MA343-10 Geometry

24/25

Department
Warwick Mathematics Institute
Level
Undergraduate Level 3
Module leader
Helena Verrill
Credit value
10
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Geometry is the attempt to understand and describe the world around us and all that is in it; it is the central activity in many branches of mathematics and physics, and offers a whole range of views on the nature and meaning of the universe.

Klein's Erlangen program describes geometry as the study of properties invariant under a group of transformations. Affine and projective geometries consider properties such as collinearity of points, and the typical group is the full matrix group. Metric geometries, such as Euclidean geometry and hyperbolic geometry (the non-Euclidean geometry of Gauss, Lobachevsky and Bolyai) include the property of distance between two points, and the typical group is the group of rigid motions (isometries or congruences) of 3-space. The study of the group of motions throws light on the chosen model of the world.

[Module web page](#)

Module aims

To introduce students to various interesting geometries via explicit examples; to emphasize the importance of the algebraic concept of group in the geometric framework; to illustrate the historical development of a mathematical subject by the discussion of parallelism.

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.

Examples of 'geometries' including: Eucledian, Spherical, hyperbolic and projective.

For these geometries, a metric will be defined and their isometry groups will be determined in terms of linear maps.

Their existence and uniqueness of parallel lines and the sum of the angles of a triangle will be analysed.

Projective linear transformations will be covered, and then the course will build towards axiomatic projective geometry.

Learning outcomes

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

- make advanced analytic and algebraic calculations within the framework of Euclidean geometry,
- consolidate their understanding of the geometry of the sphere and the hyperbolic plane,
- distinguish the different geometries in terms of their metric properties, trigonometry and parallels,
- concentrate on the abstract properties of lines and their incidence relation, leading to the idea of affine and projective geometry.

Indicative reading list

- M Reid and B Szendröi, Geometry and Topology, CUP, 2005.
- E G Rees, Notes on Geometry, Springer
- HSM Coxeter, Introduction to Geometry, John Wiley & Sons
- Richter-Gebert - Perspectives on Projective Geometry - 2011
- John G. Ratcliffe, Foundations of hyperbolic manifolds, Vols 1,2,3,

Subject specific skills

Ability to qualitatively asses and discuss the different examples of geometry in terms of their metric properties and orthogonal and parallel lines, and to concentrate on the abstract properties of lines and their incidence relation.

Transferable skills

The module provides technical competence in geometric calculations often required in applications. Beyond this, students will acquire key reasoning and problem solving skills which will empower them to address new problems with confidence.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (30%)
Seminars	9 sessions of 1 hour (9%)
Private study	61 hours (61%)
Total	100 hours

Private study description

Review lectured material and work on set exercises.

Costs

No further costs have been identified for this module.

Assessment

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

Assessment group D

	Weighting	Study time
Assessed work	15%	
In-person Examination	85%	

- Answerbook Pink (12 page)

Assessment group R

	Weighting	Study time
In-person Examination - Resit	100%	

- Answerbook Pink (12 page)

Feedback on assessment

Exam and assessed work feedback.

Availability

Anti-requisite modules

If you take this module, you cannot also take:

- MA243-10 Geometry

Courses

This module is Core option list A for:

- UMAA-GV18 Undergraduate Mathematics and Philosophy with Intercalated Year
  - Year 4 of GV18 Mathematics and Philosophy with Intercalated Year
  - Year 4 of GV18 Mathematics and Philosophy with Intercalated Year

This module is Core option list C for:

- UMAA-GV17 Undergraduate Mathematics and Philosophy
  - Year 3 of GV17 Mathematics and Philosophy
  - Year 3 of GV17 Mathematics and Philosophy
  - Year 3 of GV17 Mathematics and Philosophy
- Year 3 of UMAA-GV19 Undergraduate Mathematics and Philosophy with Specialism in Logic and Foundations

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:

- Year 4 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- UMAA-G100 Undergraduate Mathematics (BSc)
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 3 of G100 Mathematics
  - Year 3 of G103 Mathematics (MMath)
  - Year 3 of G103 Mathematics (MMath)
- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
  - Year 3 of GF13 Mathematics and Physics
  - Year 3 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)

- - Year 3 of GF13 Mathematics and Physics
  - Year 3 of FG31 Mathematics and Physics (MMathPhys)
  - Year 3 of FG31 Mathematics and Physics (MMathPhys)
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year