Math 253: Calculus III

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The University of Oregon

CRN 12509

Fall 2022

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Class Meetings: MTWF, 9–9:50

Instructor: Cruz Godar

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Office Hours: in the Fenton hall atrium — hours to be announced.

Learning Outcomes

A successful student can:

- Decide if a given sequence converges or not.

- Express an indicated sum using Σ notation in closed form.

- Compute partial sums and other finite sums.

- State the precise definition of what it means for a sequence to have a limit.

- State the precise definition of what it means for a series to converge.

- Decide if a given series converges or not, using the Comparison Test, Divergence Test, Root Test, Ratio Test, Integral Test, Limit Comparison Test, Alternating Series Test, or a combination thereof, as appropriate.

- Decide if a given series converges or not using the definition.

- Evaluate the Taylor polynomial for a given function, given a center and a degree, by computing derivatives.

- Compute the Taylor polynomial for a rational function by performing long division.

- Use Taylor polynomials to approximate the values of functions.

- Given an easy sequence that converges to a limit L, together with an ε, determine an N such that $|a_n - L| < \varepsilon$ for all $n \geq N$.

- Given an alternating series and an ε, determine how many terms are needed to have the partial sum within ε of the limit.

- Find the interval of convergence of a given power series.

- Determine if a given series is absolutely convergent.

- Given a function, a center a, a degree d, and an accuracy level ε, determine an interval about a for which the dth Taylor polynomial is within ε of the function at all points.

- Use Taylor's Inequality to bound the error of a Taylor approximation.

- Given a differential equation, find the general solution as a power series up through a given degree. Also find particular solutions.

- Answer basic conceptual questions involving convergence of sequences and series, and also give examples of related phenomena.

Materials

Textbook: *Calculus Volume 2* by Herman and Strang. This is a free textbook which you can access online here. I recommend downloading the pdf file so that you have offline access to the textbook. You are also welcome to purchase a physical copy (they're around $30), but this is unnecessary.

Calculator: A scientific calculator will save you time doing simple computations. You will only be allowed to use one of the following calculators on quizzes and exams: Casio fx-260, Casio fx-300MS (or Plus), Casio fx-300ES (or Plus), TI-30X (a, S, or IIS), TI-34. The TI-36 Pro is **not** allowed, and **no graphing calculators are allowed** either. The Casio fx-300MS is available from the UO Bookstore for about $13.

Logistical Stuff

Class is in person! Let's work to keep it that way. Masks are welcome but not required in the classroom. The most important thing is to stay home if you have cold or flu symptoms until you are feeling better, ideally with a negative Covid test. Make a friend *today* and keep in touch. If you need to quarantine during the quarter, they'll be your first resource to keep up with class notes. If both of you need to quarantine, we'll handle that situation as necessary. If *I* need to quarantine, we'll follow the guidelines in the Provost's resource rubric, which is to get a substitute for both weeks.

Assignments and Grading

Your total grade in the class is determined by your attendance and participation, and your scores on the homework, quizzes, midterm exams, and the final exam, weighted in the following manner:

Reading Quizzes: 3%
In-Class Quizzes: 7%
Weekly Homework: 20%

Midterm Exams: 20% each (40% total)

Final Exam: 30%

Your total grade at the end of the quarter will be rounded up to the nearest whole number. For example, a total grade of 88.2% will be rounded up to 89% and awarded a B+.

Reading Quizzes: I've decided to put in the time to provide interactive, typed lecture notes for this course — you can find them on the course website. These are there for two reasons: first, it's **much** easier to learn new material when you've seen it in some capacity before, even if you don't understand it very well the first time around. For this reason, reading the lecture notes or the textbook is required before each lecture. We'll have very short quizzes on Canvas — typically just a single multiple choice question per section — that ensure you're reading beforehand. Your lowest two reading quiz scores are dropped.

The second purpose the notes serve is as a lecture replacement if you need to quarantine during the quarter. Between them, the textbook, and friends' class notes, you should have plenty of resources to succeed while remote.

Homework: Each homework is graded out of 32 points. You'll be given a handful of textbook problems to write up careful solutions to, and you'll be graded on two criteria. First, 8 points are for thoroughly attempting all the problems, whether or not your solutions are correct. I'll also choose three problems to grade on correctness for 8 points each.

Homework will be assigned every Wednesday and due at the start of class the following Wednesday. Working with others is strongly encouraged, but the final work you submit must be your own. Your lowest homework score will be dropped.

All homework will be submitted via Canvas. You have two options:

- Handwrite your homework as usual and scan it, via a scanner or your smartphone. A series

of pictures will *not* be accepted — only a single pdf file may be submitted. To use your smartphone for this, use the built-in document scanner in iOS (accessible through the Files app by tapping the ⋯ menu and selecting *Scan Documents*), or the Adobe Scan app for Android.

- Typeset your homework. All the course documents (like this syllabus) are written in a language called LaTeX which compiles to the clean-looking pdf file you see. Although it takes an hour or two to become comfortable with, LaTeX is used by people in nearly every STEM-related field, and learning it now will give you a major headstart. To get started, make an account at Overleaf and create a new project. You can type as usual, and to render math expressions, surround them in dollar signs — for example, $\frac{1}{2}$ will render as $\frac{1}{2}$. I'm more than happy to help with any difficulties you run into here.

