# MATH337

## Algebra IIIA

S1 Day 2019

*Dept of Mathematics and Statistics*

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# General Information

Unit convenor and teaching staff
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Email for an appointment

Lecturer
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Tuesdays 11:00–1:00pm, 3:00–5:00pm

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Credit points
3

Prerequisites
(39cp at 100 level or above) including MATH235

Corequisites
MATH300 or MATH331 or MATH335

Co-badged status

Unit description
This unit develops the basic ideas of modern abstract algebra by concentrating on the many facets of group theory. As well as the standard material leading to the isomorphism theorems, we cover combinatorial aspects such as presentations of groups, the Todd–Coxeter algorithm, and subgroups of free groups via groupoids. Also studied are permutation groups, finitely generated abelian groups, soluble groups and group representations. The unit is especially suitable for students majoring in the theoretical aspects of physics or computing science.

## 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 a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.

Demonstrate a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical arguments.

Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience

Engage in mathematical work in a manner consistent with professional and ethical standards.

# General Assessment Information

**HURDLES**: This unit has no hurdle requirements. Students should aim to get at least 60% for the course work in order to be reasonably confident of passing the unit.

**LATE SUBMISSION OF WORK:** All assignments and assessment tasks must be submitted by the official due date and time. No marks will be given for late work unless an extension has been granted following a successful application for Special Consideration. Please contact the unit convenor for advice as soon as you become aware that you may have difficulty meeting any of the assignment deadlines.

**FINAL EXAM POLICY:** You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via ask.mq.edu.au.

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
|---|---|---|---|
| 2 Assignments | 30% | No | see iLearn |
| Project | 20% | No | see iLearn |
| Final examination | 50% | No | University examination period |

## 2 Assignments

Due: **see iLearn**
Weighting: **30%**

Two homework assignments

On successful completion you will be able to:

- Demonstrate a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.
- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience
- Engage in mathematical work in a manner consistent with professional and ethical standards.

## Project

Due: **see iLearn**
Weighting: **20%**

A substantial piece of individual work, requiring the integration of a broad range of mathematical ideas developed in this and preceding units.

A key component of this task is the demonstration of the skills developed to communicate mathematical ideas in a manner appropriate to the intended audience.

On successful completion you will be able to:

- Demonstrate a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.
- Demonstrate a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical

arguments.

- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience
- Engage in mathematical work in a manner consistent with professional and ethical standards.

## Final examination

Due: **University examination period**
Weighting: **50%**

Examination

On successful completion you will be able to:

- Demonstrate a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.
- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience

# Delivery and Resources

**Text:**

The recommended text for this course is Chris Cooper's "Groups, presentations and representations". This will be made available via iLearn.

# Unit Schedule

| | | | | |
|---|---|---|---|---|
| | 25/02/2019 | Introduction | Permutations | |
| | 04/03/2019 | Examples | | |
| | 11/03/2019 | Theory, 1 | The Todd-Coxeter algorithm | |
| | 18/03/2019 | Theory, 2 | | |
| | 25/03/2019 | | Groups acting on sets: Sylow subgroups | |
| | 01/04/2019 | Representations | | |
| | 08/04/2019 | | Free groups | |

| | | | | |
|---|---|---|---|---|
| | 29/04/2019 | Representations, (cont'd) | | |
| | 06/05/2019 | | Finitely generated abelian groups | |
| | 13/05/2019 | | | |
| | 20/05/2019 | Solvable groups | Infinite abelian groups | |
| | 27/05/2019 | | | |
| | 03/06/2019 | **Revision** | | |

Links in the above table are to files available via the MATH337 iLearn site.

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). 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
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

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

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/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

## 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

If you are a Global MBA student contact globalmba.support@mq.edu.au

## 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.

# 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 a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.
- Demonstrate a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical arguments.
- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience

## Assessment task

- Project

# 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 a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical arguments.
- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience
- Engage in mathematical work in a manner consistent with professional and ethical standards.

## Assessment tasks

- 2 Assignments
- Project

# Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally

and socially.

This graduate capability is supported by:

### Learning outcome

- Engage in mathematical work in a manner consistent with professional and ethical standards.

## 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 a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.
- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience

### Assessment tasks

- 2 Assignments
- Project
- Final examination

## 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 a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical

areas to develop a sophisticated understanding of group theory.

- Demonstrate a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical arguments.

## Assessment tasks

- 2 Assignments
- Project
- Final examination

# 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 a well developed knowledge of algebraic principles, concepts and techniques. Integrate and synthesise knowledge from multiple and diverse mathematical areas to develop a sophisticated understanding of group theory.
- Demonstrate a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical arguments.

## Assessment tasks

- 2 Assignments
- Project
- Final examination

# 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 a capacity to apply knowledge to an structured, authentic problem in group theory; with evidence of sustained logic, and clearly presented and justified mathematical arguments.
- Present mathematical ideas, arguments and findings in a professional manner appropriate to the intended audience

### Assessment tasks

- 2 Assignments
- Project
- Final examination

## 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 outcome

- Engage in mathematical work in a manner consistent with professional and ethical standards.

### Assessment task

- Project

## 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 outcome

- Engage in mathematical work in a manner consistent with professional and ethical standards.