



MATH235

Mathematics IIA

E2 2012

Mathematics

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General Information

Unit convenor and teaching staff

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Unit Convenor

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Credit points

3

Prerequisites

MATH136(P) or MATH133(P)

Corequisites

Co-badged status

Unit description

The idea of a vector space first introduced in MATH136 Mathematics IB and MATH133 Mathematics IB (Advanced) is now enriched by the introduction of an inner product. This leads to the important notion of orthogonality that underpins many areas of mathematics. The idea of linear transformations which transfer linearity from one space to another is also discussed. The results and techniques are then applied to problems such as approximation, quadratic forms and Fourier series. Differential and integral calculus involving functions of several real variables are discussed in greater depth than in MATH136 and MATH133. The ideas here are central to the development of mathematics in many different directions.

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:

Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.

Understanding logical arguments and recognising any gaps or faults in such arguments.
Expressing yourself clearly and logically in writing.

Assessment Tasks

Name	Weighting	Due
Exam	60%	Exam period
5 Assignments	20%	weeks 4, 6, 8, 10, and 12
One Test	20%	Week 7

Exam

Due: **Exam period**

Weighting: **60%**

On successful completion you will be able to:

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

5 Assignments

Due: **weeks 4, 6, 8, 10, and 12**

Weighting: **20%**

Due in weeks 4, 6, 8, 10, and 12.

On successful completion you will be able to:

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

One Test

Due: **Week 7**

Weighting: **20%**

To be held in week 7.

On successful completion you will be able to:

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

Delivery and Resources

The required text for MATH235 is available for download on

- Multivariable and Vector Analysis by W.W.L Chen
- Linear Algebra 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 following texts provide useful references for various sections of the course:

- Anton & Rorres; Elementary Linear Algebra: Applications version, 9th edition
- Lay; Linear Algebra and its Applications, 3rd edition
- Marsden & Tromba; Vector Calculus, 5th edition

Other similar texts are available in the Library.

Unit Schedule

Week	Algebra	Calculus
1	Complex linear algebra	Sets and functions. Euclidean spaces.
2	transformations in Euclidean spaces	Continuity and limits.
3	Finite-dimensional vector spaces and linear transformations	Continuity and limits.
4	Basis and dimension. Rank-nullity theorem.	Directional and partial derivatives. Derivatives.
5	Eigenvalues and eigenvectors.	Directional and partial derivatives. Derivatives.
6	Real inner product spaces.	Derivatives of vector-valued functions.
7	Gram-Schmidt orthogonalization process. Orthonal projections.	The inverse function theorem.
8	Gram-Schmidt orthogonalization process. Orthonal projections.	The implicit function theorem
9	Change of basis in inner product spaces	Critical points & extrema.
10	Orthonormal diagonalization	Lagrange multipliers.
11	Applications of real inner product spaces	Multiple integrals.
12	Complex inner product spaces	Multiple integrals: Fubini's theorem and change of variables

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://www.mq.edu.au/policy/docs/academic_honesty/policy.html

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

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

Special Consideration Policy http://www.mq.edu.au/policy/docs/special_consideration/policy.html

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

Student Support

Macquarie University provides a range of Academic Student Support Services. Details of these services can be accessed at: <http://students.mq.edu.au/support/>.

UniWISE provides:

- Online learning resources and academic skills workshops http://www.mq.edu.au/learning_skills/
- Personal assistance with your learning & study related questions.
- The Learning Help Desk is located in the Library foyer (level 2).
- Online and on-campus orientation events run by Mentors@Macquarie.

Student Services and Support

Students with a disability are encouraged to contact the [Disability Support Unit](#) who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

Details of these services can be accessed at <http://www.student.mq.edu.au/ses/>.

IT Help

If you wish to receive IT help, we would be glad to assist you at <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 and it outlines what can be done.

Graduate Capabilities

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 outcome

- Expressing yourself clearly and logically in writing.

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:

Assessment task

- 5 Assignments

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

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Understanding logical arguments and recognising any gaps or faults in such arguments.

Assessment tasks

- Exam

- 5 Assignments
- One Test

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

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

Assessment tasks

- Exam
- 5 Assignments
- One Test

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

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Expressing yourself clearly and logically in writing.

Assessment tasks

- Exam
- 5 Assignments
- One Test

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

- Solving problems, including: - formulating a precise mathematical question from a "real world" problem; - identifying and applying appropriate mathematical techniques.
- Expressing yourself clearly and logically in writing.

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 outcome

- Expressing yourself clearly and logically in writing.

Assessment tasks

- Exam
- 5 Assignments
- One Test