# MATH 2001
# Foundation of Mathematics
# Fall 2024-25

https://canvas.ust.hk/courses/59489

### Lectures

| | |
|---|---|
| **Time** | TuTh 01:30pm–02:50pm |
| **Venue** | G010, CYT Bldg |
| **Instructor** | **Prof. Quoc Ho** |
| E-mail | quoc.ho@ust.hk |
| Office | Room 3477, Department of Mathematics |

### Tutorials

| **Session** | T1A | T1B | T1C | T1D |
|---|---|---|---|---|
| **Teaching Assistant** | **YU, Wing Chun** | **YU, Wing Chun** | **ZENG, Yeqin** | **ZENG, Yeqin** |
| E-mail | wcyuad | wcyuad | yzengbj | yzengbj |

### Course Description

**Course outline.** We will (tentatively) cover the following topics (with a possibly different order): logic, sets, functions, and cardinality, proof techniques, number systems, integers and polynomials, limits and continuity.

**Credits.** 2

### Intended Learning Outcomes (ILOs)

Upon completion of this course, students are expected to:

(1) understand mathematical logic and set theory, including propositions, logical connectives, and quantifiers;
(2) be able to execute various proof techniques such as direct proof, proof by contradiction, proof by contrapositive, and mathematical induction;
(3) be able to communicate mathematical ideas in a logical and cohesive manner;
(4) be able to write mathematical documents using LaTeX;
(5) acquire important studying skills in mathematics such as reading and understanding mathematical texts, and writing mathematical proofs;
(6) be able to apply the skills above to the various mathematical topics covered in the course.

### Assessment and Grading

**Homework.** There will be (mostly) weekly problem sets. Students should submit each homework on the Canvas system in the form of a PDF file typeset in LaTeX before the deadline. **No** late homework is accepted. A 25% penalty will be deducted for homework not typeset in LaTeX. This is design to make sure that everything written down is carefully thought out, well-presented, and easy to read, all of which are important skills in mathematics.

**Examinations.** There will be a midterm exam during Week 6–8 (exact date to be confirmed), and a final exam arranged by ARO. The final exam can cover everything in the course.

All exams are closed-book, and no electronic devices are allowed.

*Make-up midterm policy.*

- Under any circumstance, students who are unable to attend the midterm exam will **not** be offered a make-up midterm that takes place after the regular exam session. Note also that only in **exceptional circumstances** are examinees permitted to join an examination after the first 30 minutes.
- For students who have valid reasons for missing the midterm, the instructor may approve an early midterm, or assign the midterm marks according to the final exam performance.
- For students who miss the midterm without a valid reason, the midterm score will be regarded as 0. This includes self-claimed sickness without any medical statement.

*Make-up final policy.* The course will follow the make-up exam policy set by ARO for the final exam. Approval from the instructor, the dean, and ARO will be needed for applying for a make-up final exam.

**Grading scheme.** This course will be assessed using **criterion-referencing**, and grades will **not** be assigned using a curve.

| Component | Weight | ILOs |
|---|---|---|
| Homework | 20% | 1, 2, 3, 4, 5, 6 |
| Midterm | 35% | 1, 2, 3, 5, 6 |
| Final | 45% | 1, 2, 3, 5, 6 |
| **Course Total** | 100% | |

*Remark.* As this course aims to build a strong foundation for further studies in mathematics, students are expected to both have a good understanding of the materials covered in the course (as expected) and to be able to communicate their understanding in a coherent and precise manner. Students will thus be assessed equally on both aspects.

**Letter Grades.** Students should aim at getting a course total of 85% or above for A–/A/A+, and about 60% or above for B–/B/B+. These numbers are suggestive only and might not reflect the actual cut off at the end of the semester. Please consult the grade descriptors below for more information.

**Grade descriptors.**

| Grades | Short Description | Elaboration on subject grading description |
|---|---|---|
| A | Excellent Performance | The student has mastered almost all concepts and techniques taught in the course, has excellent understanding of the deepest content of the subject, are able to present their understanding in a coherent and precise manner, and acquired workable knowledge for further studies in more advanced mathematics courses. |
| B | Good Performance | The student has mastered most techniques taught in the course but still needs to improve (1) their understanding of some of the more challenging and subtle concepts or (2) their skills in presenting their understanding in a coherent and precise manner. |
| C | Satisfactory Performance | The student meets the minimum expectation of the instructor and has acquired some basic techniques, but some concepts were not clearly understood, or the writing skills need serious improvements. |
| D | Marginal Pass | The student is only able to recall some fragments of the materials covered and is able to carry out only some of the easiest computations or arguments. |
| F | Fail | The student does not have sufficient understanding of even some fragments of the topics covered and is not even able to carry out some of the easiest computations or arguments. |

**Generative AI Policy.** Students are allowed to consult any person (including the instructor, TA, classmates, friends outside HKUST) in any homework for ideas and hints, but are required to write up the solutions by themselves and understand them. Students are also required to list the persons and references they have consulted in every homework.

The use of ChatGPT or other generative AI is allowed, and they can be regarded as "persons" consulted, and therefore must be listed in the homework.

However, please be warned that at the current stage of development of AI, the response to problems – especially those in pure mathematics – is reliable (although a lot of the time, it looks legitimate at the first glance). Students should thus be very critical of the response generated by AI and do not blindly copy the generated responses.

## Textbooks and References

**References.** The major reference is the instructor's lecture notes posted on Canvas. Note, however, the notes might contain only the main points. Lecture attendance is necessary to get the full treatment of the topics.

Additional useful resources include


[K] J. M. Kane. *Writing Proofs in Analysis*. Cham: Springer International Publishing, 2016. ISBN: 978-3-319-30965-1 978-3-319-30967-5. DOI: 10.1007/978-3-319-30967-5;

[H] K. Houston. *How to Think Like a Mathematician: A Companion to Undergraduate Mathematics*. 1st ed. Cambridge University Press, Feb. 12, 2009. ISBN: 978-0-521-89546-0 978-0-511-80825-8 978-0-521-71978-0. DOI: 10.1017/CBO9780511808258;

[Yan] Prof. Min Yan's course note for a previous version of this course;

[Other] Notes by various people that I find interesting/helpful.


The last two items are available on the course's webpage on Canvas. I believe that [K] is also available for download via the link given in the bibliography when you are on HKUST campus.

## Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct.