MATH235

Mathematics IIA

S1 Day 2016

Dept of Mathematics

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites
MATH133 or MATH136

Corequisites

Co-badged status

Unit description
The idea of a vector space first introduced in MATH136 and MATH133 is enriched in this unit 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:

Demonstrate a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
Understanding logical arguments and recognising any gaps or faults in such arguments.
Expressing yourself clearly and logically in writing.

General Assessment Information

Please note the University's Final Examination policy states:

Each student will be responsible for:

- checking the final examination timetable
- adhering to the final examination timetable
- ensuring they are available for the full duration of the final examination period.

The mathematics department cannot reschedule the final examination date to suit the travel and holiday arrangements of students.

Assessment Tasks

Name	Weighting	Due
3 Assignments	20%	See the iLearn for details
Exam	50%	Examination period
One Test	20%	Week 8
Tutorial participation	10%	weekly

3 Assignments

Due: **See the iLearn for details**
Weighting: **20%**

Assignments on Algebra and Calculus.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

Exam

Due: **Examination period**
Weighting: **50%**

Final exam

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

One Test

Due: **Week 8**
Weighting: **20%**

Supervised in class test.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

Tutorial participation

Due: **weekly**
Weighting: **10%**

Recorded tutorial attendance and marked post-tutorial questions. Only students who attend the whole tutorial session can submit post-tutorial work and receive marks for tutorial participation.

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- Understanding logical arguments and recognising any gaps or faults in such arguments.
- Expressing yourself clearly and logically in writing.

Delivery and Resources

The required textbook for the Calculus part of MATH235 is:

- Hughes-Hallett, Gleason & McCallum, 6th edition, 2013; *Calculus - Single & Multivariable;* Wiley.

It is available from the CO-OP Bookshop on campus, among other places.

Digital versions can be obtained from the publisher; see here.

Or the similar text:

- James Stewart, 6th edition, 2009; *Calculus; Thomson.*

Other similar texts are available in the Library.

The following texts provide useful references for the Algebra part of the course:

- Anton & Rorres; Elementary Linear Algebra: Applications version, 9th edition
- Lay; Linear Algebra and its Applications, 3rd edition.

Other similar texts are available in the Library.

The following online notes are a good source for additional material:

- Multivariable and Vector Analysis by W.W.L Chen
- Linear Algebra by W.W.L Chen

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

Unit Schedule

Week	Algebra	Calculus
1	Revision. Linear equations. Row reduction.	Sets and functions. Euclidean spaces.
2	Linear transformations in Euclidean spaces.	Continuity and limits.
3	Finite dimensional vector spaces. Linear transformations.	Continuity and limits.
4	Basis and dimension.	Directional and partial derivatives. Derivatives.
5	The Rank Nullity Theorem.	Derivatives of vector-valued functions.
6	Change of Basis.	Taylor's theorem.
7	Eigenvalues and eigenvectors.	Critical points & extrema.
8	Real inner product spaces.	Lagrange multipliers.
9	Gram-Schmidt orthogonalisation. Orthogonal projections.	Multiple integrals.
10	Basis transformations in inner product spaces.	Multiple integrals: Fubini's theorem and change of variables
11	Diagonalisation in inner product spaces.	The inverse function theorem.
12	Fourier Series.	The implicit function theorem
13	Revision	Revision

Learning and Teaching Activities

Lectures

4 one hour lectures per week

Tutorials

1 one hour 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://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://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 a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Understanding logical arguments and recognising any gaps or faults in such arguments.

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

- Understanding logical arguments and recognising any gaps or faults in such arguments.

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

- 3 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

- Demonstrate a well-developed knowledge of differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.

Assessment tasks

- 3 Assignments
- Exam
- One Test
- Tutorial participation

Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

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 differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Apply the learnt principles, concepts and techniques efficiently to solve practical and abstract problems across a range of areas in algebra, analysis and applied mathematics.
- Understanding logical arguments and recognising any gaps or faults in such arguments.

- Expressing yourself clearly and logically in writing.

Assessment tasks

- 3 Assignments
- Exam
- One Test
- Tutorial participation

Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

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 differential and integral calculus of functions of several real variables, real inner product vector spaces, complex vector spaces, concepts of orthogonality, linear transformations.
- Understanding logical arguments and recognising any gaps or faults in such arguments.

Assessment tasks

- 3 Assignments
- Exam
- One Test
- Tutorial participation

Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

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

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

Assessment tasks

- 3 Assignments
- Exam
- One Test

Learning and teaching activities

- 1 one hour tutorial per week

Extra requirements

Satisfactory performance on supervised assessment tasks, such as the test 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.