MATH136

Mathematics IB

S1 Evening 2014

Mathematics

Contents

General Information	2
Learning Outcomes	2
Assessment Tasks	3
Delivery and Resources	5
Unit Schedule	6
Learning and Teaching Activities	7
Policies and Procedures	7
Graduate Capabilities	8
Extra requirements	11

General Information

Unit convenor and teaching staff
Unit Convenor
Gerry Myerson
gerry.myerson@mq.edu.au
Contact via gerry.myerson@mq.edu.au

Other Staff
Rishni Ratnam
rishni.ratnam@mq.edu.au
Contact via rishni.ratnam@mq.edu.au

Credit points
3

Prerequisites
MATH132 or MATH135

Corequisites

Co-badged status

Unit description
The notion of linearity first introduced in MATH135 is developed through the introduction of the abstract notion of vector spaces. The new ideas are then used to further study systems of linear equations. The unit also covers an introduction to group theory, one of the most fundamental concepts in modern mathematics. The study of differential and integral calculus is taken further by the introduction of functions of two real variables and the study of first-order and second-order ordinary differential equations. The notion of a limit is enhanced by the study of sequences and series. Ideas from power series are then used to revisit differential 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:

demonstrate a well-developed knowledge of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces

and diagonalization, discrete dynamical systems, and applications of orthogonality.
apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
construct sustained logical, clearly presented and justified mathematical arguments.

Assessment Tasks

Name	Weighting	Due
Five assignments	15%	See unit website
Two Tests	25%	See unit website
Five online quizzes	0%	See unit website
Final examination	60%	University Examination Period

Five assignments

Due: **See unit website**
Weighting: **15%**

On successful completion you will be able to:

- demonstrate a well-developed knowledge of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Two Tests

Due: **See unit website**
Weighting: **25%**

On successful completion you will be able to:

- demonstrate a well-developed knowledge of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Five online quizzes

Due: **See unit website**
Weighting: **0%**

On successful completion you will be able to:

- demonstrate a well-developed knowledge of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Final examination

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

On successful completion you will be able to:

- demonstrate a well-developed knowledge of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied

mathematics.

- construct sustained logical, clearly presented and justified mathematical arguments.

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.

Practicals: you are encouraged to attend one practical each week.

Workshops: available for students wanting to see more examples and ask further questions. Attendance is strongly recommended.

Required and Recommended Texts and/or Materials

The required texts for MATH136 are available for download:

- *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 may be available from the CO-OP Bookshop on campus, and are in the reference section of the Library.

- Stewart; *Calculus*
- Trim: *Calculus*
- Anton: *Linear Algebra and its Applications*
- David C. Lay; *Linear Algebra and its Applications,*

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

Additional notes for some of the Linear Algebra topics will be posted.

Additional notes Notes for Markov chains

http://www.sosmath.com/matrix/markov/markov.html http://aix1.uottawa.ca/~jkhoury/markov.htm Most books on linear algebra with applications will cover Markov chains. Some references have the columns summing to 1, others have the rows summing to 1 (depending on which way the state table is constructed). We will adopt the convention that the future state is on the vertical axis, so the columns sum to 1.

Orthogonality and least squares

These are covered in Chapter 6 of Lay. They are also in most texts on Linear Algebra, so you will find plenty of reference material in the Library and the Numeracy Centre.

Quadratic forms

These are in Chapter 7 of Lay, and are covered in most texts on Linear Algebra. There are also some notes starting on page 10 of http://rutherglen.science.mq.edu.au/math136S108/MATH136-Week-12.pdf.

Required and Recommended Texts and/or Materials

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	Calculus	Linear Algebra [subject to change in view of possible NTEU strike Week 2]
1	Functions of two real variables	Vector spaces
2		
3		Vector spaces associated to a matrix
4		
5	First order differential equations	Eigenspaces, diagonalization
6		
	Mid-Session Break	
7	Second order differential equations	Linear systems of differential equations

8		Discrete dynamical systems
9		
10		Orthogonal projections, orthogonal matrices
11	Sequences and series	Least squares linear approximation
12		Quadratic forms
13	Revision	

Learning and Teaching Activities

Lectures

Two two-hour lectures per week, in two streams.

Tutorials

One one-hour tutorial per week.

Practicals

One one-hour practical 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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy http://mq.edu.au/policy/docs/grading/policy.html

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

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.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/

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

IT Help

For help with University computer systems and technology, visit http://informatics.mq.edu.au/help/.

When using the University's IT, you must adhere to the Acceptable Use Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

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 functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Assessment tasks

- Five assignments
- Two Tests
- Five online quizzes
- 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 functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Assessment tasks

- Five assignments

- Two Tests
- Five online quizzes
- 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 functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Assessment tasks

- Five assignments
- Two Tests
- Five online quizzes
- Final examination

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 functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.

- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

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

- demonstrate a well-developed knowledge of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and applications of orthogonality.
- apply the principles, concepts and techniques of functions of two real variables, first and second order differential equations, sequences and series, vector spaces, eigenspaces and diagonalization, discrete dynamical systems, and orthogonality efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- construct sustained logical, clearly presented and justified mathematical arguments.

Assessment tasks

- Five assignments
- Two Tests
- Final examination

Extra requirements

In order to obtain a passing grade in this unit, students are required to demonstrate their mastery of the required basic skills and techniques by passing all five on-line quizzes. Students who do

not meet this requirement will have their grade capped at F 49.

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.

Students are expected to do satisfactory work in both the Calculus and the Linear Algebra stream in order to pass Math 136.