MATH3900

Geometry and Topology

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

Contents

General Information

Unit convenor and teaching staff
Frank Valckenborgh
frank.valckenborgh@mq.edu.au

Ross Moore
ross.moore@mq.edu.au

Credit points
10

Prerequisites
130cp including MATH2010 or 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.

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:

> **ULO1:** Formulate and model practical and abstract problems in mathematical terms using methods from geometry and topology
>
> **ULO2:** Apply concepts and techniques of geometry and topology to practical and abstract problems
>
> **ULO3:** Use axioms and definitions correctly within a mathematical argument
>
> **ULO4:** Apply the mathematical notions of invariant and isomorphism in order to discriminate and classify geometric objects

General Assessment Information

General Faculty Policy on assessment submission deadlines and late submissions:

Online quizzes, in-class activities, or scheduled tests and exam must be undertaken at the time indicated in the unit guide. Should these activities be missed due to illness or misadventure, students may apply for Special Consideration.

All other assessments must be submitted by 5:00 pm on their due date.

Should these assessments be missed due to illness or misadventure, students should apply for Special Consideration.

Assessments not submitted by the due date will receive a mark of zero **unless** late submissions are specifically allowed as indicated in the unit guide or on iLearn.

If late submissions are permitted as indicated in the unit guide or on iLearn a consistent penalty will be applied for late submissions as follows:

A 12-hour grace period will be given after which the following deductions will be applied to the awarded assessment mark: 12 to 24 hours late = 10% deduction; for each day thereafter, an additional 10% per day or part thereof will be applied until five days beyond the due date. After this time, a mark of zero (0) will be given. For example, an assessment worth 20% is due 5 pm on 1 January. Student A submits the assessment at 1 pm, 3 January. The assessment received a mark of 15/20. A 20% deduction is then applied to the mark of 15, resulting in the loss of three (3) marks. Student A is then awarded a final mark of 12/20.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	15%	No	Week 6
Class Test	15%	No	Week 8
Assignment 2	15%	No	Week 11
Final Exam	55%	No	Formal University Examination Period

Assignment 1

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 5 hours
Due: **Week 6**
Weighting: **15%**

The assignments will include questions from both the topology and the geometry component of the unit.

On successful completion you will be able to:

- Formulate and model practical and abstract problems in mathematical terms using methods from geometry and topology
- Apply concepts and techniques of geometry and topology to practical and abstract problems
- Use axioms and definitions correctly within a mathematical argument
- Apply the mathematical notions of invariant and isomorphism in order to discriminate and classify geometric objects

Class Test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 6 hours
Due: **Week 8**
Weighting: **15%**

This will be an invigilated test held in class and cover both the geometry and the topology components of the unit.

On successful completion you will be able to:

- Formulate and model practical and abstract problems in mathematical terms using methods from geometry and topology
- Apply concepts and techniques of geometry and topology to practical and abstract problems
- Use axioms and definitions correctly within a mathematical argument
- Apply the mathematical notions of invariant and isomorphism in order to discriminate and classify geometric objects

Assignment 2

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 5 hours
Due: **Week 11**
Weighting: **15%**

The assignments will include questions from both the topology and the geometry component of the unit.

On successful completion you will be able to:

- Formulate and model practical and abstract problems in mathematical terms using methods from geometry and topology
- Apply concepts and techniques of geometry and topology to practical and abstract problems
- Use axioms and definitions correctly within a mathematical argument
- Apply the mathematical notions of invariant and isomorphism in order to discriminate and classify geometric objects

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 12 hours
Due: **Formal University Examination Period**
Weighting: **55%**

This will be an invigilated exam that covers all aspects of the unit

On successful completion you will be able to:

- Formulate and model practical and abstract problems in mathematical terms using methods from geometry and topology
- Apply concepts and techniques of geometry and topology to practical and abstract problems
- Use axioms and definitions correctly within a mathematical argument
- Apply the mathematical notions of invariant and isomorphism in order to discriminate and classify geometric objects

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

Important message to off-shore students

Offshore students **must** email the convenor as soon as possible to discuss study options.

Classes

We have two hours of lectures and one hour of SGTA per week.

Lectures: you should attend the two-hour lecture each week.

SGTA: you should attend one one-hour SGTA each week (starting in week 1).

Required and Recommended Texts and/or Materials

Additional notes will be attached to the course's iLearn page. Also recommended for the course is the following online texts:

The Four Pillars of Geometry by John Stillwell

Chris Cooper's Note on Geometry at https://coopersnotes.net/third_geometry.html

Chris Cooper's Note on Topology at https://coopersnotes.net/third_topology.html

Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and Adobe Reader software. There are computers for student use in the Library and MUSE.

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 1: Geometry: Euclidean geometry in the complex plane

Week 2: Topology: Topological spaces

Week 3: Geometry: Affine functions

Week 4: Topology: Surfaces and Surgery

Week 5: Geometry: Affine geometry

Week 6: Topology: Graphs on Surfaces, Graphs and Map Colouring

Week 7: Geometry: Projective geometry

Week 8: Topology: Knots and Links

Week 9: Geometry: Projective geometry; Test online

Week 10: Topology: The Alexander number of a Knot, The Alexander Group of a Knot

Week 11: Geometry: Constructions in geometry and number fields

Week 12: Topology: The Alexander Module, The Alexander Polynomial

Week 13: Revisions

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

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

The Writing Centre

The Writing Centre provides resources to develop your English language proficiency, academic writing, and communication skills.

- Workshops
- Chat with a WriteWISE peer writing leader
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues

Student Enquiries

Got a question? Ask us via AskMQ, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

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