All homework and reading quizzes have an automatic late policy built into Canvas: for every hour late that they're submitted, they'll be graded at 1.5% less.

WebWork: This course does not use WebWork! Most of the problems are process-focused instead of solution-focused, so WebWork is even less useful than it otherwise would be. Because of this, the written homework will be longer and more in-depth to keep the overall amount of homework the same.

Quizzes: We'll have a quiz every week on Wednesday, during the last 20 minutes of class. Your lowest two quiz scores will be dropped. The purpose of these is to practice working in a timed environment before the exams, and they serve more as a barometer for how well you're prepared for the exams than an evaluation of your ability at the time. To that end, these will be group quizzes, taken in pairs. If you aren't getting the scores you'd like on the quizzes, **reach out for help before the exam.**

Exams: Our class will have two midterms on the Wednesdays of weeks 4 and 8, taking up all 50 minutes of class time. Each midterm will cover multiple sections of material, and the final exam will cover all of the sections covered in the course. You must take the final to pass the class. The

final will replace the lower of your two midterms if it is higher.

A recent policy change at UO means I am no longer allowed to take reasons for absences into account when determining accommodations, with the exceptions of the AEC, religious exemptions, and university-sponsored events like sports. Outside of these categories, every accommodation must be available to everyone, regardless of circumstance. To attempt to walk the line between strict policies that are unfair to students with legitimate excuses and relaxed policies that are exploitable, I'm dropping double the number of dropped quizzes and reading quizzes I typically do, and also replacing the lowest midterm with the final if it helps. This is to counterbalance the fact that no late or make-up work will be accepted without an official exception for one of the three categories listed previously. The goal is to allow for up to about two weeks of missed class due to illness or other unexpected circumstance, but these policies apply to everyone equally.

- Midterm 1: Wednesday, October 19th

- Midterm 2: Wednesday, November 16th

- Final: Monday, December 5th at 10:15 AM

A note on grading: the vast majority of problems in this class are graded on a four-point scale that is curved to an eight-point one:

8: Work that shows command of the material and has only a few small mistakes, if any.

7: Work that shows a strong understanding of the relevant material, but contains enough errors that they get in the way of the demonstration of that understanding.

5: Work that shows elements of understanding, but is too clouded with mistakes to be considered on the right track.

3: Work that demonstrates a very small amount of understanding, but still some.

0: No work shown for any problem where work is required or work that demonstrates no understanding at all of the relevant material.

Course Schedule

This schedule is tentative, and may change slightly throughout the quarter.

Week	Sections
1	0, 1
2	2, 3
3	4, 5
4	6, 7
5	7, 8
6	9, 10
7	11
8	12
9	13
10	Review

Section 0: Calculus II Review

Section 1: Sequences

Section 2: Series

Section 3: The Divergence and Integral Tests

Section 4: Comparison Tests

Section 5: Alternating Series

Section 6: The Ratio and Root Tests

Section 7: Power Series

Section 8: Properties of Power Series

Other Things

Accessibility: For those of you who are currently registered with Accessible Education Center for a documented disability, please present your paperwork to me during the first week of the term (or earlier) so that we can design a plan for you. Those of you with a disability, or who think they might have one, but are not registered with AEC should contact them as soon as possible. It is much more likely that measures can be taken to provide adequate special accommodation if the organization is done through AEC. Please let me know if you need additional accommodations.

Prohibited Discrimination and Harassment Reporting: I am a student-directed employee. For information about my reporting obligations as an employee, please see Employee Reporting Obligations. Students experiencing any form of prohibited discrimination or harassment, including sex or gender based violence, may seek information on safe.uoregon.edu, respect.uoregon.edu, titleix.uoregon.edu, or aaeo.uoregon.edu or contact the non-confidential Title IX office (541-346-8136), AAEO office (541-346-3123), or Dean of Students offices (541-346-3216), or call the 24-7 hotline 541-346-SAFE for help. I am also a mandatory reporter of child abuse. Please find more information at Mandatory Reporting of Child Abuse and Neglect.

Conduct: This university exists for your benefit. If you believe something is not as it should be, don't hesitate to let me know.

And as you should hold the university to a high standard, I will hold all of you to one in return. Academic dishonesty, including looking at other students' quizzes or tests or using any materials other than those allowed during a testing period, submitting others' work as your own, or altering returned work and resubmitting it, will be met with the strictest disciplinary action possible.

A word on learning: Math is not a subject that is learned passively. It is one thing to understand examples from lecture and another thing entirely to work through problems by yourself. Students who come to lecture expecting it to be enough on its own to pass the tests — and therefore don't put much or any effort into the homework — typically end up with very poor class grades. For your own benefit, it's crucial to stay on top of the homework, to follow along with lecture, and to seek help — from a friend, from my office hours, from the textbook, or from a tutor — when that becomes difficult. In the same vein, it's critical that if you're struggling, you reach out before large assignments, not after. I want to help however I can, but if a test has already been graded and handed back, there's usually nothing I can do.