Information Sheet for Math 312 Spring 2025

Class meets: MTRF noon in BH 201

Credits: four credits

Teacher: Branko Ćurgus, Proofesor of Mathematics

Office: BH 184A

Office Hour: MTRF at 11 am or by appointment (in person or see the class **Canvas page** for a Zoom link)

Email: curgus@wwu.edu

Course website: https://faculty.curgus.wwu.edu/Courses/312_202520/312.html

Sources:

- **Proofs in Elementary Analysis**, lecture notes by Branko Ćurgus.
- All material discussed in class and your notes on it.
- **Class website**.
- Ask questions. Asking your own questions, and engaging in answering them on your own or in interactions with others, is the most important aspect of learning. While studying, thinking about the subject of this class, or discussing math with colleagues, you may encounter a question. Record your question and the context in which it occurred. I believe that questions are better when shared. Our class Canvas page features a **Discussions** section, which is an excellent place to share questions with the class. Of course, you are also welcome to stop by my office hour and ask your questions in person.
- You are the most important source for your learning and the steward of your ideas.

Course objectives: The real numbers play a fundamental role in mathematics, in particular in the branch of mathematics called mathematical analysis. The objective of this course is to provide a rigorous presentation of the basic properties of the real numbers and the fundamental concepts of mathematical analysis: sequences and continuous functions. To be rigorous, as much as possible, we will construct proofs for almost all the statements we discuss. Our main focus will be constructing valid proofs and discussing their validity.

Homework: Your daily homework should consist of studying the material covered in class. The goal is understanding, or even more, internalizing the concepts and methods we study. Your goal is to make what is being learned your own knowledge.

There will be five short homework assignments. I will post the homework problems on Canvas a few days before they are due. The due dates will be posted on Canvas. Each homework will be graded by an integer between `0` and `20`, including `0` and `20`. The sum of the homework grades, denoted by `HW` below, will count towards the final grade.

Assignments: There will be one in-class assignment and the final assignment. The assignment during the class will be due one week after it has been posted. I will post the final assignment before the last week of classes and it will be due on the last day of the finals week, on Friday, June 13, 2025 at 11:59 pm.

Exam: There will be only one exam on Friday, May 30, 2025. The questions on this exam will be four important proofs and several definitions presented during the class. To help you prepare, I will post a list of proofs and definitions from which I will select the four proofs and several definitions for the exam. Since this is a small class, I hope that each one of you can allocate a two-hour window between 11 am and 2 pm on Friday, May 30, 2025, to allow you two hours to complete the exam.

Participation is an important part of this class. You can earn participation points by asking or answering questions in class or initiating or participating in **Canvas discussions**. In **Canvas discussions** you can ask questions or answer questions posted by others. You can also comment on my class lecture notes, or my posts on the class website. At the end of the quarter, your participation grade will be determined based on the number and quality of your engagement in these activities. Your participation grade, denoted by `PG`, will be an integer between `0` and `100`.

Grading: Your final grade will be determined using the following formula

$$\texttt{FG} = \left\lceil \texttt{(HW + PG + Ex + AC + AF)/5} \right\rceil.$$

where `HW` is the sum of the five homework grades, `PG` is the participation grade, `Ex` is the exam grade, `AC` is the in-class assignment grade, and `AF` is the final assignment grade. Each of the numbers that appears in the above formula is an integer between `0` and `100`, including `0` and `100`. Your letter grade will be assigned according to the following table.

F : 0 - 39	D−: 40 - 44	D : 45 - 49	D+: 50 - 54	C−: 55 - 59	C : 60 - 64
C+: 65 - 69	B−: 70 - 74	B : 75 - 79	B+: 80 - 84	A−: 85 - 89	A : 90 - 100

How to succeed: Attend classes regularly. Actively read the suggested parts of the notes, read the class website, and do the assigned problems. Do and redo more problems, as practice is key to mastering the material. Read the lecture notes before class to prepare for the topics that will be covered. Ask questions if there is anything that needs to be clarified. Keep organized notes of all your work. Make sure that you *fully understand* each proof presented in class, posted on the class website, or available on Canvas. Do not hesitate to ask questions whenever something is unclear, whether in class or outside of class. Ask other students in class or me. I am available to discuss any questions during my office hours, or you can make an appointment to meet at another time. You can find a link to my Zoom office hours on the **class Canvas page**.

