MATH132

Mathematics IA (Advanced)

S1 Day 2016

Dept of Mathematics

Contents

General Information

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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

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.

Assessment Tasks

Name	Weighting	Due
Five assignments	20%	See ilearn.
Two Tests	20%	See ilearn.
Final examination	60%	University Examination Period

Five assignments

Due: **See ilearn.**
Weighting: **20%**

See announcements in ilearn for the assignment exercises.

On successful completion you will be able to:

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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.

Two Tests

Due: **See ilearn.**
Weighting: **20%**

Tests will be held in tutorials.

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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- 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).

Final examination

Due: **University Examination Period**
Weighting: **60%**

Supervised by Academic Programme Section.

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.
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Delivery and Resources

Classes

Lectures: you should attend two hours of each lecture stream each week, making a total of four hours.

Tutorials: you should attend one tutorial each week.

Required and Recommended Texts and/or Materials

The required text for MATH132 is available for download on

- *First Year Calculus* by W.W.L Chen
- *Linear Algebra* by W.W.L Chen
- *Miscellaneous Topics in First Year Mathematics* by W.W.L Chen

You should download and study these.

The online notes are intended primarily as a source of reference. These are not intended to be treated as the only source for learning.

The same material is covered in many texts. You should try several of these, adopting one which suits your personal style of learning.

More notes on elementary topics are available at:

- *Elementary Mathematics* by W.W.L Chen

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*

Other similar texts are available in the Library, and for reference in the Numeracy Centre (C5A 225).

Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and Adobe Reader software. Several areas of the university provide wireless access for portable computers. There are computers for student use in the Library and in the Numeracy Centre (C5A 255).

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	Algebra	Calculus
1	Complex numbers: definitions, basic operations, equations with complex roots	The real numbers.
2	Complex numbers: modulus-argument form, De Moivre theorem, locus and regions in the complex plane	Mathematical Induction.
3	Polynomials: remainder theorem, factor theorem, rational roots	Limit of sequence, Functions
4	Polynomials: multiple roots, complex roots, relation between roots and coefficients	Limit of functions
5	Linear equations, solving systems of linear equations	Continuity, derivative
6	Applications of network flow, electrical networks, economics and chemistry	Properties of derivative
	recess	recess
7	Matrices and basic properties	Differential
8	Applications of matrices	Mean value theorem
9	Determinants: definition and basic properties	Antiderivative
10	Applications of determinants	Integration
11	Vectors in 2 and 3 dimensions, inner product, cross product	Fundamental theorem of calculus
12	Applications of vectors	Applications of definite integrals
13	Revision	Revision

Learning and Teaching Activities

Lectures

4 hours of lectures per week, 2 in algebra, 2 in calculus.

Tutorial

One hour of tutorial per week.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of 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/support/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.

Student Support

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

dents.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

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 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.
- 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.

Assessment tasks

- Five assignments
- Final examination

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 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.
- 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.

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.
- 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.

Assessment tasks

- Five assignments
- Two Tests
- 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 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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- Two Tests
- 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 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.
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Assessment tasks

- Five assignments
- Two Tests
- 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

- 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.
- 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).

Assessment tasks

- Five assignments
- Two Tests

- 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 outcomes

- 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 task

- Five assignments

Extra Requirements

Satisfactory performance on supervised assessment tasks, such as tests and the final exam, is necessary to pass this unit. If there is a significant difference between a student's marks on supervised assessment tasks and on unsupervised assessment tasks, the scaling of these tasks may be adjusted when determining the final grade, to reflect more appropriately that student's performance on supervised tasks.

Changes since First Published

Date	Description
02/03/2016	Corrected broken links to William Chen's notes