Math 300: Introduction to Complex Variables

Instructor information

- Instructor: Richard Froese
- Email: rfroese@math.ubc.ca
- Office: Math Annex 1106
- Hours: Thurs: 2:00pm, F: 2:00pm, by appointment.
- Office Phone: 822-3042

Location and Time

MWF 8:00-9:00 in BUCH A102

Textbook

We will use the textbook

Fundamentals of Complex Analysis with Applications to Engineering and Science (Third Edition), by E. Saff and A. Snider.

You can also refer to the free online textbook

A First Course in Complex Analysis by Beck, Marchesi, Pixton and Sabalka.

Topics

1. *The complex numbers. (Saff & Snider sections 1.1 - 1.6)*

- Definition of complex numbers, arithmetic operations.
- Geometry of complex numbers, modulus, conjugate.
- Basic inequalities: triangle and reverse triangle.
- Complex exponentials and the polar form of a complex numbers.
- The argument of a complex numbers.
- Trig identities via complex exponentials
- Geometry of multiplication
- Roots of unity, roots of a complex number.
- Planar sets

2. *Analytic functions. (Saff & Snider sections 2.1 - 2.5)*

- Complex functions
- Limits and conrinuity
- Complex differentiability and the Cauchy-Riemann equations.
- Analytic (Holomorphic) functions
- harmonic functions

3. *Examples of Complex Functions. (Saff & Snider sections 3.1 - 3.3, 3.5)*

- polynomials and rational functions
- complex exponential and trig functions
- complex logarithm, branches of the logarithm
- complex powers.

4. *Complex Integration. (Saff & Snider sections 4.1 - 4.7)*

- contours, definition and basic properties of complex integral.
- basic bound for complex integrals.
- computing integrals from the definition, fundamental theorem of calculus.
- equivalent conditions to existence of an antiderivative.
- Cauchy theorem
- Cauchy integral formula
- some consequences: Liouville's theorem and the fundamental theorem of algebra.
- maximum modulus principle for analytic functions.
- applications to harmonic functions: mean value property, maximum modulus principle for harmonic functions.
- Morera's theorem

5. *Taylor and Laurent Series (Saff & Snider sections 5.1 - 5.6)*

- sequences and series of complex numbers
- sequences and series of functions
- regions of convergence
- power series
- uniform convergence
- Taylor series, how to compute them.
- Laurent series
- zeros and isolated singularities, classification

6. *The residue theorem (Saff & Snider sections 6.1 - 6.4)*

- classification of singularities
- residues
- applications of the residue theorem
- argument principle and Rouche's theorem (time permitting)

Homework, tests and grades

There will be weekly homework assignments, usually due on Mondays. You will be required to upload files in pdf format (either scanned handwritten solutions, or prepared with a typesetting program such as LaTeX) on the course canvas page. A selection of problems will be graded. Late homework will not be accepted, even if you have a good excuse. To compensate, I will drop the lowest homework score. Even if you miss the deadline, its a good idea to do the problems, since this is the best way to prepare for the tests and exam. You are welcome to discuss the homework problems with your friends, but are expected to hand in your own work.

There will be two midterm exams on **October 11** and **November 8** in class and a final exam during the exam period.

The following weightings will be used in computing your final grade:

Homework (lowest score dropped):	10%
Midterms:	2 x 20%
Exam:	50%

If you miss a test for a legitimate reason, please fill out an academic request form and bring it to me. The weight of the test will be transfered onto the final exam. In accordance with UBC policy for academic concessions, this form may be used once per course.

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students ae expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available here.