On Your Written Work: Students must submit their work electronically through Canvas Assignments. The only allowable file type is PDF. I cannot grade work submitted by email. Please ensure that your PDF file is of high quality and easily readable. LaTeX is a free software designed for typesetting high-quality mathematical documents, which can enhance the readability and professionalism of your work. I encourage you to learn LaTeX and use it for your writing. As a starting point, you can use my website **Getting Started with LaTeX**.

If you submit your handwritten work, write neatly on paper with a light-colored background using dark pencil or ink, and ensure that all text and figures are clearly visible. Please use a good scanning app to produce a high-quality, readable PDF file.

You will have sufficient time to work on homework and assignments, so please ensure that your papers are well-written and well-presented. Presenting calculations alone without the context in which they occur and explanations of your reasoning is insufficient for full credit. Writing mathematics in complete sentences organized in meaningful paragraphs is an integral part of learning mathematics. You can use examples in my notes or my writing on the class website as a guide for writing.

Student learning outcomes: By the end of this class, a successful student will demonstrate: (1) the understanding of the mathematical concept of a set and basic operations with sets; (2) the understanding of the mathematical concept of a function and basic definitions related to functions; (3) the understanding of the axiomatic foundation of real numbers $\mathbb{R}$, the most

important subsets and properties of $\mathbb{R}$ and the ability to construct rigorous proofs in this setting; (4) the understanding of the fundamental role of the Completeness Axiom and the related concepts of infimum and supremum; (5) the understanding of the basic topological notions in $\mathbb{R}$ and $\mathbb{R}^2$; (6) the knowledge and the understanding of the rigorous definition of the convergence of sequences in $\mathbb{R}$ and ability to construct rigorous proofs in this setting; (7) the knowledge of the Monotone Convergence Theorem and its relationship to the Completeness Axiom; (8) the understanding of the concept of a subsequence and the definitions of the limit inferior and the limit superior; (9) the understanding of the Cauchy criterion for convergence; (10) the understanding of the ϵ-δ definition of continuity of a function and the ability to use this definition to prove that important elementary functions are continuous; (11) the understanding and the ability to prove the Extreme Value Theorem for continuous functions on closed intervals; (12) the understanding and the ability to prove the Intermediate Value Theorem for continuous functions on closed intervals;

Diversity, Equity, Inclusion: Welcome to my class. I promise to keep my mind open to the mathematical experiences you bring to this class. I want to help each of you to use those personal experiences creatively to build your own understanding of the mathematical content studied in this class. I will try to bring diverse approaches to most concepts. I understand that each of you comes to this class with a diverse background. Please let me know if you are not happy with your background understanding of a particular topic, which is a prerequisite for this class. We can meet outside of class and discuss that topic, find some study material for you, or create some study material especially for you. The goal is to create an environment where you can succeed in this class and be proud of your achievements.

Academic Honesty Policy: Academic dishonesty is not tolerated at Western Washington University. Representing the work of another as one's own is an act of academic dishonesty. For a full description of the academic honesty policy and procedures at Western, see **Appendix D** in the University Catalog.

Flexibility Statement: This syllabus is subject to change. Changes, if any, will be announced in class or online. Students will be held responsible for all changes.

Sylabii@WWU: Please go to https://syllabi.wwu.edu/ where you will find Syllabi Policies for Students and Campus Resources for Students

The Branko Ćurgus Mathematical Experience: Mathematics has always been a personal experience for me: **The Branko Ćurgus Mathematical Experience**. I want to create an environment where you can embrace mathematics as your own personal experience. How can this be achieved? Begin by acknowledging what you don't understand without fear. Discuss challenges openly with others. Open your mind, ask questions. Share your questions generously with others, treating them like precious gems. Questions are the gateway to deeper comprehension. Indeed, questions serve as a bridge from confusion to clarity.