

# MA243-10 Geometry

23/24

**Department**

Warwick Mathematics Institute

**Level**

Undergraduate Level 2

**Module leader**

Helena Verrill

**Credit value**

10

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## 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: Euclidian, 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 analytic and algebraic calculations within the framework of Euclidean geometry,
- understand the geometry of the sphere and the hyperbolic plane,
- compare 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 Szendrői, Geometry and Topology, CUP, 2005 (some Chapters will be available from the General office). E G Rees, Notes on Geometry, Springer

HSM Coxeter, Introduction to Geometry, John Wiley & Sons

1,2,3 of John G. Ratcliffe, Foundations of hyperbolic manifolds

## Subject specific skills

Ability to qualitatively assess 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.

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# Study

## Study time

| Type          | Required                    |
|---------------|-----------------------------|
| Lectures      | 30 sessions of 1 hour (30%) |
| Tutorials     | 9 sessions of 1 hour (9%)   |
| Private study | 16 hours (16%)              |
| Assessment    | 45 hours (45%)              |
| Total         | 100 hours                   |

## Private study description

Review lectured material and work on set exercises.

## Costs

No further costs have been identified for this module.

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## Assessment

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

### Assessment group D

|                                    | Weighting | Study time |
|------------------------------------|-----------|------------|
| Assessed work                      | 15%       | 15 hours   |
| 2 hour online examination (Summer) | 85%       | 30 hours   |

- Answerbook Pink (12 page)

### Assessment group R

|                               | Weighting | Study time |
|-------------------------------|-----------|------------|
| In-person Examination - Resit | 100%      |            |

- Online examination: No Answerbook required

## Feedback on assessment

Exam and assessed work feedback.

[Past exam papers for MA243](#)

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## Availability

### Courses

This module is Core option list A for:

- UMAA-GV17 Undergraduate Mathematics and Philosophy
  - Year 2 of GV17 Mathematics and Philosophy
  - Year 2 of GV17 Mathematics and Philosophy
  - Year 2 of GV17 Mathematics and Philosophy

This module is Core option list B for:

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

This module is Core option list D for:

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

This module is Option list A for:

- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
  - Year 2 of G105 Mathematics (MMath) with Intercalated Year
  - Year 4 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G100 Undergraduate Mathematics (BSc)
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 2 of G100 Mathematics
  - Year 2 of G103 Mathematics (MMath)
  - Year 2 of G103 Mathematics (MMath)
  - Year 3 of G100 Mathematics
  - Year 3 of G103 Mathematics (MMath)
  - Year 3 of G103 Mathematics (MMath)
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)

- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
  - Year 2 of GG14 Mathematics and Statistics
  - Year 2 of GG14 Mathematics and Statistics
- UMAA-G101 Undergraduate Mathematics with Intercalated Year
  - Year 2 of G101 Mathematics with Intercalated Year
  - Year 4 of G101 Mathematics with Intercalated Year

This module is Option list B for:

- UCSA-G4G1 Undergraduate Discrete Mathematics
  - Year 2 of G4G1 Discrete Mathematics
  - Year 2 of G4G1 Discrete Mathematics
- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics
- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
  - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics
  - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics