

MATH-313

Number theory I.b - Analytic number theory

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Cursus	Sem.	Type
Mathematics	BA5	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The aim of this course is to present the basic techniques of analytic number theory.

Content

This course provides an introduction to analytic number theory. After introducing the basic definitions and methods, our aim will be to prove Dirichlet's theorem on primes in arithmetic progressions and the prime number theorem.

Covered topics include:

1. Arithmetic functions: Multiplicative functions, Dirichlet convolutions
2. Asymptotic estimates: Euler's summation formula, Summation by parts, Dirichlet's hyperbola method
3. Elementary results on the distribution of prime numbers: Chebyshev's theorem, Mertens' theorems
4. Dirichlet series: Euler product, Perron's formula
5. Primes in arithmetic progressions: Dirichlet characters, Dirichlet L-functions, Proof of Dirichlet's theorem on primes in arithmetic progressions
6. The Riemann zeta function: Analytic continuation, Functional equation, Hadamard product
7. The prime number theorem: Explicit formula, Zero-free region, Proof of the prime number theorem
8. Primes in arithmetic progressions refined: Siegel zeros, Siegel-Walfisz theorem

Learning Prerequisites**Required courses**

- Analyse I, II, III
- Algèbre Linéaire I, II
- Algèbre I

Teaching methods

Lectures with exercise sheets.

Expected student activities

Proactive attitude during the course and the exercise sessions, possibly with individual presentation of the solution of exercise problems.

Assessment methods

Written exam.

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography

- *Introduction to Analytic Number Theory*, T. M. Apostol
- *Multiplicative Number Theory I. Classical Theory*, H. L. Montgomery & R. C. Vaughan
- *Multiplicative Number Theory*, H. Davenport

Ressources en bibliothèque

- [Multiplicative Number Theory I / Montgomery](#)
- [Introduction to Analytic Number Theory / Apostol](#)
- [Multiplicative Number Theory / Davenport](#)

Moodle Link

- <https://go.epfl.ch/MATH-313>