



# MATH235

## Mathematics IIA

S1 Day 2019

*Dept of Mathematics and Statistics*

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### Disclaimer

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## General Information

Unit convenor and teaching staff

Unit Convenor & Lecturer

Elena Vynogradova

[elena.vynogradova@mq.edu.au](mailto:elena.vynogradova@mq.edu.au)

Contact via Email

12 Wally's Walk Office 709

Email for an appointment

Lecturer

Vladimir Gaitsgory

[vladimir.gaitsgory@mq.edu.au](mailto:vladimir.gaitsgory@mq.edu.au)

Contact via Email

12 Wally's Walk Office 7.38

Email for an appointment

Frank Schoenig

[frank.schoenig@mq.edu.au](mailto:frank.schoenig@mq.edu.au)

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.

**LATE SUBMISSION OF WORK:** All assignments and assessment tasks must be submitted by the official due date and time. No marks will be given for 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.

**FINAL EXAM POLICY:** You are advised that it is Macquarie University policy not to set early 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](https://ask.mq.edu.au).

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. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. 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 ([bit.ly/FSESupp](https://bit.ly/FSESupp)) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

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

## Assessment Tasks

Name	Weighting	Hurdle	Due
<u>2 Assignments</u>	40%	No	See the iLearn for details
<u>One Test</u>	15%	No	Week 9
<u>Exam</u>	45%	No	Examination period

### 2 Assignments

Due: **See the iLearn for details**

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.

### 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.

## Exam

Due: **Examination period**

Weighting: **45%**

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.

## 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	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

### SGTA

1 one hour 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) (<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) (<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) (<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](http://ask.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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](http://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](http://ask.mq.edu.au)

If you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto: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/](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**

- 2 Assignments
- One Test
- 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**

- 2 Assignments
- One Test
- 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

- 2 Assignments
- One Test
- Exam

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour 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

- 2 Assignments
- One Test
- Exam

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour 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

- 2 Assignments
- One Test
- Exam

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour 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

- 2 Assignments
- One Test
- Exam

## Learning and teaching activities

- 1 one hour SGTA per week

## Changes since First Published

Date	Description
15/02/2019	The hurdle requirement of SGTA participation has been removed.