



# MATH136

## Mathematics IB

S2 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

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Friday 10-11

Lecturer

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Tuesday 10-12

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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:** From week 2, participation in a weekly Small Group Teaching Activity (SGTA) is **compulsory**. Participation will be assessed by observation of students' work during classes and through presentation of work completed prior to the SGTA. Participation and reasonable engagement in the class activities in at least 10 out of 12 SGTA's are requirements to pass the unit. This is a hurdle requirement.

Achieving a pass grade (50%) or higher in the Matlab Assignment 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 must 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](http://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
<a href="#">SGTA Participation</a>	0%	Yes	weekly (from Wk 2)
<a href="#">Matlab Assignment</a>	10%	Yes	Week 12 10pm Thu 31 Oct
<a href="#">Test 1</a>	20%	No	Week 5 (3pm Wed 28 Aug)
<a href="#">Test 2</a>	20%	No	Week 11 (12 noon Friday 25 Oct)
<a href="#">Final examination</a>	50%	No	University Examination Period

### SGTA Participation

Due: **weekly (from Wk 2)**

Weighting: **0%**

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

Participation in a weekly Small Group Teaching Activity (SGTA) is **compulsory**. Participation will be assessed by observation of students' work during classes and through the presentation of work completed prior to the SGTA. Participation and reasonable engagement in the class activities in at least 10 out of 12 SGTA's 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.

## Matlab Assignment

Due: **Week 12 10pm Thu 31 Oct**

Weighting: **10%**

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

Matlab Assignment

Achieving a pass grade (50%) or higher in this assignment 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: 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.

## Test 1

Due: **Week 5 (3pm Wed 28 Aug)**

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 (12 noon Friday 25 Oct)**

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.

## 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.

## Delivery and Resources

### Delivery: Day, Internal.

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

**SGTA:** You should attend and participate in one Small Group Teaching Activity each week, from week 2. Students must participate in the SGTA in which they are enrolled. Any variation to this has to be approved by the convenor. **This is a hurdle requirement.**

**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
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



Week	Algebra	Calculus
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

## 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](https://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 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

- SGTA Participation
- Matlab Assignment

## 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.

## 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.
- 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.

## **Assessment tasks**

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

## **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**

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

## Assessment tasks

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

## 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

- 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.
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## Assessment tasks

- SGTA Participation
- Matlab Assignment
- Test 1

- Test 2
- Final examination

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

### Assessment tasks

- SGTA Participation
- Final examination