MAT 545—Real Analysis I—Fall 2025

Course Description: This course provides a rigorous study of real-valued functions of a real variable. Topics include properties of the real numbers, convergence of sequences and series, basic topology of the real line, limits and continuity, the derivative and its applications, and the Riemann integral.

Class Meetings: Thursdays 4:25–7:10 PM in UNA 127.

Instructor: Scott Parsell (aka Scotty P), UNA 175, 610-436-3465, `sparsell@wcupa.edu`.

Office Hours: MWF 11 am - 12 pm and TTh 12:30 - 1:30 PM in UNA 175 or by Zoom Appointment (Meeting ID 678 406 1662 with passcode 872054). No appointment is needed for in-person meetings, but please let me know in advance if you want to Zoom. Please come prepared with specific questions; since other students may be waiting, office hours cannot be used for working through your whole assignment or repeating material covered in the lectures–tutoring is a more suitable resource for this type of activity. Other times may be available by appointment.

D2L and Email: Course materials and grades will be posted on West Chester's "Desire 2 Learn" website at `https://d2l.wcupa.edu`. It is critical that you check D2L and your WCU email regularly for important announcements.

Textbook: *Elementary Real Analysis* by Thomson, Bruckner, and Bruckner, 2nd edition (2008). Free download available on the authors' website (see the link provided in D2L).

Program Goals and Learning Outcomes (PSLO): This course will assess the following program goals and program student learning outcomes for the MS in Mathematics Degree.

Program Goal 2: Acquire a core of mathematical knowledge in theoretical and applied analysis

PSLO 2a: define limits, derivatives, and integrals using precise mathematical language;

PSLO 2b: construct epsilon-delta proofs of fundamental analytic results;

PSLO 2c: apply definitions and theorems to solve problems arising in analysis;

PSLO 2d: investigate the mathematical applications of analysis;

PSLO 2e: explain analytic concepts orally and in writing.

Program Goal 3: Effectively communicate mathematics

PSLO 3a: describe mathematical ideas effectively in writing;

PSLO 3b: critique written and oral mathematical arguments;

PSLO 3c: organize and outline mathematical concepts in an oral presentation;

Program Goal 5: Exhibit information literacy

PSLO 5a: design an independent research project;

PSLO 5b: locate information required to perform the desired task;

PSLO 5c: evaluate the quality and relevance of materials assembled;

PSLO 5d: interpret research results both orally and in writing.

Course Student Learning Outcomes (CSLO): Upon completion of this course, students will:

CSLO 1. state basic algebraic and topological properties of the real numbers;

CSLO 2. prove statements involving limits of sequences and functions;

CSLO 3. define and apply basic properties of the derivative;

CSLO 4. communicate abstract mathematics precisely using correct logic, language, and notation;

CSLO 5. read and assimilate new mathematical concepts independently.

Homework: (PSLO 2a-e,3a; CSLO 1-4) Weekly problem sets will be assigned and graded. You may discuss the problems in collaboration with other students, and in fact you may submit one writeup jointly for a group of up to three students if you're working closely together and agree on essentially the same solutions. However, everyone is responsible for understanding all of the problems, so a divide and conquer approach is not recommended. Solutions that have obviously been copied from another individual, text, or website without attribution (or that have been produced by Chegg) will receive no credit and will trigger an academic integrity violation.

Reading: (PSLO 5a-d; CSLO 5) Because learning to read and absorb mathematics is of fundamental importance, you will be asked to read selected portions of the text prior to class. Only a selection of the most fundamental, interesting, or difficult topics from each chapter will be discussed in detail during class time. You'll complete reading checks in D2L prior to the class period in which a topic is to be discussed, and you'll be asked to submit questions about the reading that can help to focus our class discussions.

Exams: (PSLO 2a-e; CSLO 1-4) There will be two in-class exams on **October 13** and **November 17** and a final exam on **December 15** from 6:00–8:00 PM. The final exam cannot be waived under any circumstances. Requests for make-up exams must be made *prior to the exam* unless a last-minute emergency makes this impossible.

Research Project: (PSLO 3a-c,5a-d; CSLO 5) For the semester research project, you will be asked to research an advanced mathematical topic of interest to you. The result of your research must be:

1. An expository paper which is an organized reflection of your semester-long reading and research and which should be part of your capstone portfolio unless your choose to write a masters thesis. This paper must be at least 3 pages long and include typeset mathematics. Latex is strongly encouraged and templates will be provided if you are new to using latex.

2. A 15-minute presentation to the class about your research. You will be asked to share your paper with the class as part of this presentation.

