



# MATH132

## Mathematics IA (Advanced)

S1 Day 2018

*Dept of Mathematics*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Christopher Lustri

[christopher.lustri@mq.edu.au](mailto:christopher.lustri@mq.edu.au)

Frank Valckenborgh

[frank.valckenborgh@mq.edu.au](mailto:frank.valckenborgh@mq.edu.au)

Credit points

3

Prerequisites

(HSC Mathematics Extension 1 Band E3-E4 or Extension 2) or admission to BSc in Advanced Mathematics or BAdvSc or BActStud or BActStudBSc or BAppFinBActStud or BActStudBProfPrac

Corequisites

Co-badged status

Unit description

This is the first mainstream mathematics unit for students who have entered the university with a strong background in mathematics. It is highly recommended for students with a serious interest in science and technology, and recommended for students in many other areas who wish to develop their mathematical knowledge with attention to the detail required for a rigorous development of the subject. Apart from some brief discussion on complex numbers and congruences, the main topic in the algebra half of this unit concerns linearity and the interplay between algebra and geometry. Plane geometry is first used to motivate the study of systems of linear equations. Algebraic techniques involving matrices and determinants are then developed to study these problems further. The algebraic machinery developed is then used to study geometrical problems in three-dimensional space. The notion of a limit is developed to a more sophisticated level than in secondary school mathematics, and this is used to study the differential and integral calculus involving functions of one real variable to a far greater depth than before. Some numerical techniques for integration are also discussed. Students who do not have the required background for this unit can take MATH135 which studies the same material, but from a less sophisticated standpoint.

## 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 polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.

Present a broad outline of the scope of linear algebra and calculus, 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 limits and other infinite processes correctly.

Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using methods from calculus and linear algebra.

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 calculus and linear algebra, 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.

## General Assessment Information

**HURDLES:** Attendance at, and reasonable engagement in, tutorials in all first year mathematics units is compulsory. Participation will be assessed by tutors via rosters and observation of students' work during classes. Attendance and reasonable engagement in the class activities in, at least 10 out of 12 of the tutorial classes are requirements to pass the unit. This is a hurdle requirement.

**ATTENDANCE and PARTICIPATION:** Please contact the unit convenor as soon as possible if you have difficulty attending and participating in any classes. There may be alternatives available to make up the work. If there are circumstances that mean you miss a class, you can apply for a [disruption to study](#).

**IMPORTANT:** If you apply for Disruption to Study for your final examination, you must make yourself available for the Supplementary Examination as organised by the Faculty of Science & Engineering. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

**LATE SUBMISSION:** Late submission of assessment tasks, without an extension granted (arranged *prior* to the due date) or without an appropriate Disruption to Studies, will result in a zero being awarded for that assessment task. Additionally, assessment tasks handed in without a signed coversheet will also result in a zero for that task.

Information about the submission process of assessment tasks will be made available on iLearn.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Assignment 1</u></a>	10%	No	Week 4
<a href="#"><u>Assignment 2</u></a>	10%	No	Week 8
<a href="#"><u>Assignment 3</u></a>	10%	No	Week 12
<a href="#"><u>Mid-semester Test</u></a>	10%	No	Week 8 (Tuesday)
<a href="#"><u>Final Exam</u></a>	60%	No	Exam Period

### Assignment 1

Due: **Week 4**

Weighting: **10%**

Assignment based on all material up to this point.

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, 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 limits and other infinite processes correctly.
- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using methods from calculus and linear algebra.
- 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 calculus and linear algebra, 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.

## Assignment 2

Due: **Week 8**

Weighting: **10%**

Assignment based on all material up to this point.

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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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.

## Assignment 3

Due: **Week 12**

Weighting: **10%**

Assignment based on all material up to this point.

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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- Be able to work effectively, responsibly and safely in an individual or team context.

## Mid-semester Test

Due: **Week 8 (Tuesday)**

Weighting: **10%**

In-class one-hour test based on first six weeks of material.

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, 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 limits and other infinite processes correctly.

- Demonstrate the ability to formulate and model practical and abstract problems in mathematical terms using methods from calculus and linear algebra.
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- Be able to work effectively, responsibly and safely in an individual or team context.

## Final Exam

Due: **Exam Period**

Weighting: **60%**

Two hour final exam covering all taught material.

On successful completion you will be able to:

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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- Be able to work effectively, responsibly and safely in an individual or team context.

## Delivery and Resources

### Classes

**Lectures:** You should attend all four lectures each week, making a total of four hours.

**Tutorials:** You must attend and participate in at least 10 of the 12 weekly tutorial classes to pass this unit.

### Required and Recommended Texts and/or Materials

The following texts are recommended for this unit, and are available from the CO-OP Bookshop on campus, and are in the reference section of the Library.

- Stewart; *Calculus*
- Anton: *Linear Algebra and its Applications*

### Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and .pdf reader software. Several areas of the university provide wireless access for portable computers, and access to internet-enabled computers.

**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

	Topics Covered
Week 1	<b>Complex numbers:</b> definitions, basic operations, equations with complex roots, modulus-argument form, De Moivre theorem, regions in the complex plane.
Week 2	<b>Polynomials:</b> remainder theorem, factor theorem, rational roots, multiple roots, complex roots, relation between roots and coefficients.
Week 3	<b>Linear equations:</b> solving systems of linear equations, applications.
Week 4	<b>Matrices:</b> Matrices and basic properties, applications.
Week 5	<b>Determinants:</b> definition and basic properties, applications.
Week 6	<b>Vectors:</b> Vectors in 2 and 3 dimensions, inner product, cross product
Week 7	<b>Number systems:</b> The real numbers, induction.
	Mid-semester break



Week 8	<b>Mid-term test</b> <b>Limits:</b> Limit of sequences, functions.
Week 9	<b>Derivatives:</b> Continuity, derivatives, properties.
Week 10	<b>Derivatives:</b> Differentials, mean-value theorem.
Week 11	<b>Integration:</b> Antiderivatives, integrals.
Week 12	<b>Integration:</b> Fundamental theorem of calculus, applications.
Week 13	<b>Revision</b>

## Learning and Teaching Activities

### Lectures

There will be four one hour lectures per week. During these the content of the unit will be explained and example problems will be solved and applications in other disciplines discussed.

### Tutorial

There is a one-hour tutorial class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central\)](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) (<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](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://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 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](http://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](http://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](http://ask.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/](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 knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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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.

### Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Mid-semester Test
- Final Exam

## 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 knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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## 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 outcomes

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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## 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 polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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- Ethical application of mathematical approaches to solving problems and appropriately reference and acknowledge sources in an mathematical context.
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## 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 polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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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 polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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### Assessment tasks

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- Assignment 2
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## 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 polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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## 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

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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## 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

- Demonstrate knowledge of the principles and concepts of polynomial algebra, linear algebra, and calculus in one variable. Be competent with the rigour required in elementary real analysis.
- Present a broad outline of the scope of linear algebra and calculus, their roles in other fields, and the way other fields contribute to their development.
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- Assignment 1
- Assignment 2
- Assignment 3
- Mid-semester Test
- Final Exam