Department of Mathematics & Statistics
Concordia University

MATH 366
Complex Analysis I
Winter 2025

Preface: **This course will be taught in person. Lecture notes will be posted at the course's Moodle site as well as weekly homework assignments. All assignments should be submitted, as .pdf files, ONLINE, via Moodle.**

Instructor: Dr. J. Harnad
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Class Schedule: Wednesdays & Fridays, 11:45-1:00 PM., Jan. 13 – Apr. 12, 2025.

Office Hours: Fridays, 10:00-11:25 AM. (Starting Friday, Jan. 17, 2025)

Prerequisites: Math 264/265 or an equivalent multivariable calculus course.

Text: *Complex Variables and Applications*, 9th Edition (2014) by J. W. Brown and R. V. Churchill (McGraw-Hill Education). (**Important:** only use the 9th edition.)
ISBN-10: 0073383171 (Hardcover edition) or 978-0073383170 (Kindle edition)
The textbook will be available at:
https://www.bkstr.com/concordiastore/home
Note: Students should order textbooks as early as possible, especially for printed versions in case books are backordered or there are any shipping delays.

Assignments: Assignments, consisting of 8-10 problems (drawn mainly from the textbook) will be due weekly, submitted via Moodle. These are *very important* for the process of learning. They indicate the level of difficulty of the problems that students are expected to be able to solve. Every effort should be made to complete and submit all weekly assignments. Complete solution sets will be posted weekly, on the day of submission, so late submissions cannot be accepted. These grades, based on the 10 best grades received, are worth 10% of the total grade. The main purpose of grading is to provide helpful feedback to the students (and the professor) on how well they are keeping up with the course material.

The grading scheme includes weekly assignments of which a representative subset will be graded. Students will not be told in advance which subset of the assigned problems will be graded and should try to do all assigned problems. Solutions to all assigned problem will be posted at the course's Moodle site on the same day as they are due.

Use of Computer Algebra System: It is optional but recommended to install and use Maple or Mathematica. These symbolic computational tools can be used to verify and illustrate any analytical results you get while doing your assignment problems.

Calculators: Only calculators approved by the Department (with a sticker attached as a proof of approval) are permitted for the class test and final examination. For a list of Approved and Not-approved calculators see www.concordia.ca/artsci/math-stats/services.html

Midterm Exam: A **midterm exam**, covering the first seven weeks of the course, and evaluated as 30% of the total grade will be given in week 8.

Final Exam: To be scheduled by the Exams Office.

PLEASE NOTE: Students are responsible for finding out the date and time of the final exam once the schedule is posted by the Examination Office. Any conflicts or problems with the scheduling of the final exam must be reported directly to the Examination Office, **not** to your instructor. It is the Department's policy and the Examination Office's policy **that students are to be available until the end of the final exam period. Conflicts due to travel plans will not be accommodated.**

Final Grade: 30% midterm, 10% assignments, and 60% final exam.

Approximate schedule of topics

Week	Chapters	Topics	Assignments (Numbering: 9th edition)	Due date
1. Jan. 15 Jan. 17	Ch. 1. Secs. 1-12	Complex numbers: algebraic properties; complex plane; conjugates, polar form; roots; regions in the complex plane	**Notation: Sec 3, #5 = 3.5**	Jan. 22 (assignment 1)
2. Jan. 22 Jan. 24	Ch. 2. Secs. 13-24	Analytic functions 1: mappings, limits, continuity, derivatives, Cauchy-Riemann equations, CR equations in polar coordinates, examples		Jan. 29 (assignment 2)
3. Jan. 29 Jan. 31	Ch. 2. Secs. 25-29	Analytic functions 2: harmonic functions, reflection principle, analytic continuation		Feb. 5 (assignment 3)
4. Feb. 5 Feb. 7	Ch. 3. Secs. 30-40	Elementary functions: exponential, complex exponents, trigonometric functions, hyperbolic functions, inverses, multi-sheeted function		Feb. 12 (assignment 4)
5. Feb. 12 Feb. 14	Ch. 4. Secs. 41-53	Integrals 1: Contours, contour integrals, branch cuts, Cauchy-Goursat theorem, antiderivatives, multiply connected domains		Feb. 19 (assignment 5)

6. Feb. 19 Feb. 21	Ch. 4. Secs. 54- - 59	Integrals 2: Cauchy integral formula, extensions for derivatives, Cauchy inequality, Liouville's theorem, maximal modulus principle, fundamental theorem of algebra.		March 5 (assignment 6)
Feb. 24 - March 2		**Reading week**		
7. March 5 March 7	Ch. 5. Secs. 60- 68	Series: convergence, Taylor series, negative powers, Laurent series		March 12 (assignment 7)
8. March 12 March 14	**Midterm Exam:** Ch. 5. Secs. 69- 73	**March 13: Midterm exam** Chapters 1-4: all sections; Chapt. 5, Secs. 60-68. Absolute and uniform convergence. Continuity of power series. Integration and differentiation of power series; uniqueness; multiplication and division		 March 19 (assignment 8)
9. March 19 March 21	Ch. 6. Sec. 74 -76 Ch. 6. Sec. 77 -84	Types of singular points, isolated singular points, poles, residues at poles, Cauchy residue theorem. Residues at infinity, zeros of analytic functions, behaviour near isolated singular points, examples.		 March 26 (assignment 9)
10. March 26, March 28	Ch. 7. Sec. 85-93	Applications of residues, improper integrals, Jordan's lemma, indented paths, integration along a branch cut; definite integrals involving sines and cosines, argument principle. (Omit: Secs. 94, 95)		April 2 (assignment 10)
11. April 2 April 4	Ch. 8. Secs. 96- 103, 107, 108, 110,111 (Omit all other sections.)	Mapping by elementary functions: linear transformations, inverse map, mappings of the upper half-plane, linear fractional transformations, w=e^z, z^2, z^(1/2). Riemann surfaces		Apr. 9 (assignment 11)

12. April 9 April 11	Ch. 8. 108, 110,111 Ch. 9. Secs. 112, 113,114	Maps by branched functions. Riemann surfaces. Conformal maps: preservation of angles, examples, harmonic conjugates, transformations of harmonic functions		Apr. 16 (assignment 12)
April xx		**Final exam**		Final exam covers all listed course topics: Chapts. 1- 9.

Student Services
You may wish to access the many services available to you as a Concordia student. An overview of these resources can be found here: https://www.concordia.ca/students/services.html

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: https://www.concordia.ca/conduct/academic-integrity.html" *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

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Extraordinary circumstances
In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.