More details:

- **Topic:** Your topic should at least be tangentially related to analysis and, should be something that you are interested in. It may be an applied or theoretical topic. It should not be a topic taught in a mathematics course here at WCU. A list of possible project ideas will be posted on D2L. If you have an idea that is not on the list but that you think would make a nice project, you are encouraged to submit it for approval. Creativity will be rewarded.

- **Proposal:** You must submit a proposal for your project no later than the Friday of the 6th week of the semester. I advise against waiting this late to begin - in fact, I'm likely to give bonus points for submitting your proposal early.

- **Due date:** The due date for submitting your project paper is the Friday of the second to last week of the semester. Every student will be asked to give a 15 minute presentation sharing their project with the rest of the class. Project presentations will be given the week before finals week.

- **Grading:** A rubric that details how projects will be graded will be posted on D2L.

Grading Scheme: Grades are based on reading checks (5%), problem sets (20%), in-class exams (15% each), and the final exam (25%), research project (20% each). Once your numerical grade is computed, your letter grade will be assigned according to the following breakdown:

92.5-100.0 %	A	72.5-76.4 %	C
89.5-92.4 %	A-	69.5-72.4 %	C-
86.5-89.4 %	B+	0.0-69.4 %	F
82.5-86.4 %	B		
79.5-82.4 %	B-		
76.5-79.4 %	C+		

Tentative Schedule: Minor adjustments may occur over the course of the semester. Note that you'll be asked to read a bit about each topic *before* it is covered in class. RC stands for a reading check in D2L, and PS stands for a problem set to be submitted in class. The last day to withdraw from the course is **Wednesday, October 26**.

9/1	Introduction Overview of the Real Numbers (1.1–1.5)
9/8	Properties of the Real Numbers (1.6–1.10) RC 1 due
9/15	Limits of Sequences (2.1–2.8) RC 2 and PS 1 due
9/22	Subsequences and Cauchy sequences (2.9–2.13) RC 3 and PS 2 due
9/29	Topology of the real line (4.1–4.3) RC 4 and PS 3 due, Project Topic Due
10/6	Compactness (4.4–4.5) RC 5 and PS 4 due
10/13	**Exam 1** covering RC/PS 1–4
10/20	Limits of functions (5.1–5.2) RC 6 and PS 5 due
10/27	Continuity and Uniform Continuity (5.4–5.6) RC 7 and PS 6 due
11/3	Extreme Value and Intermediate Value Theorems; Discontinuities (5.7–5.9); RC 8 and PS 7 due
11/10	The Derivative (7.1–7.4) RC 9 and PS 8 due
11/17	**Exam 2** covering RC/PS 5–8
11/24	Thanksgiving Break
12/1	The Mean Value Theorem and its consequences; L'Hôpital's Rule (7.5–7.7, 7.11); RC 10 and PS 9 due, Project Due
12/8	Project Presentations and review; PS 10 due
12/15	**Final Exam (6–8 pm)** covering RC/PS 1–10

University Policies

Academic Integrity & Personal Integrity: It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Graduate Handbook, the Graduate Catalog, the Ram's Eye View, and the University website at www.wcupa.edu

Accommodations for students with disabilities: West Chester University is committed to providing equitable access to the full WCU experience for Golden Rams of all abilities. Students should contact the Office of Educational Accessibility (OEA) to establish accommodations if they have had accommodations in the past or if they believe they may be eligible for accommodations due to a disability, whether or not it may be readily apparent. There is no deadline for disclosing to OEA or for requesting to use approved accommodations in a given course. However, accommodations can only be applied to future assignments or exams; that is, they can't be applied retroactively. Please share your letter from OEA as soon as possible so that we can discuss accommodations. If you have concerns related to disability discrimination, please contact the university's ADA Coordinator in the Office of Diversity, Equity, and Inclusion or 610-436-2433.

Excused absences policy: Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Graduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

Inclusive Learning Environment and Anti-Racist Statement: Diversity, equity, and inclusion are central to West Chester University's mission as reflected in our Mission Statement, Values Statement, Vision Statement, and Strategic Plan: Pathways to Student Success. We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and responses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time.

Resources for education and action are available through WCU's Office for Diversity, Equity, and Inclusion (ODEI), DEI committees within departments or colleges, the student ombudsperson, and centers on campus committed to doing this work (e.g., Dowdy Multicultural Center, Center for Women and Gender Equity, and the Center for Trans and Queer Advocacy). Guidance on how to report incidents of discrimination and harassment is available at the University's Office of Diversity, Equity and Inclusion.

Reporting incidents of sexual violence: West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University's commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: The sexual misconduct reporting page.

Emergency Preparedness: All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

Electronic Mail Policy: It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.