MATH300

Geometry and Topology

S1 Day 2015

Dept of Mathematics

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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Credit points
3

Prerequisites
39cp including MATH235

Corequisites

Co-badged status

Unit description
This unit is designed to widen geometric intuition and horizons by studying topics such as projective geometry, topology of surfaces, graph theory, map colouring, ruler-and-compass constructions, knot theory and isoperimetric problems. This unit is especially recommended for those students preparing to become teachers of high school mathematics.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
Present a broad outline of the scope of topology and geometry in two dimensions, their roles in other fields, and the way other fields contribute to their development.
Demonstrate the ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning. In particular, the ability to use axioms and definitions correctly within an argument.

Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using methods from geometry and topology.
Be able to apply the principles, concepts, and techniques learned in this unit to solve practical and abstract problems.
Demonstrate appropriate interpretation of information communicated in mathematical form. Be able to understand what is being said in mathematical expressions.
Be able to present reasoning and conclusions informed by analysis involving geometry and topology, in a variety of modes, to diverse audiences (expert and non-expert).
Ethical application of mathematical approaches to solving problems and appropriately reference and acknowledge sources in an mathematical context.
Be able to work effectively, responsibly and safely in an individual or team context.

Assessment Tasks

Name	Weighting	Due
Eight assignments	20%	TBA
One Test	20%	TBA
Final examination	60%	University Examination Period

Eight assignments

Due: **TBA**
Weighting: **20%**

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
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- Ethical application of mathematical approaches to solving problems and appropriately reference and acknowledge sources in an mathematical context.
- Be able to work effectively, responsibly and safely in an individual or team context.

One Test

Due: **TBA**
Weighting: **20%**

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
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- Be able to present reasoning and conclusions informed by analysis involving geometry and topology, in a variety of modes, to diverse audiences (expert and non-expert).

Final examination

Due: **University Examination Period**
Weighting: **60%**

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
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arguments incorporating deductive reasoning. In particular, the ability to use axioms and definitions correctly within an argument.

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- Be able to apply the principles, concepts, and techniques learned in this unit to solve practical and abstract problems.
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Delivery and Resources

Classes

Lectures: you should attend two hours of each lecture stream each week, making a total of four hours.

Required and Recommended Texts and/or Materials

The required text for MATH300 is available for download on

- *MATH300 Geometry and Topology* by C. Cooper

You should download and study these.

The online notes are intended primarily as a source of reference. These are not intended to be treated as the only source for learning.

ADDITIONAL NOTES

- Notes on knots. The part that is relevant to us begins on Page 3 with "The next invariant we will discuss is the Conway polynomial."
- Worked example of calculating the Alexander polynomial.
- Notes on modules.
- Notes on surfaces, with nice pictures — compiled by N. Hitchen at Univ. of Oxford.

Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and Adobe Reader software. Several areas of the university provide wireless access for portable computers. There are computers for student use in the Library and in the Numeracy Centre (C5A 255).

Difficulties with your home computer or internet connection do not constitute a reasonable excuse for lateness of, or failure to submit, assessment tasks.

Unit Schedule

WEEK	GEOMETRY	TOPOLOGY
1	Rigid motions in the plane	Topological spaces
2	Linear algebra	Surfaces
3	Affine Geometry	Surfaces and Surgery
4		Characterising Surfaces
5	Projective Geometry	Graphs on Surfaces
6		Graphs and Map Colouring
	Recess	Recess
7	Projective Geometry	Graphs and Map Colouring
8		Knots and Links
9	Conic sections	The Alexander Number of a Knot
10		The Alexander Group of a Knot
11	Ruler and Compass Constructions	The Alexander Module
12		Th Alexander Polynomial
13	Revision	

Learning and Teaching Activities

Lectures

Attend 4 hours of lectures per week. Two in geometry, two in topology

Assignments

Write solutions to 8 assignments

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcomes

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
- Present a broad outline of the scope of topology and geometry in two dimensions, their roles in other fields, and the way other fields contribute to their development.
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- Be able to apply the principles, concepts, and techniques learned in this unit to solve practical and abstract problems.
- Be able to present reasoning and conclusions informed by analysis involving geometry and topology, in a variety of modes, to diverse audiences (expert and non-expert).

Assessment task

- Eight assignments

Learning and teaching activity

- Write solutions to 8 assignments

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to

handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Demonstrate the ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning. In particular, the ability to use axioms and definitions correctly within an argument.
- Be able to present reasoning and conclusions informed by analysis involving geometry and topology, in a variety of modes, to diverse audiences (expert and non-expert).
- Ethical application of mathematical approaches to solving problems and appropriately reference and acknowledge sources in an mathematical context.
- Be able to work effectively, responsibly and safely in an individual or team context.

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
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Assessment tasks

- Eight assignments
- One Test
- Final examination

Learning and teaching activities

- Attend 4 hours of lectures per week. Two in geometry, two in topology
- Write solutions to 8 assignments

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
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Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
- Present a broad outline of the scope of topology and geometry in two dimensions, their roles in other fields, and the way other fields contribute to their development.
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Learning and teaching activities

- Attend 4 hours of lectures per week. Two in geometry, two in topology
- Write solutions to 8 assignments

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms

effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Demonstrate knowledge of the principles and concepts of elementary topology and Euclidean, affine, and projective geometry in the plane.
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Assessment tasks

- Eight assignments
- Final examination

Learning and teaching activities

- Write solutions to 8 assignments

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcomes

- Ethical application of mathematical approaches to solving problems and appropriately reference and acknowledge sources in an mathematical context.
- Be able to work effectively, responsibly and safely in an individual or team context.

Assessment task

- Eight assignments

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Ethical application of mathematical approaches to solving problems and appropriately reference and acknowledge sources in an mathematical context.
- Be able to work effectively, responsibly and safely in an individual or team context.

Extra Requirements

Satisfactory performance on supervised assessment tasks, such as tests and the final exam, is necessary to pass this unit. If there is a significant difference between a student's marks on supervised assessment tasks and on unsupervised assessment tasks, the scaling of these tasks may be adjusted when determining the final grade, to reflect more appropriately that student's performance on supervised tasks.