# MATH3907

## Algebra IIIA

Session 1, 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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see iLearn

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Credit points
10

Prerequisites
130cp including (MATH2010 or MATH235)

Corequisites
MATH3900 or MATH3901 or MATH3905 or 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 and its applications. Groups are used to describe symmetries of
physical and mathematical objects. The course begins by introducing their basic theory,
including generators and relations, Lagrange's theorem, and quotient groups. These ideas are
applied to topics such as geometry and the possibility or impossibility of solving polynomial
equations.

## 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 a well-developed knowledge of algebraic principles, concepts and calculation techniques as occur within Group Theory.

**ULO2:** Apply relevant knowledge to problems in group theory and other fields in which group theory is used; through sustained logic, with clearly presented and justified mathematical arguments.

**ULO3:** Synthesize multiple ideas and techniques of group theory in order to solve a larger scale problem.

**ULO4:** Present mathematical ideas, arguments and findings in a professional manner as appropriate to the intended audience.

# General Assessment Information

**ASSESSMENT SUBMISSION**: Non-timed assessments, such as assignments and the project, will be submitted online through the iLearn page. Submit assessments online via the appropriate link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

- Assignment submission is via iLearn. You should upload this as a single scanned PDF file.

- Please note the quick guide on how to upload your assignments provided on the iLearn page.

- Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.

- It is your responsibility to make sure your assignment submission is legible.

- If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

**LATE SUBMISSION OF WORK**: Assignments and the project 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. If no Special Consideration is granted, the following penalties apply:

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 5pm 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.

**FINAL EXAM POLICY**: 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 this 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.

# Assessment Tasks

| Name | Weighting | Hurdle | Due |
| --- | --- | --- | --- |
| Assignment 1 | 15% | No | Week 5 |
| Assignment 2 | 15% | No | Week 11 |
| Project | 20% | No | Week 13 |
| Final Exam | 50% | No | Final Exam period |

## Assignment 1

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 12 hours
Due: **Week 5**
Weighting: **15%**

A collection of problems relevant to the material taught during weeks 1–5 of the teaching session.

On successful completion you will be able to:
- Demonstrate a well-developed knowledge of algebraic principles, concepts and

calculation techniques as occur within Group Theory.

- Apply relevant knowledge to problems in group theory and other fields in which group theory is used; through sustained logic, with clearly presented and justified mathematical arguments.
- Present mathematical ideas, arguments and findings in a professional manner as appropriate to the intended audience.

## Assignment 2

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 12 hours
Due: **Week 11**
Weighting: **15%**

A collection of problems relevant to the material taught during weeks 5–10 of the teaching session.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of algebraic principles, concepts and calculation techniques as occur within Group Theory.
- Apply relevant knowledge to problems in group theory and other fields in which group theory is used; through sustained logic, with clearly presented and justified mathematical arguments.
- Present mathematical ideas, arguments and findings in a professional manner as appropriate to the intended audience.

## Project

Assessment Type [1]: Project
Indicative Time on Task [2]: 20 hours
Due: **Week 13**
Weighting: **20%**

This project gives students the opportunity to apply the knowledge gained in the unit to a larger scale mathematical problem than the short questions typical in assignments.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of algebraic principles, concepts and calculation techniques as occur within Group Theory.
- Apply relevant knowledge to problems in group theory and other fields in which group theory is used; through sustained logic, with clearly presented and justified mathematical arguments.
- Synthesize multiple ideas and techniques of group theory in order to solve a larger scale problem.
- Present mathematical ideas, arguments and findings in a professional manner as appropriate to the intended audience.

# Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 15 hours
Due: **Final Exam period**
Weighting: **50%**

This will be an invigilated exam, held during the final exam period.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of algebraic principles, concepts and calculation techniques as occur within Group Theory.
- Apply relevant knowledge to problems in group theory and other fields in which group theory is used; through sustained logic, with clearly presented and justified mathematical arguments.
- Present mathematical ideas, arguments and findings in a professional manner as appropriate to the intended audience.

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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

**Offshore students:** Offshore students must contact the unit convenor as soon as possible to discuss study options.

**Lectures**: There are two hours of lecture content per week. The lectures will be used to introduce and discuss new content.

**Small group teaching activity**: Students should also register and participate in one one-hour SGTA class per week. Students will discuss problems related to the previous week's lecture content, and work through similar questions.

# Unit Schedule

| Week | Topic | Assessments due |
|---|---|---|
| 1 (21 Feb) | Groups: definition and examples. Permutation groups. | |
| 2 (28 Feb) | Permutation groups (cont.) Presentations of groups. Isomorphism of groups. | |
| 3 (7 Mar) | Subgroups. Cosets. | |
| 4 (14 Mar) | Lagrange's theorem. Homomorphisms. | |
| 5 (21 Mar) | Equivalence relations on groups. Quotient groups. | Assignment 1 |
| 6 (28 Mar) | Normal subgroups. Conjugacy, centralisers and centres. | |
| 7 (4 Apr) | Modular arithmetic | |
| Recess | | |
| 8 (25 Apr) | Rings and fields | |
| 9 (2 May) | Polynomials | |
| 10 (9 May) | Quotient rings | |
| 11 (16 May) | Field extensions | Assignment 2 |
| 12 (23 May) | Galois Theory | |
| 13 (30 May) | Revision, catchup | Project |

The timing of these topics is indicative, and may need to be changed. Any such changes will be communicated via iLearn.

# 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.