students → Course Schedule. Instructors are not permitted to make ad hoc arrangements for final examinations.

Final Course Grades

Final course grades are submitted within 48 hours of the scheduled final exam time or final project due date (if a final project is used in lieu of an exam). Grades are posted in SIS under My Grades. Additional guidance on accessing official grade records is available through the Office of the Registrar, Homewood Schools.

Attendance and Absences

Attendance Expectations

Class attendance is a student responsibility and is expected of all undergraduate students at Johns Hopkins University. When health concerns, religious observances, or personal or family matters prevent attendance, students are expected to notify their instructors as soon as possible and communicate directly about making up missed class time or assignments. Additional guidance regarding absences is available through Student Outreach and Support.

Honor System (Illness-Related Absences)

Students should follow the honor system when reporting absences due to illness. The Student Health and Wellness Center does not provide documentation for absences related to individual class meetings.

Religious Holidays

Religious holidays are valid reasons for excused absences. Students who anticipate missing class or an examination due to a religious observance must inform their instructor as early in the semester as possible to arrange appropriate accommodations. Information about religious holidays and spiritual life at Hopkins is maintained by Student Affairs through Religious and Spiritual Life. Students may also request a formal religious accommodation through the Office of Institutional Equity. Questions about specific situations may be directed to the University Chaplain at 410-516-1880 or kschnurr@jhu.edu.

Academic Integrity

The strength of the University depends on academic and personal integrity. In this course, you are expected to be honest and truthful in all academic work. Ethical violations include, but are not limited to, cheating on exams; plagiarism; reuse of assignments; unauthorized collaboration; improper use of the internet, generative AI tools, or electronic devices; alteration of graded assignments; forgery or falsification; lying; facilitating academic dishonesty; and unfair competition.

Expectations regarding the use of generative AI tools (including, but not limited to ChatGPT, Gemini, Claude, or similar technologies) should be outlined by the instructor and may vary by assignment. When AI use is permitted, it must align with course learning goals and be used transparently and responsibly. Students remain fully responsible for the accuracy, originality, and integrity of all work they submit, regardless of whether AI tools are used. Talk with your instructor if you are unclear about any expectations.

Any suspected violations should be reported to the course instructor. You can read the Homewood Undergraduate Academic Ethics Policy in detail and report an incident through the Office of Student Conduct. Students may also consult with the Office of Student Conduct at 410-516-2509 or via email at studentconduct@jhu.edu.

Students with Disabilities - Accommodations and Accessibility

Students with disabilities (including those with psychological conditions, medical conditions and temporary disabilities) **must request that their accommodations are shared** with instructional staff by Student Disability Services (SDS) for each course. SDS will then provide an Accomodation Letter with instructors. Please request accommodations be shared for this course as early as possible to provide time for effective communication and arrangements.

Johns Hopkins University values diversity and inclusion. We are committed to providing welcoming, equitable, and accessible educational experiences for all students. For further information or to start the process of requesting accommodations, please contact Student Disability Services at Homewood Campus, Shaffer Hall #101, call: 410-516-4720 and email: studentdisabilityservices@jhu.edu or visit the website.

Student Health and Wellness

Student Health and Wellness are an integral part of campus life at Johns Hopkins University. The university offers a range of services and resources to support students' physical, mental, and emotional well-being, including the Student Health Center, Health Promotion, Fitness and Recreation, and Sexual Assault Response and Prevention.

If you are experiencing an illness or medical issue, please note that sick notes are not required. Students are expected to use the honor system when notifying instructors that they need to miss class for health-related reasons.

Many students experience periods of stress, anxiety, or depression during their time at Hopkins. If you are struggling with mental health concerns, Mental Health Services provides a wide range of confidential resources and support services for students.

In addition, the Johns Hopkins University Behavioral Health Crisis Support Team (BHCST) is available on and around the Homewood campus seven days a week. The BHCST pairs licensed crisis clinicians with specially trained public safety officers to provide immediate, compassionate support during mental health crises and to help connect individuals to ongoing care. Homewood community members can reach the BHCST by calling Public Safety at 410-516-4600 and requesting a clinician.

If you are concerned about your own well-being or that of a fellow student, please use the following resources:

- Emergencies (immediate threat to self or others): 911 or 410-516-4600
- On-scene mental health support: BHCST via Public Safety at 410-516-4600
- Undergraduate support and care coordination: Student Outreach & Support at 410-516-7857 or studentoutreach@jhu.edu

Seeking help is a sign of strength, and Hopkins encourages students to make use of these resources to support their health and success.

Inclusivity and Classroom Climate

Johns Hopkins University is committed to creating a classroom environment that values the diversity of experiences and perspectives that all students bring. Everyone on campus has the right to be treated with dignity and respect. JHU believes fostering an inclusive climate is important because research shows that students who interact with peers who are different from themselves learn new things and experience tangible educational outcomes. You can read more about the comitment to an inclusive educational environment and goals based on results of the Campus Climate Survey through the Office of the Provost.

Please help create a welcoming and vibrant classroom climate. You should expect to be challenged intellectually by instructors, the TAs, and your peers, and at times this may feel uncomfortable. Indeed, it can be helpful to be pushed sometimes in order to learn and grow. But at no time in this learning process should someone be singled out or treated unequally on the basis of any seen or unseen part of their identity.