SYLLABUS COMPLEX FUNCTIONS

Course: Complex functions, summer 2025.

Lecturer: Gilles Felber.

Class times and locations: Monday to Thursday, 12 p.m. to 2 p.m., room 005.

No class on the 4th week, June 30 to July 4. Make-up classes/replacements on the 5th week, July 7 to 11 (to be determined).

Contact: felber@renyi.hu.

Website: gillesfelber.ch/lectures/clx25/

Office hours: by appointment. Feel free to contact if you would like to talk one-on-one.

Description: This is an introductory course in complex analysis. We will cover the basic theorems of this beautiful subject, with detailed proofs and illustrating examples.

Prerequisites: Familiarity with Euclidean geometry, linear algebra over real numbers, and the arithmetic of complex numbers. Basic real analysis, including the concepts of the Riemann integral, pointwise and uniform limits, partial derivatives, and differentiability in several variables. Knowledge of measure theory and topology is not needed.

Homeworks: One homework sheet is uploaded to the website every week on Monday, that is due on the beginning of Thursday's class (first week: Monday 16). You can either send it via email in pdf, or hand in on paper.

Preliminary schedule:

Week 1: Introduction, the complex plane: arithmetic, geometry and topology.

Week 2: Holomorphic functions and power series, complex integration along curves.

Week 3: Cauchy's theorem for convex and simply connected regions.

Week 5: Examples, Cauchy's formula, Taylor series, midterm exam.

Week 6: Liouville's theorem, fundamental theorem of algebra, uniqueness principle, Morera's theorem and uniform limits.

Week 7: Singularities and Laurent series, the residue theorem, argument principle.

Week 8: Rouché's theorem, open mapping theorem, maximum modulus principle, chosen topics, final exam.

Textbook: Elias M. Stein and Rami Shakarchi. *Complex Analysis*. Ed. by Rami Shakarchi. Princeton University Press, 2003.

Additional reading: Tristan Needham. Visual Complex Analysis: 25th Anniversary Edition. Oxford University PressOxford, Feb. 2023.

Midterm exam: week 5. Final exam: July 31. Both exams will be done in class.

Grading: the exams will be graded as follows: A + 90%, A 80%, A - 70%, B + 60%, B 50%, B - 40%, C + 30%, C 20%, D 10%. The course grade is the average of the two exam grades.