

THE CHINESE UNIVERSITY OF HONG KONG
Department of Mathematics
MATH1050A (First term, 2016-17)
Foundation of Modern Mathematics

This course introduces rigorous mathematical reasoning, proofs, and high dimensional geometry. The use of logic in mathematics and various methods of proof will be illustrated by concrete examples from a variety of topics in mathematics.

Topics are selected amongst: logic and axiomatic systems; sets, relations and functions; infinite sets and countability; numbers and polynomials; lines, planes, conics and quadrics.

Instructor

- Fong Wing-Chung (Office: Rm 218 LSB. Email: wcfong@math.cuhk.edu.hk)

Tutors

- Suen Yat-Hin (Office: Rm 232 LSB. Email: yhsuen@math.cuhk.edu.hk)
- Cheung Siu-Wun (Office: Rm G06 LSB. Email: swcheung@math.cuhk.edu.hk)

Time and Venue

- Lectures and tutorials: Mondays 1430-1615hrs LSB LT5, Wednesdays 1030-1215hrs LHC 104.
- Supplementary lecture: 1430-1715hrs, Monday 5/12. *Time to be confirmed. Venue to be announced.*

Assessment Scheme

- **Coursework:** 50%

Tutorials: You will be awarded one mark for satisfactory participation in each tutorial.

Assignments: Each assignment contains two parts (Parts 1, 2). You will be awarded one mark for satisfactory performance in Part 1 of each assignment.

Part 2 of each assignment is usually intended for training in the writing of proofs, and does not count in the overall assessment; you are not required to submit your work.

The **Further Exercises** do not count in the overall assessment.

In the assignments and the further exercises, questions which require more thought and/or work and/or tricks and/or organization and/or ... are marked by $\diamond, \clubsuit, \heartsuit, \spadesuit$, in ascending order of overall difficulty level.

Quiz: There is one quiz. The tentative date is Thursday 3/11 (in Week 9). The time is very likely to be 1900-2100hrs, and the venue(s) will be announced.

Your coursework score C will be given by the formula

$$C = \min\{T + A, 10\} + \left[\frac{T + A}{2} + \frac{Q}{100} \left(40 - \frac{T + A}{2} \right) \right].$$

Here T is your total tutorial score, A is your total assignment score, and Q is your quiz score out of the full score of 100.

- **Final Examination:** 50 %

Course Material and Course Announcements

Course material (for example, supplementary notes, assignments, tutorial sheets) will be uploaded to the course homepage at

http://www.math.cuhk.edu.hk/course_builder/1617/math1050a/1050ahp-mat.html

Course announcements made in class may be put onto the course homepage and communicated via the CWEM.

References

1. B. Bajnok, *An Invitation to Abstract Mathematics*, Springer-Verlag.
2. M. Beck, R. Geoghegan, *The Art of Proof: basic training for deeper mathematics*, Springer-Verlag.
3. K. G. Binmore, *Foundations of Analysis: a straightforward introduction (Book 1 Logic, Sets and Numbers)*, Cambridge University Press.
4. E. D. Bloch, *Proofs and Fundamentals: a first course in abstract mathematics*, (First or Second Edition), Birkhäuser/Springer-Verlag.
5. G. Chartrand, A. D. Polimeni, P. Zhang, *Mathematical Proofs: A Transition to Advanced Mathematics*, Addison-Wesley.
6. D. W. Cunningham, *A Logical Introduction to Proof*, Springer-Verlag.
7. U. Daepf, P. Gorkin, *Reading, Writing, and Proving: a closer look at mathematics* (Second Edition), Springer-Verlag.
8. L. J. Gerstein, *Introduction to Mathematical Structures and Proofs* (Second Edition), Springer-Verlag.
9. K. T. Leung, P. H. Cheung, *Fundamental Concepts of Mathematics*, Hong Kong University Press.
10. I. Stewart, D. Tall, *Foundation of Mathematics* (Second Edition), Oxford University Press.

To understand the topics of this course in the context of the rest of mathematics, you may refer to the following books:

1. H. Eves, *Foundations and Fundamental Concepts of Mathematics* (Third Edition), Dover.
2. I. Stewart, *Concepts of Modern Mathematics*, Dover.

To understand the topics of this course in the context of computer science, you may refer to:

- J. Truss, *Discrete Mathematics for computer scientists* (Second Edition), Addison Wesley.

As for higher dimensional geometry, you may refer to:

- G. B. Thomas, *Thomas Calculus* (any recent edition), Addison-Wesley or Pearson.

The book below offers valuable general advice on how to get used to ‘proof-type’ mathematics courses:

- L. Alcock, *How to Study for a Mathematics Degree*, Oxford University Press.

Teaching Schedule

The schedule is provisional. We will adapt it along the way to suit the mathematical capability of the students.

- Weeks 1-6: various methods of mathematical proofs; set operations; logic; numbers.
- Weeks 7-11: functions and relations.
- Weeks 12-13: infinite sets.