THE UNIVERSITY OF BRITISH COLUMBIA

Greg Martin

Professor
Department of Mathematics

Teaching

MATH 437/537 (Fall 2024)
MATH 539 (Winter 2025)

Past courses

My students

Other Links

UBC Number Theory group
NT seminar schedule

UBC Math Department
Math faculty directory

Lectures: Tuesdays and Thursdays, 11:00 AM–12:20 PM, room MATH 225 (Mathematics Building)
Office hours: right after class, by appointment, or drop in
Office: room MATH 212 (Mathematics Building)
Email address: gerg@math.ubc.ca

Course description: This course covers the fundamental techniques in classical analytic number theory. The objects of study are the natural numbers; the theorems sought are statistical statements about the distribution of primes, the number of divisors of integers, and similar multiplicative questions; the techniques involve both "by hand" real analytic estimation and contour integration of meromorphic functions. The successful student will be well equipped to understand much of the current research literature in this area.

Prerequisites: Students should have had a previous course in number theory (preferably MATH 537 here at UBC). It will be assumed that the student has had the usual undergraduate training in analysis (for example, MATH 320) and a strong course in complex analysis (preferably MATH 508). In particular, in complex analysis students should have a working knowledge of power series, poles and the residue theorem, logarithmic derivatives and the argument principle, and analytic continuation. Students will also need to have a working knowledge of LaTeX, although this can be acquired along the way if necessary.

Course textbook: The recommended textbook for this course is the book by Montgomery and Vaughan, *Multiplicative Number Theory I: Classical Theory* (Cambridge University Press, 2006). Here is a link to Hugh Montgomery's home page, at which you can access a list of errata for the book.

Topics to be covered in this course:

- Dirichlet series and the Mellin transform
- Arithmetical functions and their summation and estimation
- Prime counting functions and Chebyshev's and Mertens's estimates
- The Riemann zeta function and its zeros
- The prime number theorem and applications
- (if time permits) Dirichlet characters and Dirichlet's theorem on primes in arithmetic progressions

Other possible references for analytic number theory:

- H. Iwaniec and E. Kowalski, *Analytic Number Theory*
- P. T. Bateman and H. G. Diamond, *Analytic Number Theory: An introductory course*
- H. Davenport, *Multiplicative Number Theory*
- T. M. Apostol, *Introduction to Analytic Number Theory*

Possible references for elementary number theory:

- I. Niven, H. S. Zuckerman, and H. L. Montgomery, *An Introduction to the Theory of Numbers*
- G. H. Hardy and E. M. Wright, *An Introduction to the Theory of Numbers*

The evaluation scheme will be decided on collaboratively by the instructor and the students during the second week of classes! Below is what the evaluation scheme was the last time I taught this course, but that's only for context—we will decide together how evaluation will be done this semester.

Evaluation: The course mark will be based on six or seven homework assignments, due roughly every two

weeks, as well as group work done in class about three times a month. Your homework will be marked on correctness, completeness, rigor, and elegance. A correct answer will not earn full marks unless it is completely justified, in a rigorous manner, and written in a logical sequence that is easy to follow and confirm. *Survival tip*: don't start these assignments the night before they're due! Anecdotal evidence suggests that each assignment could take as much as 15 hours or more to complete.

Other than the group work, *no handouts will be distributed in class*. All homework assignments and any other course materials will be posted below on this course web page. **Homework solutions must be prepared in LaTeX** and submitted to me in PDF format via email; please prepend your name to the filename before submitting your homework (with the format GregMartin-homework1.pdf). I will supply LaTeX templates with each assignment. All homeworks are due before the beginning of class (9:29 AM) on the indicated days.

- Homework #0: due Tuesday, January 14. Download both the TeX file and the PDF file.
- Homework #1: due Tuesday, January 28
- Homework #2: due Tuesday, February 11
- Homework #3: due Thursday, March 5
- Homework #4: due Monday, March 23 by 11:59 PM
- Homework #5: due Tuesday, April 7

Students are allowed to consult one another concerning the homework problems, but *your submitted solutions must be written by you in your own words*. Students can be found guilty of plagiarism if they submit virtually identical answers to a question, or if they do not understand what they have submitted.

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.