MATH 3146 – Sections 001 and 002
Complex Variables
Fall 2021

Instructor:
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Office: MONT 411

Meeting: Tu/Th 2:00pm-3:15 pm in MONT 419 (section 001)
Tu/Th 3:30pm-4:45 pm in MONT 421 (section 002)

Office Hours: Monday 10:30-11:30 am online via Blackboard Collaborate
Thursday 9:00-10:00 am in MONT 411
Friday 8:00-9:00 am online via Blackboard Collaborate
or by appointment (i.e., email me if you cannot make it at the above times)

Text: *Complex Variables and Applications,* 9th Edition, by James Ward Brown and Ruel Churchill

Prerequisites: MATH 2110 and 2410, or MATH 2420 or MATH 2144. Not open for credit to students who have passed MATH 5046.

Goals & Expectations: The goal for the semester is to learn, to understand, and to be able to work with the main ideas of complex variables and functions, including functions of a complex variable, integration in the complex plane, and conformal mappings. This means that you should not only be able to work through problems similar to those done in class and on the homework, but also that you should be able to articulate the ideas presented in the course in a clear and coherent manner. This course will have concrete and abstract components. Being able to explain why something is true will constitute a significant part of the course.

You will develop a conceptual understanding of the course material in an inquiry-based classroom, which requires a lot of independent work, group work, and class discussions. There will be no lecture.

Face Coverings and Illness: To ensure a safe learning environment, masks/face coverings must be properly worn at all times in buildings, including classrooms, regardless of vaccination status. That includes covering both the mouth and nose, not just the mouth. Activities that involve temporarily removing the mask, such as eating or drinking, are not allowed in classrooms.

A student who is not wearing a mask/face covering will be asked by the instructor to put one on immediately or leave the room. Repeatedly failing to follow this expectation will result in a referral to Community Standards. Please join me in encouraging your peers and instructors to wear face coverings properly at all times in the classroom.

During the COVID-19 pandemic, it is especially important for you to stay home if you are feeling ill. Please contact me ASAP via email if you need to miss class due to illness or other personal reasons. If you are missing an exam due to illness or other personal reasons, please include in your email your available times for a make-up quiz or exam over the next few days.

Course Objectives: Upon successful completion of this course, you will have demonstrated that you can:

1. Perform arithmetic operations with complex numbers using both rectangular and polar forms
2. Use properties of analytic functions, including identifying and differentiating various common analytic functions
3. Evaluate and apply properties of contour integrals
4. Identify a function's power series and residue at a point, and use this information to evaluate a contour integral
5. Engage others to improve (revise) your and their mathematical communication, verbal and oral
6. Collaborate with others to build mathematical understanding for all members of your community

Participation: The best way to learn math (or anything, for that matter) is to practice it actively. You will spend the vast majority of your time in class working on problems with your peers and talking to others about your solutions to problems. Therefore, your participation is crucial to everyone's learning.

If you have an extenuating circumstance that requires you to miss class, please contact me as soon as possible once you know that you will miss class so that we can arrange another way for you to engage with the missed day's material.

Each student in this class is vital to the success of the classroom community, which is why it is important that we all respect each other, carefully consider one another's ideas, and value each other's contributions. I am very serious about helping to create a classroom environment in which anyone feels free to ask questions, raise concerns, make mistakes, celebrate successes, and so on. You are expected to behave courteously and respectfully to your classmates and to me, but please do not stop yourself from asking a question because you fear it will sound stupid or obvious. We are all here to learn together, which means we will struggle often.

Homework: You will be given a list of problems each week that are recommended for you to complete; however, homework will not be collected on a regular basis. Instead, you will choose from this list some problems to present your solutions to the class, and some problems to add your solutions to your group solution set for feedback and revision.

In-Class Presentations: Each day in class, we will spend most of our time listening/responding to a few students' presentations of their proposed solutions to homework problems. You will be provided a rubric for these presentations, a sign-up sheet to volunteer to present problems in advance, and your group will support you during class to polish your presentation before you present. If your presentation is not successful the first time, then you may try again during the following class meeting.

Group Solution Set: Each student will be assigned to a group, who will work together to create a solution set for each of the semester's homework problem sets. You will be provided a rubric for these solution sets, and your group members will be required to support you in revising posts.

Responses to Presentations and Discussion Board Posts: You are expected to engage with your classmates' solutions in both written and presentation forms. Please respond regularly to others' proposed solutions by asking clarifying questions and making constructive suggestions to improve the mathematical correctness, completeness, and communicative quality of the solutions. You will be provided a rubric for these responses.

Grading Policy: Your graded work will be returned to you in a timely manner, usually within a week. If you believe there is a grading error, please work with me ASAP to resolve it.

