MTH 401 – Real Analysis

Spring 2026, University of Portland

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Welcome!

Before we get into the details of the course, I want to share with you a few thoughts about my general approach to teaching and learning. My main goal as the professor in this course is to help you succeed in not just learning the material but in growing as a learner. Learning takes effort, a willingness to try something that may not work, and the ability to use feedback to refine your understanding. My job is to foster an environment in which each and every one of you are supported in these aspects.

Much of the work for this course will be done within class or small group discussions for which we will rely on everyone in this class as a source for feedback and support. Because of this, it's important that we create an inclusive community that is respectful of our differences and offers space for the boundary-setting necessary for positive relationships to form. Our diversity is reflected by differences in race, gender, sexuality, ability, class, religion, nationality, and other cultural identities and material circumstances.

1 General Information

- **Instructor:** Chris Hallstrom, PhD (he / him / his).
- **Office:** Buckley Center 270
- **Email:** hallstro@up.edu.
- **Webpage:** All course content will be posted on learning.up.edu Moodle
- Dr. Hallstrom's Calendly link.

1.1 Course Description

In this course, we will revisit the fundamental concepts and results from Calculus with the goal of understanding better how the basic theorems and results follow from foundational definitions and axioms. We will consider the question of how we can make these concepts and arguments precise as well as how we can communicate mathematical ideas clearly. Specific topics will include the axioms for a complete ordered field, the formal defintion of the limit, continuity for both sequences and functions, and the derivative. We will investigate and prove various properties and consequences that follow from these topics.

In addition to content learning, we will also focus on the task of communication of rigorous mathematical argument. By the end of the semester, you should be able to

- effectively communicate mathematical ideas orally using correct terminology and language
- develop and write correct and complete mathematical proofs using the standards and conventions of the discipline.

Inquiry Based Learning

We will use a method of instruction often called Inquiry Based Learning (IBL) which is designed to engage and foster skills and habits that working mathematicians use regularly; you will be asked to solve problems, make conjectures, experiment, explore, create, collaborate, and communicate your work with your peers. Rather than giving you facts to memorize or showing you clear paths to solutions, my role is to guide you via a sequence of carefully chosen problems through a journey of mathematical discovery.

Throughout the semester, you will receive a list of definitions to interpret and make sense of, as well as exercises and theorems which you and your classmates will answer or prove. There will be very little traditional lecture. Instead, class time will consist of student presentations of new material. For best results, you should come to class prepared to share your work or ideas about that day's problems. This method of inquiry does not work nearly as well if you're looking at problem for the first time in-class.

You will be asked to share your solutions and explain your thinking in class regularly. You will be asked to generate examples and counterexamples, to make conjectures, and to prove or disprove these conjectures. When observing other student presentations, it is your responsibility to follow their argument closely and decide if their explanations are reasonable. If you cannot follow their logic, or have questions about their solution, it is your responsibility to ask!

A key feature of our IBL method is student **discovery** and therefore **outside resources are not allowed**. This means that you should not consult any texts (other than the notes handed out in class), the internet, students not currently enrolled in the course, or faculty other than myself. Consulting outside resources will deprive you of opportunities to engage with the

material. You are encouraged to work with your classmates on the problems, although every student must write up and submit their *own* solutions to written work. **You can always ask me for help if you're stuck on a problem.**

1.2 Course Materials

We will use a set of course notes that I will provide. Both hard copies and electronic versions will be available. No other materials are needed.

1.3 Attendance

Since we will be doing much of our learning through collaborative in-class activities, it's important that you come to class regularly, prepared to engage and participate. Everyone's contributions are valued!

That said, I also recognize that for many reasons, this is not always be possible. If you do need to miss class **for any reason** just let me know – there is no penalty apart from missing out on that day's activity. If you miss class often, you can expect me to reach out to see how I can support you coming to class.

