M472 Introduction to Complex Analysis – Spring 2019

Instructor information:

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Office hours: Monday 4:30 – 5:30; Friday 3:30 – 4:30; or by appointment.

Course description: Complex numbers and complex-valued functions have a beautiful theory (much nicer than the real numbers, in many ways!) which leads to a lot of applications. Moreover, we need the tools of complex analysis in order to solve many integrals and series of **real-valued** functions. In M 472, we will (among other things):

- Show how complex numbers explain the neat relationship between the Taylor series of e^x, sin(x), and cos(x);
- discover why, if a complex-valued function f(z) is defined, bounded, and differentiable on the entire complex plane, then f(z) must be constant;
- compute integrals of real-valued functions by using complex line integrals.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Understand and use the basics of complex analysis (definitions, terminology, concepts, techniques, methods);
2. Demonstrate understanding of the different ways in which analyticity can be defined;
3. Apply Cauchy's theorem and the Cauchy integral formula, and understand some of their applications;
4. Evaluate real integrals by using complex analytic methods;
5. Write clear proofs involving the concepts of Complex Analysis.

Required textbook: Saff & Snider, "Fundamentals of Complex Analysis: with Applications to Engineering and Science," third edition.

Course Structure: There will be weekly written homework, due on Tuesdays. We will also have a midterm exam and a final exam, both of which will consist of a written component and an oral component.

On the homework, I encourage you to work together to figure out the solutions, but what you turn in should represent the understanding in your own brain. For that reason, please **use only your own brain** (and pencil/paper/LaTeX) to write up the homework solutions! Don't write the homework up while you're in office hours or a group discussion – wait till later. Take notes on the results of the discussion, by all means, but try to **write the solution without consulting those notes** (or your textbook, or the internet, or a friend). If you get stuck, look at the notes/textbook/etc for a hint – but try to use as few hints as possible. This way, you will build up the "mental muscles" that will enable you to succeed in this course, and in particular on the exams (where you won't have notes/internet/friends helping you).

Reading the textbook will be another regular component of the course. Learning how to learn from the textbook will serve you well in any future math or science courses (or if you have to consult your old textbooks for a refresher!). Plus, reading the book gives you a model for how to write mathematics that will complement what I demonstrate in class, and which I hope you will incorporate into your homework assignments.

To that end, I will usually ask you to read a section of the textbook before class, and post a comment in the relevant Discussion forum in Moodle **by 10 AM** the morning before class. I don't expect you to be able to understand everything in the textbook at the beginning of the semester -- this is the role of the Discussion forums, for you to tell me what you didn't understand from the textbook and what you want to focus on in class that day. However, I do expect you to **put serious effort** into the reading assignments, so that your ability to learn math from the textbook will improve over the course of the semester. We will spend time in class discussing strategies for reading a math textbook; one aspect of this is to **budget 10 minutes per page** for the reading assignments.

Your comments in the Discussion forums will be graded on a scale of 0 to 2, based on how well you convince me that you have read the section and thought about it, and I will drop your lowest 5 scores.

For example:

- You will receive a 0 if you don't post any comment.
- A comment like "Everything makes sense, I have no questions" will earn a score of 0.
  (Even if everything makes sense, I'm sure you can find something more specific to say! How does this section connect with other sections? What did you think was interesting? Was there any part of the section that didn't make sense at first? What was it that eventually made that part make sense?)

- If your comment asks a question that indicates to me that you only skimmed the textbook, you will earn a score of 1. For example: ``Why does 'arg' sometimes mean a set and sometimes a single number?" (This is explained on page 18 of the textbook.)
- A comment such as ``In Figure 1.12, why is the first angle labeled in between the vectors, while the second one is labeled outside? Which one corresponds to –pi/2?" will earn a score of 2.

This question demonstrates that its author read the section and thought about what s/he read.

You are welcome to consult other textbooks for the reading assignments, if you prefer. To facilitate this, in each Moodle discussion forum, I will describe the topic of the reading so that you can find the appropriate material in another textbook.

If you do consult other textbooks, please be careful to either use the notation from the course textbook on homework assignments and when posting in the Discussion forums, or to define the notation you use.

Course guidelines and policies:

Classroom and Course-related Behavior

University policy requires that all of us in the classroom treat each other with respect, and refrain from behavior that will disrupt the educational process. Please refrain from using any electronics during class that are not directly related to what we are doing.

I encourage you to ask questions at any time, and I will ask lots of questions of the class. To make sure that I haven't lost the majority of the class, I may call on people randomly to answer my questions. Saying "I don't know" is a perfectly acceptable answer! You are almost certainly not the only one who's confused, so this is a signal for me to try another explanation, or give some more details.

If you would prefer to be called by a different name, or gender pronoun, than is listed on the course roster, please let me know.

Student Conduct Code

All students need to be familiar with the Student Conduct Code. You can find it at http://www.umt.edu/student-affairs/dean-of-students/default.php or by searching in the "A to Z Index" on the UM home page. In particular, discrimination and harassment are not tolerated at the University of Montana. If you feel that you have been subjected to discriminatory or harassing behavior, please contact the Office of Equal Opportunity and Affirmative Action at 243-5710 or http://www.umt.edu/policies/browse/personnel/discrimination-harassment-sexual-misconduct-stalking-and-retaliation for help in addressing the situation. You can also report the discrimination or harassment to me or to another faculty member you trust.

Academic Honesty

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

Disability modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Due Dates and Late Work

Unless stated otherwise, all assignments are due at the beginning of class on the day on which they are due. Late work will receive no credit. However, to give everyone a buffer for busy weeks, the Homework category will be graded out of 220 points, although there will be 260 possible points to earn (20 points for each of 13 assignments).

Except in exceptional circumstances, exams must be taken at their scheduled time. If you know you have a conflict with an exam, please contact me **early** to see what arrangements can be made.

Grading policy

Item	Percentage
Discussion posts (Reading reactions)	7%
Written Homework	60%
Midterm Exam	13%
Cumulative final exam	20%