

MA4H4-15 Geometric Group Theory

26/27

Department

Warwick Mathematics Institute

Level

Undergraduate Level 4

Module leader

Robert Kropholler

Credit value

15

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This will be an introduction to the basic ideas of geometric group theory. The main aim of subject is to apply geometric constructions to understand finitely generated groups. Although many of the ideas can be traced back a century or more, the modern subject has its origins in the 1980s and has rapidly grown into a major field in its own right. It draws on ideas from many subjects, though two particular sources of inspiration are low dimensional topology and hyperbolic geometry. A significant insight is that most 'finitely presented groups are hyperbolic' in a broad sense. This has many profound applications. Some familiarity with group presentations will be useful. Beyond that, geometric or topological background is probably more relevant than algebraic background.

[Module web page](#)

Module aims

This module will offer students the opportunity to get relevant background training within the highly active research area of geometry/topology.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

Group presentations. Cayley graphs. Quasi-isometries. Hyperbolic groups. Dehn functions and other quasi-isometry invariants.

Also included would be a brief informal review of fundamental groups and hyperbolic geometry (for those who have not seen these before), though these serve mainly to provide a source illustrative examples and motivation, and are not essential to the logical development.

Learning outcomes

By the end of the module, students should be able to:

- An understanding of the main notions of quasi-isometry, quasi-isometry invariants, and hyperbolic groups.
- To be able to apply these in particular examples.

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

The course will expose students to a wide range of ideas in an advanced subject at the forefront of current mathematical research. The students will learn to familiarise themselves with abstract concepts, and to relate them to physical intuition.

Transferable skills

They will learn to follow complex reasoning, to construct logical arguments, to think independently, and to develop research skills.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Tutorials	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 hours

Private study description

Office hours, private study, preparation for lectures and exams, assignment sheets.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group D

	Weighting	Study time	Eligible for self-certification
Assignments	15%		No
Centrally-timetabled examination (On-campus)	85%		No

- Answerbook Gold (24 page)

Assessment group R1

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

- Answerbook Gold (24 page)

Feedback on assessment

Marked coursework and exam feedback.

[Past exam papers for MA4H4](#)

Availability

Courses

This module is Optional for:

- TMAA-G1PE Master of Advanced Study in Mathematical Sciences

- Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
- Year 1 of G1PE Master of Advanced Study in Mathematical Sciences
- Year 1 of TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
 - Year 1 of G1PC Mathematics (Diploma plus MSc)
 - Year 2 of G1PC Mathematics (Diploma plus MSc)

This module is Core option list F for:

- Year 4 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

This module is Option list A for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1P0 Postgraduate Taught Mathematics
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 5 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list B for:

- TMAA-G1PD Postgraduate Taught Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 1 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
 - Year 2 of G1PD Interdisciplinary Mathematics (Diploma plus MSc)
- Year 1 of TMAA-G1PC Postgraduate Taught Mathematics (Diploma plus MSc)
- Year 4 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 5 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)

This module is Option list C for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
 - Year 3 of G105 Mathematics (MMath) with Intercalated Year
 - Year 4 of G105 Mathematics (MMath) with Intercalated Year
 - Year 5 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G103 Undergraduate Mathematics (MMath)
 - Year 3 of G103 Mathematics (MMath)
 - Year 4 of G103 Mathematics (MMath)
- Year 4 of UMAA-G107 Undergraduate Mathematics (MMath) with Study Abroad
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
 - Year 3 of G106 Mathematics (MMath) with Study in Europe
 - Year 4 of G106 Mathematics (MMath) with Study in Europe

This module is Option list E for:

- Year 5 of USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated