Complex Analysis

MAT 452

Prereq: C or better in MAT 228

Professor

D. Bradley

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Class Meetings

Mon., Wed. & Fri. thru May 1

9:00 a.m. – 9:50 a.m.

Neville Hall, Room 204

Office Hours

Mon., Wed. & Fri. thru May 1

TBA

https://tinyurl.com/ProfBradley-OfficeHour

Mandated Policy Declarations

Required Syllabus Statements

Overview

Jacques Hadamard (1865–1963) has written that

> *"Le plus court chemin entre deux vérités dans le domaine réel passe par le domaine complexe."*
>
> (The shortest route between two truths in the real domain passes through the complex plane.)

This course will trace the development of the powerful techniques which complex analysis can bring to bear on a wide variety of mathematical problems. In support of Hadamard's famous epigraph, one finds an astonishing diversity of applications, ranging from computer science (analysis of algorithms), to enumerative combinatorics (growth rate of sequences), to engineering (the Joukowski transformation and airfoil design, electrical potentials, heat conduction, and hydrodynamics), to physics (differential equations, Fourier and Laplace transforms), and number theory (Mellin transforms, exponential sums, and the prime number theorem).

Reference Material

Textbook: There is no required textbook. However, the following references are suggested.

- *Introduction to Complex Analysis* (revised or 2nd ed.) by Hilary A. Priestley.
- *A First Course in Complex Analysis* (open text) by Matthias Beck, Gerald Marchesi, Dennis Pixton, and Lucas Sabalka.

Course Goals

- Hone skills needed to read, write, and understand proofs.
- Become fluent in the language of logic, set theory, and infinitessimal analysis.
- Reinforce concepts acquired in prior mathematics courses.
- Strengthen problem-solving skills.

Learning Objectives

- Become adept at performing calculations with complex numbers and complex arithmetic.
- Recognize the difference between a differentiable function of a real variable and a differentiable function of a complex variable.
- Acquire an understanding of Cauchy's residue theorem, and how it can be used to calculate real definite integrals and sum infinite series.
- Demonstrate familiarity with the transforms of Fourier and Laplace, their applications, and how they can be evaluated using contour integration.

Content

Topics include complex arithmetic, differentiability, power series, line integrals, Cauchy's theorem, residue theory, and applications.

Assessment

We'll have a two-hour cumulative final exam worth 30%, and one in-class midterm test worth 15%. Take-home assignments will comprise the remaining 55% of the total grade.

Expectations

Regular attendance and active participation during class meetings is expected unless ill or isolating/quarantining due to potential exposure to contagious disease. Although an occasional request for a moderate extension on a deadline will ordinarily be granted, I regret being unable to accept multiple submissions of late work, especially as the end of the semester approaches.