I will do my best to post on Moodle a short summary of what we do in class, so if you do miss class, you should look there to see what we did that day. You may also find it helpful if you're able to check-in with a classmate to see what we covered. Finally, I'm always available in office hours to discuss anything you missed.

Poem 013: Did I Miss Anything? by Tom Wyman

1.4 AI Policy

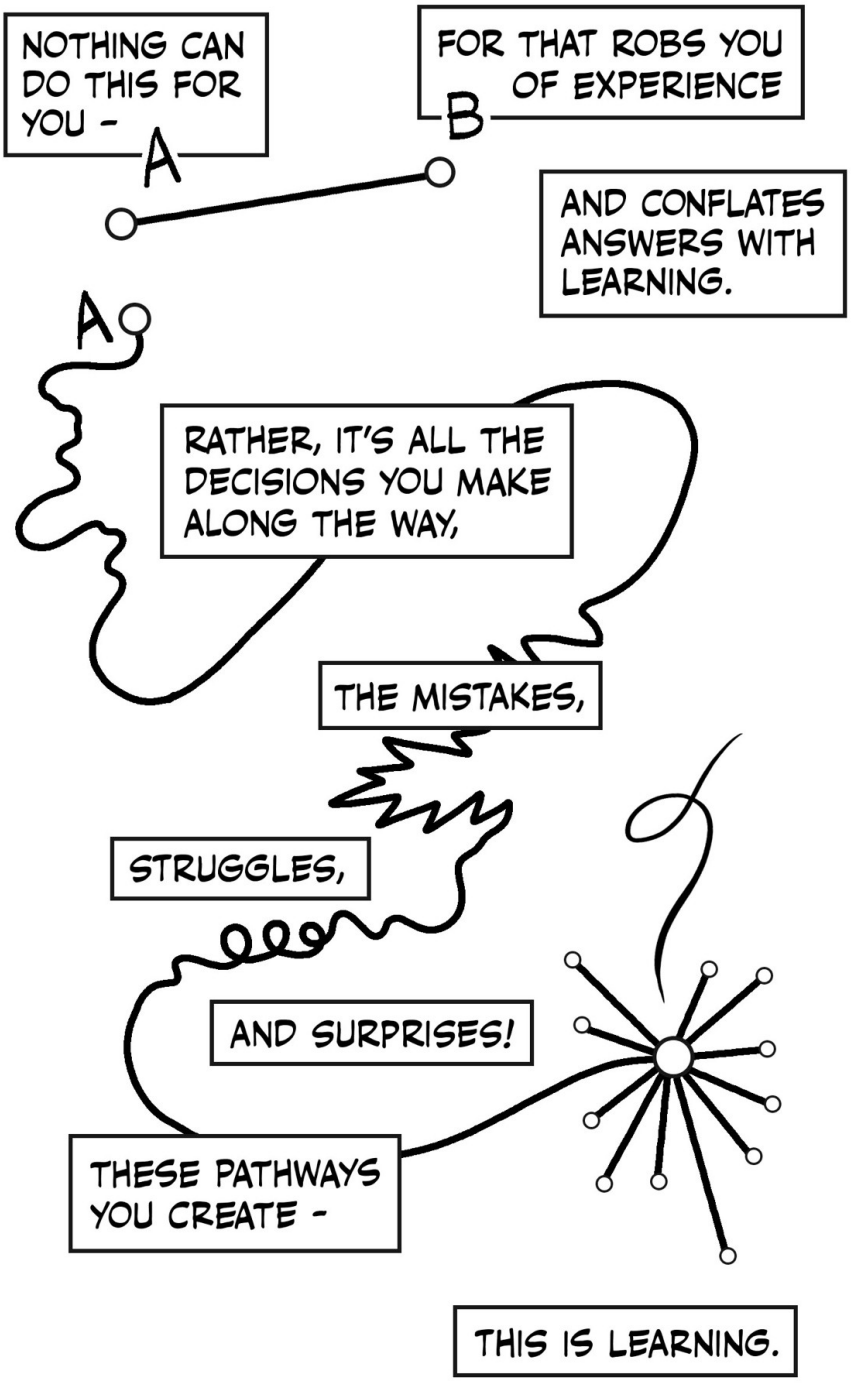
> **!** Using AI in this class fundamentally undermines our learning goals and **should not be used in any way**.