Exams: There will be two midterm exams, tentatively scheduled for the following days during class: **Tuesday, October 12 and Tuesday, December 7.** Please plan to be available during class time on those days.

If you must miss an exam, please contact me as soon as you know you will miss it.

Applications Project: If you wish to earn a grade of A or A- in this course, you will need to successfully complete a project exploring applications of complex variables and functions to your major or intended field of work. You will receive more information about this project during the semester.

Grading: At the end of the term, you're going to submit a Final Portfolio and Letter Grade Reflection, where you will tell me how you did and thus what grade you earned in the course, based on the following rubric we're going to create together.

You can use any assessments throughout the course (posted and revised homework solutions, notes from presentations, exam solutions, and applications project) as evidence in this discussion. I will probably agree with you, because you know yourself, your work, and your understanding pretty well. If I don't, we'll talk about it.

Letter grade	Description of work and participation
A	Successful completion of the Applications Project before the deadline and all basics, PLUS: Shows strong understanding of all learning objectives 80% average exam score after revisions Contribute fair share of solutions and feedback to written homework solution sets Present in class about once a month, or about three times Regularly come prepared to help with presentations (preparations and feedback)

B	All basics, PLUS: Shows understanding of all learning objectives, or strong understanding of most learning objectives 70% average exam score after revisions Contribute fair share of solutions and feedback to written homework solution sets Present in class about once a month, or about three times Regularly come prepared to help with presentations (preparations and feedback)
C	All basics, PLUS: Shows basic understanding of all learning objectives, or strong understanding of half of the learning objectives 60% average exam score after revisions Contribute about half of fair share to written homework solutions (solutions and feedback) Present in class at least twice Ready to help with presentations (preparations and feedback) about ½ the time
D	All basics, PLUS: Shows some understanding of all learning objectives, or basic understanding of some learning objectives 50% average exam score after revisions Contribute sometimes to written homework solutions (solutions and feedback) Present in class at least once Rarely help with presentations (preparations and feedback)
F	Does not demonstrate understanding or participation at the level of any other letter grade

How to Succeed in this Course: For many of you, this course will involve more conceptual and abstract ideas than you are used to seeing in mathematics classes. This will take some adjustment, and now is the best time to develop the habits that will help you succeed. These include:

- carefully completing all readings and assigned homework before class
- actively participating in class
- actively participating on your group discussion board and on the class discussion board
- engaging with your work and the work of others to revise and improve it
- asking and answering questions to and from your peers and instructor
- focusing on developing the ability to explain your ideas, both verbally and in writing, correctly using the vocabulary defined in the course
- finding your mathematics support community – classmates, office hours, Q center, etc.

Diversity, Equity, and Inclusion: In learning, we must embrace diversity of race, gender, sexual orientation, ability, background, age, beliefs, ethnicity, and other visible and non-visible categories. As your instructor, I will do my best to foster a culture of equity and justice in this class and in the university as a whole. Discrimination will not be tolerated. By joining this classroom community you are committing to taking a growth mindset, which means we will work together to learn from each other and be more compassionate.

Academic Integrity: Please respect your and others' work and academic experience. You are expected to turn in work that reflects your own understanding of the topics. Therefore, your writing should not bear resemblance to that of any other student in the course or to any other sources used, and any ideas used for which any other party had a share in developing should be cited as such.

You may use any citation format – for example, a parenthetical at the end of your solution: "(I worked with Jaime from my group on #4)," or, "(I got the idea for my solution to #2 from 3Blue1Brown on YouTube: https://www.youtube.com/watch?v=P2LTAUO1TdA&t=2s&ab_channel=3Blue1Brown)."

Tentative Course Schedule

Week 1	Complex numbers and operations
Week 2	Properties of complex numbers, polar coordinates
Week 3	Real-valued functions of a complex number
Week 4	Limits, Continuity; Cauchy-Riemann equations
Week 5	Analytic functions; Elementary complex functions
Week 6	More elementary complex functions
Tuesday, October 12 (Week 7)	**Exam 1**
Week 7	Differentiation; Integration
Week 8	Contour integrals, Antiderivatives, Cauchy-Goursat Theorem
Week 9	Cauchy Integral Formula; Sequences, Series
Week 10	Laurent series
Week 11	Residues, Singular points; Cauchy's Residue Theorem
Week 12	Classifying isolated singularities
November 22-26	**Thanksgiving Recess – No Class**
Week 13	Applications of residues; Harmonic conjugates
Week 14	Catch-up and Final Portfolio Work
Tuesday, Dec 7 (Week 14)	**Exam 2**
Wednesday, Dec 8	**Applications Project Due**
Final Exam week	
Dec 13	**Final Portfolio Due**

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