



MATH136

Mathematics IB

S1 Day 2019

Dept of Mathematics and Statistics

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Disclaimer

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

General Information

Unit convenor and teaching staff

Unit Convenor & Lecturer

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See iLearn

Lecturer

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Credit points

3

Prerequisites

MATH132 or MATH135

Corequisites

Co-badged status

Unit description

The ideas related to systems of linear equations introduced in MATH135 are further developed to study ideas related to linearity, including matrices, determinants, eigenvalues and eigenvectors and diagonalisation in Euclidean spaces. Complex numbers, polynomials and rational functions are covered in reasonable detail. The study of differential and integral calculus is taken further by the discussion of additional techniques of integration and the study of first-order and second-order ordinary differential equations, and the notion of a limit is enhanced by the study of sequences and series and their convergence. Finally, we will discuss some aspects relating to the continuity and differentiability of functions of two real variables.

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:

At the end of this unit students will be able to: Demonstrate a well-developed knowledge of the properties of matrices and the role of eigenvectors and eigenvalues in the study of linear systems.

At the end of this unit students will be able to: Demonstrate an understanding of and proficiency in the basic concepts of calculus of functions of one or more variables.

At the end of this unit students will be able to: Understand the concepts of sequences and series and their convergence, and apply a range of convergence tests.

At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.

At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

At the end of this unit students will be able to: Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.

At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

General Assessment Information

HURDLES: Attendance at, and reasonable engagement in, tutorials in all first year mathematics units is **compulsory**. Participation will be assessed by tutors via rosters and observation of students' work during classes. Attendance and reasonable engagement in the class activities in, at least 10 out of 12 of the tutorial classes are requirements to pass the unit. This is a hurdle requirement.

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 [Special Consideration](#).

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.

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) 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.

Assessment Tasks

Name	Weighting	Hurdle	Due
Test 1	20%	No	Week 5
Test 2	20%	No	Week 11
Matlab Assignment	10%	No	See ilearn
Final examination	50%	No	University Examination Period
SGTA	0%	Yes	weekly

Test 1

Due: **Week 5**

Weighting: **20%**

Test on material discussed in lectures in weeks 1-4

On successful completion you will be able to:

- At the end of this unit students will be able to: Demonstrate an understanding of and proficiency in the basic concepts of calculus of functions of one or more variables.
- At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.
- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

Test 2

Due: **Week 11**

Weighting: **20%**

Test on material discussed in lectures in weeks 5-10

On successful completion you will be able to:

- At the end of this unit students will be able to: Demonstrate a well-developed knowledge of the properties of matrices and the role of eigenvectors and eigenvalues in the study of linear systems.
- At the end of this unit students will be able to: Demonstrate an understanding of and proficiency in the basic concepts of calculus of functions of one or more variables.
- At the end of this unit students will be able to: Understand the concepts of sequences and series and their convergence, and apply a range of convergence tests.
- At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.
- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

Matlab Assignment

Due: **See ilearn**

Weighting: **10%**

Matlab Assignment

On successful completion you will be able to:

- At the end of this unit students will be able to: Demonstrate a well-developed knowledge of the properties of matrices and the role of eigenvectors and eigenvalues in the study of linear systems.
- At the end of this unit students will be able to: Demonstrate an understanding of and proficiency in the basic concepts of calculus of functions of one or more variables.
- At the end of this unit students will be able to: Understand the concepts of sequences and series and their convergence, and apply a range of convergence tests.
- At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.

- At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.
- At the end of this unit students will be able to: Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

Final examination

Due: **University Examination Period**

Weighting: **50%**

Final exam

On successful completion you will be able to:

- At the end of this unit students will be able to: Demonstrate a well-developed knowledge of the properties of matrices and the role of eigenvectors and eigenvalues in the study of linear systems.
- At the end of this unit students will be able to: Demonstrate an understanding of and proficiency in the basic concepts of calculus of functions of one or more variables.
- At the end of this unit students will be able to: Understand the concepts of sequences and series and their convergence, and apply a range of convergence tests.
- At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.
- At the end of this unit students will be able to: Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

SGTA

Due: **weekly**

Weighting: **0%**

This is a hurdle assessment task (see [assessment policy](#) for more information on hurdle assessment tasks)

Attendance at, and reasonable engagement in, Small Group Teaching Activities (SGTA) in all

first year mathematics units is compulsory.

