

THE CHINESE UNIVERSITY OF HONG KONG
Department of Mathematics
MATH1050B/C (Second 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

- Chen Yuan (Office: Rm 232 LSB. Email: yuanchen@math.cuhk.edu.hk)
- Chau Chi Fai (Office: Rm 222B LSB. Email: cfchau@math.cuhk.edu.hk)
- Yau Yu Tung (Office: Rm 505 AB1. Email: ytyau@math.cuhk.edu.hk)

Time and Venue

- Lectures and tutorials:
Section B: Tuesdays 1630-1815hrs LSB LT3, Thursdays 1330-1515hrs LSB LT4.
Section C: Wednesdays 1430-1615hrs LSB LT3, Thursdays 1630-1815hrs MMW 702.
Tutorials starts *from Week 4*.
- Supplementary lectures:
Section B only: 1830-1915hrs, Thursday 6/4, LSB LT2.
Both sections: 1430-1715hrs, Monday 24/4, MMW LT1.

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. Date: 16/3 (in Week 9). Time: 1900-2100hrs. Venue: LSK LT5. The quiz paper is the same for both sections.

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 %
The examination papers are the same for both sections.
- Your grade will be determined by your overall performance in the various assessment components of the course, regardless of which section you have registered in.

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/math1050bc/1050bchp-mat.html

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

References

Each of these books below (and many others) cover to various extent much (but not necessarily all) of the course material, and may serve as general reference:

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. D. W. Cunningham, *A Logical Introduction to Proof*, Springer-Verlag.
6. U. Daepf, P. Gorkin, *Reading, Writing, and Proving: a closer look at mathematics* (Second Edition), Springer-Verlag.
7. L. J. Gerstein, *Introduction to Mathematical Structures and Proofs* (Second Edition), Springer-Verlag.
8. K. T. Leung, P. H. Cheung, *Fundamental Concepts of Mathematics*, Hong Kong University Press.

For a deeper discussion on set language (and set theory), you may refer to these books:

1. P. R. Halmos, *Naïve Set Theory*, Springer-Verlag.
2. K. T. Leung, D. L. C. Chan, *Elementary Set Theory*, Hong Kong University Press.
3. C. Schumacher, *Chapter Zero* (Second Edition), Addison-Wesley.

To put the material in this course in the context of the rest of mathematics, you may refer to these books:

1. H. Eves, *Foundations and Fundamental Concepts of Mathematics* (Third Edition), Dover.
2. I. Stewart, *Concepts of Modern Mathematics*, Dover.
3. I. Stewart, D. Tall, *Foundation of Mathematics* (Second Edition), Oxford University Press.

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 7-12: functions and relations.
- Weeks 13-14: infinite sets.