



# MATH136

## Mathematics IB

S2 Day 2018

*Dept of Mathematics*

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Frank Valckenborgh

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12 Wally's Walk (E7A) 613

Thursday, 10-12am

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 facility with a range of integration techniques and methods for solving ordinary differential equations.

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 8 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 a [Special Consideration](#).

**IMPORTANT:** If you apply for Special Consideration for your final examination, you must make yourself available for the Supplementary Examination as organised by the Faculty of Science & Engineering. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Assignments</u></a>	30%	No	See iLearn site
<a href="#"><u>Tutorial Homework</u></a>	20%	Yes	Weekly
<a href="#"><u>Class Test</u></a>	10%	No	See iLearn site
<a href="#"><u>Final examination</u></a>	40%	No	University Examination Period

## Assignments

Due: **See iLearn site**

Weighting: **30%**

Three assignments

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 facility with a range of integration techniques and methods for solving ordinary differential equations.
- 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.

## Tutorial Homework

Due: **Weekly**

Weighting: **20%**

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

Tutorial homework based on the previous tutorial class

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 facility with a range of integration techniques and methods for solving ordinary differential equations.
- 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.

## Class Test

Due: **See iLearn site**

Weighting: **10%**

Mid semester class test conducted in tutorials

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 facility with a range of integration techniques and methods for solving ordinary differential equations.
- 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: **40%**

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 facility with a range of integration techniques and methods for solving ordinary differential equations.
- 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

### Classes

**Lectures:** You should attend all four lectures each week, making a total of four hours.

**Tutorials:** You must attend and participate in at least 8 of the 12 weekly tutorial classes to pass this unit.

### Required and Recommended Texts and/or Materials

The required texts for MATH136 are

- Anton & Rorres: Elementary Linear Algebra, Applications Version , 11th Edition, Wiley 2014.
- Hughes-Hallet et al: Calculus Single and Multivariable, 7th Edition, Wiley 2017.

## Unit Schedule

Week	Topic
1	Complex Numbers

2	Polynomials and rational functions	
3	Partial fractions	
4	Matrices and matrix algebra	
5	Determinants, eigenvalues and eigenvectors	
6	Diagonalization and applications	
7	Linear transformations in the plane	
8	Sequences and series	
9	Power series and Taylor series	
10	Ordinary differential equations - first and second order linear equations	
11	Linear systems of differential equations	
12	Functions of several variables : limits, continuity and partial derivatives	
13	Revision	

## 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.

### Tutorials

There is a one-hour tutorial 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 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](http://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](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)

## 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.

#### Learning and teaching activities

- There is a one-hour tutorial 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.

#### Assessment tasks

- Assignments
- Tutorial Homework
- Class Test
- Final examination

## Learning and teaching activities

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

## 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 tutorial 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.
- At the end of this unit students will be able to: Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
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- 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

- Assignments
- Tutorial Homework
- Class Test
- Final examination

## 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 tutorial class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

## 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 facility with a range of integration techniques and methods for solving ordinary differential equations.
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## Assessment tasks

- Assignments
- Tutorial Homework
- Class Test
- Final examination

## 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 tutorial class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

## 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 facility with a range of integration techniques and methods for solving ordinary differential equations.
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## **Assessment tasks**

- Assignments
- Tutorial Homework
- Class Test
- Final examination

## **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 tutorial class each week. During this time students will discuss problems related to the previous week's lecture content and work through similar problems.

## **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**

- Assignments
- Tutorial Homework
- Class Test
- Final examination

## **Learning and teaching activities**

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

## **Changes from Previous Offering**

The unit content will be covered in a different order. In more detail, the theory of sequences, series and Taylor series will be introduced earlier.

## **Extra requirements**