Participation will be assessed by instructors via rosters and observation of students' work during classes.

Attendance and reasonable engagement in the class activities in, at least, 10 out of 12 of the classes are requirements to pass the unit. This is a hurdle requirement.

On successful completion you will be able to:

- At the end of this unit students will be able to: Demonstrate a well-developed knowledge of the properties of matrices and the role of eigenvectors and eigenvalues in the study of linear systems.
- At the end of this unit students will be able to: Demonstrate an understanding of and proficiency in the basic concepts of calculus of functions of one or more variables.
- At the end of this unit students will be able to: Understand the concepts of sequences and series and their convergence, and apply a range of convergence tests.
- At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.
- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

Delivery and Resources

Delivery: Day, Internal.

Classes: Students are strongly encouraged to attend all four lectures each week.

SGTA: You should attend one Small Group Teaching Activity each week. SGTA classes are compulsory. Students have to attend the class in which they are enrolled. Any variation to this has to be approved by the convenor.

This unit will use: iLearn; students need regular access to a reliable internet connection. Matlab; students need regular access to the computer program Matlab (available for download onto personally owned devices, and on computers around campus).

Textbook: Algebra - *Lay*, Linear Algebra and its Applications, 5th edition. Calculus - *Stewart*, Calculus (Metric Version), 8th edition.

Unit Schedule

Week	Algebra	Calculus
1	Matrices (Review), Vectors in \mathbb{R}^n	Limits, Improper Integrals

Week	Algebra	Calculus
2	Linear Combinations, Solutions of Linear Systems, Elementary Matrices	Indeterminate Forms, Continuity
3	Inverse Matrices	IVT, Newton's Method, Rolle's Thm, MVT
4	Triangular Matrices, LU Decomposition, Determinants	Numerical Integration, Complex Numbers
5	Determinants, Adjugates	Argand Plane, Polar Form
6	Linear dependence, Vector spaces & subspaces	De Moivre's Thm, Polynomials
7	Bases & Dimension	Factor Thm, Taylor Polynomials
8	Eigenvalues & Eigenvectors	Infinite Series
9	Eigenspaces, Diagonalisation	Functions of Several variables
10	Powers of Matrices, Linear Transformations	Partial Derivatives
11	Matrix of a Linear Transformation	Directional Derivatives, Extrema, Second Order DEs
12	Composition of Linear Transformations	Systems of DEs

Learning and Teaching Activities

Lectures

There will be four one hour lectures per week. During these the content of the unit will be explained and example problems will be solved and applications in other disciplines discussed.

SGTA

There is a one-hour SGTA class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

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](http://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central) (<http://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 outcome

- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

Assessment tasks

- Matlab Assignment
- SGTA

Learning and teaching activities

- There will be four one hour lectures per week. During these the content of the unit will be explained and example problems will be solved and applications in other disciplines discussed.
- There is a one-hour SGTA class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

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 outcomes

- At the end of this unit students will be able to: Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- At the end of this unit students will be able to: Demonstrate foundational learning skills including active engagement in their learning process.

Learning and teaching activities

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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:

Learning and teaching activities

- There is a one-hour SGTA class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

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

- At the end of this unit students will be able to: Demonstrate a well-developed knowledge of the properties of matrices and the role of eigenvectors and eigenvalues in the study of linear systems.

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Assessment tasks

- Test 1
- Test 2
- Matlab Assignment
- Final examination
- SGTA

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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

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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.

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Learning outcomes

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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

- At the end of this unit students will be able to: Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- At the end of this unit students will be able to: Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.
- At the end of this unit students will be able to: Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
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Assessment tasks

- Final examination
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Learning and teaching activities

- There is a one-hour SGTA class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.