Here's the thing – your goal in this class is **not** to perform calculations, to work through examples, or even to get the right answer. Yes, we will do those things but they're all in service of the **actual goal** which is to **think** and to **communicate** mathematically.

Struggling to build your own understanding and to make sense of difficult concepts is precisely the point. Using Gen AI to do these tasks for you is to give up those opportunities to learn. Don't undermine your growth as a human learner by looking for shortcuts!

My role is to help guide your thinking and to help you think more like an expert and to do that I need to see and hear *your* thinking. If you use AI to do the work in this class:

- you haven't done your job because you haven't produced a record of your own thinking;
- I can't do my job because I don't have access to your thinking. Worse than that, you are essentially asking me to read and respond to something that you didn't write, which is profoundly disrespectful of my time and energy.



Bottom line: I do not see any practical, helpful, or ethical way to use Gen AI and LLMs to assist you in achieving this goal.

While I'm not interested in being an AI cop, you should be clear about how this policy will be enforced

- If I have any concerns or questions about whether a submission represents your own work, I reserve the right to ask you to meet with me so you can explain your thinking before I give feedback.
- Any submission that's not a record of your own thinking will be considered a violation of UP's Academic Integrity policy and will be handled accordingly.

It goes without saying that this AI policy applies to this course and your other courses may have different policies.

Additional Reading

If you would like to understand more about how I came to this position on AI in the classroom, here are a few articles that might interest you.

- Why We're Not Using AI in This Course, Despite It's Obvious Benefits by Patrick Lin.
- I Am An AI Hater by Anthony Moser. A succinct summary of the many (many) ethical issues around AI tools.
- Bullshit Machines is a good explainer on how LMMs work.

2 Student Support

Research suggests that our best learning happens when we work in a zone of *productive discomfort*, meaning that we feel challenged and a bit outside of our comfort zone. This means that as you're working through the material - whether completing homework tasks or reviewing class notes - **you should have questions**. While much of our in-class time will be spent trying to address those questions, there may not always be enough time to get all your questions answered during class; or you might not want to wait until class to address your questions. At the same time, it's important that you do not feel completely stuck (at least for too long). For these reasons, it's extremely important to me that you have resources to support your learning outside of class.

2.1 Drop-In Hours

I will post on Moodle several blocks of time during the week that I am available for drop-in help. You do not need to let me know you're coming – just stop by my office (BC 270). Many students find these drop-in hours can be particularly helpful if you are working together with classmates. You can work together at one of the tables down the hall from my office and just pop in when you have any questions.

2.2 Sign-Up Hours

While I will do my best to provide multiple options for drop-in hours, I recognize that these times might not work well with everyone's schedule. Or you simply might find it more convenient to meet with me at a different time. If you go to my Calendly scheduler, you can sign-up for a time slot to meet. If there is a specific time that works for you and you don't see it available on the Calendly scheduler, please reach out to me via email and we will find a time that works for your schedule.

2.3 Open Door

I have the scheduled drop-in hours simply to give you some times when you know that I'll be available – but you are **always** welcome to stop by my office **at any time**. Unless I'm in class or in a meeting, I will generally be available to meet with you.

3 Course Structure

3.1 Daily Tasks

Your standing assignment in this course is to work through and prepare complete solutions or proofs for all of the problems in the class notes. You should come to class prepared to present and discuss your ideas, both in small groups and as a whole class. If you get stuck on a problem, come prepared to ask questions.

As we go, you should keep track of what problems we cover each day so that you can anticipate what problems we will cover in the next class. I will post on Moodle a running account of what material we cover each day so that if you do happen to miss class, you will know how far we got in the notes.