

THE CHINESE UNIVERSITY OF HONG KONG
Department of Mathematics
MMAT 5120 (Term 1, 2023-24)
Topics in Geometry
Course Outline

Outline

This course is intended to provide a brief, but solid, modern introduction to various basic geometries using analytic methods. In this term, we will focus on various plane geometries including some “non-Euclidean” geometries, with emphasis on the hyperbolic plane geometry. A brief introduction to solid Euclidean and hyperbolic geometries using quaternions will also be included if time allows.

Prerequisites

Students taking this course should be familiar with complex numbers and calculus of functions with one and two variables.

Class Information

- Instructor: CHAN Kwok Wai (Office: LSB 212; Email: kwchan@math.cuhk.edu.hk)
- Teaching Assistant: MU Zuodong (Office: LSB 222B; Email: zdmu@math.cuhk.edu.hk)
- Lectures: Thu 6:30pm - 9:15pm at YIA LT5
- Webpage: <https://www.math.cuhk.edu.hk/course/2324/mmat5120>

Suggested Texts

- Lecture notes available at the course webpage.
- *Modern Geometries*. M. Henle, Prentice Hall, Inc., Upper Saddle River, NJ, 1997. (Chap. 2-10)
- *A gateway to modern geometry, The Poincaré half-plane*. S. Stahl, Second edition. Jones and Bartlett Publishers, Boston, MA, 2008. Online access available in CUHK library.

Assessment

- 20%: 2 Homework Assignments
- 30%: 3 Quizzes (28th Sep, 26th Oct, 23rd Nov)
- 50%: Final (7th Dec)

Tentative Schedule

- Complex numbers
- Geometric transformations
- Klein's Erlanger Programm
- Möbius geometry
- Steiner circles
- Plane hyperbolic geometry
- Cycles in hyperbolic geometry
- Length in hyperbolic geometry
- Area in hyperbolic geometry
- Hyperbolic trigonometry
- Higher dimensional geometries (optional)