MATH7906

Research Topics in Mathematics 3

Session 2, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

Contents

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General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites
Admission to MRes

Corequisites

Co-badged status

Unit description
This unit is based on an area of current mathematical research. The specific area may vary from year to year depending on the interests of the students and lecturer.

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: Demonstrate advanced disciplinary knowledge and skills in a particular area of mathematics.

ULO2: Apply advanced mathematical skills to related areas of mathematics or other disciplines.

ULO3: Use abstract mathematical frameworks to synthesize diverse examples or phenomena from within a particular area of mathematics.

ULO4: Communicate effectively the results of advanced mathematical reasoning.

General Assessment Information

Late Assessment Submission Penalty

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following late penalty applied. Please see https://students.mq.edu.au/study/assessment-exams/assessments for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at 11:55 pm. A 1-hour grace period is provided to students who experience a technical concern.

Assessments where Late Submissions will be accepted In this unit, late submissions will accepted as follows:

- Assignment 1 – YES, Standard Late Penalty applies
- Assignment 2 – YES, Standard Late Penalty applies
- Assignment 3 – YES, Standard Late Penalty applies
- Assignment 4 – YES, Standard Late Penalty applies

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 4	25%	No	Week 13
Assignment 3	25%	No	Week 11
Assignment 1	25%	No	Week 5
Assignment 2	25%	No	Week 8

Assignment 4

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 10 hours
Due: **Week 13**
Weighting: **25%**

The assignments reinforce and build on material from lectures, as well as leading students towards more advanced topics. They are designed to promote a more independent style of learning than in standard undergraduate units.

On successful completion you will be able to:
- Demonstrate advanced disciplinary knowledge and skills in a particular area of

mathematics.

- Apply advanced mathematical skills to related areas of mathematics or other disciplines.

- Use abstract mathematical frameworks to synthesize diverse examples or phenomena from within a particular area of mathematics.

- Communicate effectively the results of advanced mathematical reasoning.

Assignment 3

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 10 hours
Due: **Week 11**
Weighting: **25%**

The assignments reinforce and build on material from lectures, as well as leading students towards more advanced topics. They are designed to promote a more independent style of learning than in standard undergraduate units.

On successful completion you will be able to:

- Demonstrate advanced disciplinary knowledge and skills in a particular area of mathematics.

- Apply advanced mathematical skills to related areas of mathematics or other disciplines.

- Use abstract mathematical frameworks to synthesize diverse examples or phenomena from within a particular area of mathematics.

- Communicate effectively the results of advanced mathematical reasoning.

Assignment 1

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 10 hours
Due: **Week 5**
Weighting: **25%**

The assignments reinforce and build on material from lectures, as well as leading students towards more advanced topics. They are designed to promote a more independent style of learning than in standard undergraduate units.

On successful completion you will be able to:

- Demonstrate advanced disciplinary knowledge and skills in a particular area of mathematics.
- Apply advanced mathematical skills to related areas of mathematics or other disciplines.
- Use abstract mathematical frameworks to synthesize diverse examples or phenomena from within a particular area of mathematics.
- Communicate effectively the results of advanced mathematical reasoning.

Assignment 2

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 10 hours
Due: **Week 8**
Weighting: **25%**

The assignments reinforce and build on material from lectures, as well as leading students towards more advanced topics. They are designed to promote a more independent style of learning than in standard undergraduate units.

On successful completion you will be able to:

- Demonstrate advanced disciplinary knowledge and skills in a particular area of mathematics.
- Apply advanced mathematical skills to related areas of mathematics or other disciplines.
- Use abstract mathematical frameworks to synthesize diverse examples or phenomena from within a particular area of mathematics.
- Communicate effectively the results of advanced mathematical reasoning.

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[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

Classes

Lectures: lectures will be delivered as pre-recorded videos, made available via iLearn. In total

you are expected to spend two hours each week reviewing lecture videos and accompanying notes.

Small Group Teaching Activities (SGTA): there will be one two-hour SGTA class on campus every week, in which we will meet together, go through homework problems made available via iLearn, and discuss through the important concepts from that week's lecture material.

Recommended Texts

The lecture material is designed to be self-contained, but the two recommended texts are:

- Tom Leinster, Basic Category Theory
- Steve Awodey, Category Theory

Unit Schedule

WEEK	TOPIC	ASSESSMENT DUE
1	Categories: definition and examples.	
2	Constructions on categories. Types of morphisms in categories.	
3	Initial and terminal objects; products and coproducts.	
4	Functors; the category of categories. Examples of functors.	
5	Limits. Examples of limits.	Assignment 1
6	Completeness of Set. Completeness in other categories.	
7	Natural transformations. Functor categories. Equivalences of categories.	
	RECESS	
8	Free and cofree constructions. Examples.	Assignment 2
9	Adjunctions. Transpose notation. Examples of adjunctions.	
10	Adjunctions versus free constructions. Right adjoints preserve limits.	
11	Presheaves and hom-functors.	Assignment 3
12	Representations and the Yoneda lemma.	
13		Assignment 4

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.