

Math 2043 Honors Mathematical Analysis

Course Syllabus - Spring 2026

Course

Title: Honors Mathematical Analysis

Code: Math 2043

Credit Points: 4

Pre-requisite: Grade A- or above in MATH 1024

Exclusion: MATH 2033

Instructor

Name: Min YAN

Contact: mamyan@ust.hk, room 3487, phone 23587442

Lecture: L1

Date/Time: Tuesday/Thursday 15:00 - 16:20

Venue: room 5583

Tutorial: T1A

Date/Time: Wednesday 18:00 - 18:50

Venue: room 2306

[Tutorial arrangement is likely to be changed, after consulting with students]

Grader: Wenzhao JI, wjiab@connect.ust.hk

Course Description

The MATH 2043 and 3043 is a rigorous sequence in analysis on the line and higher dimensional Euclidean spaces. Limit, continuity, least upper bound axiom, open and closed sets, compactness, connectedness, differentiation, uniform convergence, and generalization to higher dimensions.

Content/Schedule

1. Sequence: Chapter 1, week 1-2
supremum and infimum, monotone sequence, upper and lower limit, Balzano-Weierstrass theorem, Cauchy criterion, Heine-Borel theorem.
2. Function: Chapter 2, week 2-3
continuity, monotone function, compactness property, connectedness property, inverse function.
3. Multivariable limit: Chapter 6, week 4-5
norm, continuity, topology in Euclidean space, equivalence of norm.
4. Differentiation: Chapter 3, week 6-7
approximation, differentiability, mean value theorem, high order differentiability, Taylor expansion, local extreme, convexity.
5. Multivariable Differentiation: Chapter 8, week 8-9
multivariable approximation, differentiability, inverse and implicit differentiation, submanifold, high order differentiation, Lagrange multiplier, .
6. Integration: Chapter 4, week 10-11
Riemann integration, Darboux integration, fundamental theorem, Riemann-Stieltjes integration, bounded variation function.
7. Topic in Analysis: Chapter 5, week 12-13

improper integration, series, convergence test, absolute and conditional convergence, uniform convergence, power series.

Teaching and Learning Method

1. Lecture:
The lecture note is Chapters 1-6 and 8 of Advanced Analysis. Learn the concepts through definitions, examples, and discussions.
2. Tutorial:
Practise on typical problems. Learn additional related topics in analysis.
3. Online:
The course is managed through Canvas. Moreover, a WeChat group is set up, where the students, the instructor, and the grader can discuss and communicate all things about the course.

Intended Learning Outcomes

By the end of this course, students should be able to:

1. Build a strong background on mathematical analysis, on real line and on metric spaces, for future studies in advanced courses in mathematics, statistics, and related subjects.
2. Be familiar with the rigorous treatment of single-variable, multivariable functions.
3. Develop logical reasoning and critical thinking skills.

Assessment

Homework: about 10 assignments, 20% of course grade

Midterm exam: 3 hours, 20% of course grade
(time and venue to be determined in 5th week)

Final exam: 3 hours, 50% of course grade
(time and venue to be set by the university)

Mapping of Course ILOs to Assessment Tasks

Homework: ILO 1, 2, 3

The assigned homework is the minimum. You should do as many exercises as possible. The exercises are integrated parts of my lecture note. You *must* use the method from the examples and discussions right before the exercises. The goal of the exercises is to master the concept and method. I will provide answers to almost all the exercises.

Midterm exam: ILO 1, 2, 3

The midterm will test Chapters 1, 2, 3, 6. The test will emphasize the correct understanding of concepts, and the right way to do the problems.

Final exam: ILO 1, 2, 3

The final will test Chapters 4, 5, 8. The test will emphasize the correct understanding of concepts, and the right way to do the problems.

Grading

A, excellent: 85 points

The student has mastered almost all concepts and techniques of mathematical analysis taught in the course, has excellent understanding of the deepest content of the subject, and acquired workable knowledge for further studies of real analysis, functional analysis, PDE, and related fields.

B, good: 60 points

The student has mastered most techniques of mathematical analysis taught in the course, yet the understanding of some challenging concepts may not be deep enough for further studies on related advanced subjects.

C, satisfactory: 35 points

The student meets the minimum expectation of the instructor, has acquired some basic techniques of the subject, yet some concepts were not clearly understood.

D, marginal:

The student is only able to recall some fragments of topics and is able to complete some of the easiest problems.

F, fail:

The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete some of the easiest problems.