MATH235

Mathematics IIA

S2 Day 2019

Dept of Mathematics and Statistics

Contents

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General Information

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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

HURDLES: This unit has no hurdle requirements. This means that there are no second chance examinations and assessments if you happen to fail at your first attempt.

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 Special Consideration.

ASSIGNMENT SUBMISSION: Assignment submission will be online through the iLearn page.

Submit assignments online via the appropriate assignment link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

• Assignment submission is via iLearn. You should upload this as a single scanned PDF file.

• Please note the quick guide on how to upload your assignments provided on the iLearn page.

• Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.

• It is your responsibility to make sure your assignment submission is legible.

• If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

LATE SUBMISSION OF WORK: All assignments or assessments must be submitted by the

official due date and time. No marks will be given to late work unless an extension has been granted following a successful application for Special Consideration. Please contact the unit convenor for advice as soon as you become aware that you may have difficulty meeting any of the assignment deadlines. It is in your interests to make frequent submissions of your partially completed work. Note that later submissions completely replace any earlier submission, and so only the final submission made before the due date will be marked.

FINAL EXAM POLICY: examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via ask.mq.edu.au.

SUPPLEMENTARY EXAMINATIONS:

IMPORTANT: If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. If you apply for special consideration, you must give the supplementary examination priority over any other pre-existing commitments, as such commitments will not usually be considered an acceptable basis for a second application for special consideration. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (https://bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification sometime in the week prior to the exam with the exact date and time of their supplementary examination.

Assessment Tasks

Name	Weighting	Hurdle	Due
One Test	15%	No	Week 9
2 Assignments	40%	No	See iLearn
Exam	45%	No	Examination period

One Test

Due: **Week 9**
Weighting: **15%**

Supervised in class 1 hour 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.

2 Assignments

Due: **See iLearn**
Weighting: **40%**

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: **45%**

Final exam - Two hour (plus 10 minutes reading time)

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 texts for MATH235 are

- Anton & Rorres: Elementary Linear Algebra, Applications Version , 11th Edition, Wiley 2014
- Hughes Hallett et al : Calculus Single and Multivariable, 6th Edition, Wiley 2014

They are available from the CO-OP Bookshop on campus, among other places.

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

Unit Schedule

Week	Algebra	Calculus
1	• Systems of linear equations/row reduction • Matrix inverse • Brief introduction to linear transformations and linear operators (kernel, range)	Sets and functions. Euclidean spaces.
2	• Introduction to vector spaces	Continuity and limits.
3	• Change of basis	Continuity and limits.
4	• Linear transformations • Matrices for linear transformations	Partial derivatives.
5	• Kernel and range of linear transformation (cont'd) • Row space and column space	Partial derivatives.
6	• Eigenvalues and eigenspaces of linear transformations • Matrices of linear transformations in different bases	Differentiation.
7	• Similar matrices • Diagonalisation	Differentiation
8	• Inverse operators • Inner product • Gram-Schmidt	Taylor series.
9	• Orthogonal and symmetric matrices	Stationary points and Lagrange multipliers.
10	• Quadratic forms • Orthogonal projections	Multiple integrals.
11	• Least squares approximations • Pseudo-inverse	Multiple integrals.

12	• Singular value decomposition • Complex vector spaces	The implicit function theorem and inverse function theorem.
13	• Revision	Revision

Learning and Teaching Activities

Lectures

There are 4 one hour lectures to attend per week

Small Group Teaching Activity (SGTA)

Students should attend and participate in one SGTA per week

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). 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). 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 (https://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 published on platform other than eStudent, (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@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

If you are a Global MBA student contact globalmba.support@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.

Assessment tasks

- One Test
- 2 Assignments
- 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 outcome

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

Assessment tasks

- One Test
- 2 Assignments
- Exam

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

- One Test
- 2 Assignments
- Exam

Learning and teaching activities

- There are 4 one hour lectures to attend per week
- Students should attend and participate in one SGTA 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

- One Test
- 2 Assignments
- Exam

Learning and teaching activities

- There are 4 one hour lectures to attend per week
- Students should attend and participate in one SGTA 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

- One Test
- 2 Assignments
- Exam

Learning and teaching activities

- There are 4 one hour lectures to attend per week
- Students should attend and participate in one SGTA 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

- One Test
- 2 Assignments
- Exam

Learning and teaching activities

- Students should attend and participate in one SGTA per week