



# Exchange programme Vrije Universiteit

Vrije Universiteit Amsterdam - Exchange programme Vrije Universiteit - 2022-2023

## Exchange

Vrije Universiteit Amsterdam offers many English-taught courses in a variety of subjects, ranging from arts & culture and social sciences, neurosciences and computer science, to economics and business administration.

The International Office is responsible for course approval and course registration for exchange students. For details about course registration, requirements, credits, semesters and so on, please [visit the exchange programmes webpages](#).

# Complex Analysis

Course Code	X_400386
Credits	6.00
Period	P4+5
Course Level	300
Language Of Tuition	English
Faculty	Faculty of Science
Course Coordinator	prof. dr. J. Hulshof
Examiner	prof. dr. J. Hulshof
Teaching Staff	prof. dr. J. Hulshof
Teaching method(s)	Partial Exam, Lecture, Seminar

## Course Objective

- The student can decide whether a complex function is analytic (= differentiable in the complex sense) and knows the connection with the Cauchy-Riemann equations.
- She can do computations with elementary functions such as  $\exp/\log/\sin/\cos$  over the complex numbers.
- She can integrate analytic functions along a path on the complex plane, using the theorem of Cauchy-Goursat and its corollaries.
- She can compute Laurent series and determine the type of singularities of analytic functions.
- She can compute integrals of complex functions using the residue theorem and knows how to use this to compute integrals of real functions.

## Course Content

In complex analysis one generalizes the standard concepts of real analysis such as differentiation and integration from the real line to the complex plane. Although these generalizations arise very naturally and all standard examples of functions are also differentiable in the complex sense, the latter property surprisingly turns out to be much stronger. As a consequence, complex differentiable functions immediately obey very special properties which we are going to explore in this course. In particular, they lead to completely new and efficient methods for computing integrals of real functions.

During the lectures the following topics will be treated:

- complex differentiation and the Cauchy-Riemann equations
- complex integration and the theorem of Cauchy-Goursat
- elementary properties of complex differentiable functions
- singularities, Laurent series and the residue theorem
- application to integrals of real functions

## Additional Information Teaching Methods

Lecture (2 hours) and tutorial class (2 hours)

## Method of Assessment

Two written exams (40%+40%) and two hand-in homeworks (10%+10%). The retake exam counts for 100% of the final grade.

## Literature

Churchill, R. V., & Brown, J. W.: Complex variables and applications.  
Ninth edition, 2014, McGraw-Hill Book Co., New York

### Additional Information Target Audience

Bachelor Mathematics Year 2

### Recommended background knowledge

Calculus, Analysis, Linear algebra