



# MATH136

## Mathematics IB

S1 Evening 2015

*Dept of Mathematics*

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## General Information

Unit convenor and teaching staff

Unit Convenor

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E7A 203

Credit points

3

Prerequisites

MATH132 or MATH135

Corequisites

Co-badged status

Unit description

The notion of linearity first introduced in MATH135 is developed through the introduction of the abstract notion of vector spaces. The new ideas are then used to further study systems of linear equations. The study of differential and integral calculus is taken further by the introduction of functions of two real variables and the study of first-order and second-order ordinary differential equations. The notion of a limit is enhanced by the study of sequences and series. Ideas from power series are then used to revisit differential equations.

## 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:

By the end of this unit, you should 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.

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

Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables

Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.

Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.

Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

## Assessment Tasks

Name	Weighting	Due
<u>Assignments</u>	18%	See unit website
<u>Tutorial Work</u>	20%	Weekly
<u>Online quizzes</u>	7%	See unit website
<u>Class Test</u>	15%	See unit website
<u>Final examination</u>	40%	University Examination Period

## Assignments

Due: **See unit website**

Weighting: **18%**

Three assignments

On successful completion you will be able to:

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables
- Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- Express mathematical ideas clearly and logically, providing appropriate justification for

conclusions.

## Tutorial Work

Due: **Weekly**

Weighting: **20%**

Submission of selected tutorial problems

On successful completion you will be able to:

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables
- Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

## Online quizzes

Due: **See unit website**

Weighting: **7%**

Several online quizzes

On successful completion you will be able to:

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables

## Class Test

Due: **See unit website**

Weighting: **15%**

Mid semester class test conducted in tutorials

On successful completion you will be able to:

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables
- Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

## Final examination

Due: **University Examination Period**

Weighting: **40%**

Final exam

On successful completion you will be able to:

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables
- Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.

- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

## Delivery and Resources

### Classes

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

**Tutorials:** You should attend one tutorial each week.

**Practicals:** You are encouraged to attend one practical each week.

**Workshops:** The Numeracy centre provides these for students wanting to see more examples and ask further questions. Attendance is strongly recommended. Registration is not required.

### Required and Recommended Texts and/or Materials

The required texts for MATH136 are

- Anton: Elementary Linear Algebra, Applications Version , 11th Edition, Wiley 2014
- Hughes Hallet : Calculus Single and Multivariable, 6th Edition, Wiley 2014

Other useful material is available for download on

- [W.W.L Chen: First Year Calculus](#)
- [W.W.L Chen: Linear Algebra](#)
- [W.W.L Chen: Miscellaneous Topics in First Year Mathematics](#)

## Unit Schedule

Week	Topic
1	Complex Numbers
2	Matrices and matrix algebra
3	Determinants, eigenvalues and eigenvectors
4	Diagonalization and applications
5	Linear transformations in the plane
6	Polynomials and rational functions; partial fractions

7	Further techniques of integration	
8	Ordinary differential equations - first and second order linear equations	
9	Linear systems of differential equations	
10	Functions of several variables : limits, continuity and partial derivatives	
11	Gradients, directional derivatives, tangent planes and normals	
12	Sequences and series	
13	Revision	

## Learning and Teaching Activities

### Lectures

There will be two two 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. In most weeks, three hours of lectures will be devoted to presenting new material, and the fourth hour will be devoted to demonstrating how these ideas are applied in practice.

### Tutorials

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

### Practical

There is a weekly practical in which more examples are presented and explained

### Workshop

There is a weekly optional workshop provided by the Numeracy Centre.

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of 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/support/student\\_conduct/](https://students.mq.edu.au/support/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://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use 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 and teaching activities

- There is a 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 outcome

- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.

### Assessment tasks

- Assignments
- Tutorial Work
- Class Test
- Final examination

### Learning and teaching activities

- There is a 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 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

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables
- Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

### Assessment tasks

- Assignments
- Tutorial Work
- Online quizzes
- Class Test
- Final examination

### Learning and teaching activities

- There will be two two 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. In most weeks, three hours of lectures will be devoted to presenting new material, and the fourth hour will be devoted to demonstrating how these ideas are applied in practice.

- There is a 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

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

### Assessment tasks

- Assignments
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- Class Test
- Final examination

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- There is a 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**

- By the end of this unit, you should 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.
- Demonstrate facility with a range of integration techniques and methods for solving ordinary differential equations.
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- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

## **Assessment tasks**

- Assignments
- Tutorial Work
- Online quizzes
- Class Test
- Final examination

## **Learning and teaching activities**

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- There is a 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**

- Demonstrate an understanding of the key concepts of limits, continuity and differentiation in the context of functions of several variables
- Construct elementary mathematical arguments, using the concepts and techniques studied in this unit.
- Apply the concepts and techniques studied in this unit to a range of applications, particularly drawn from Physics and Engineering.
- Express mathematical ideas clearly and logically, providing appropriate justification for conclusions.

## **Assessment tasks**

- Assignments
- Tutorial Work
- Online quizzes
- Class Test
- Final examination

## **Learning and teaching activities**

- There is a 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 content and delivery of MATH136 has been substantially revised from previous offerings so that related material is studied in a large block; with more intensive tutorial work focused on students developing and demonstrating competence in applying skills related to current material. These changes build on and mirror the changes introduced in MATH135 in Session 1.

## **Extra requirements**

In order to obtain a passing grade in this unit, students are required to demonstrate their mastery of the required basic skills and techniques by passing all five on-line quizzes. Students who do not meet this requirement will have their grade capped at F 49.

Access to the higher grades (High Distinction and Distinction) requires appropriate mastery of the ideas and concepts as demonstrated by responses to those parts of tasks marked as being designed to permit the demonstration higher order achievement. Without such mastery, grades will be capped at C 74.

Satisfactory performance on supervised assessment tasks, such as tests and the final exam, is necessary to pass this unit. If there is a significant difference between a student's marks on supervised assessment tasks and on unsupervised assessment tasks, the scaling of these tasks may be adjusted when determining the final grade, to reflect more appropriately that student's performance on supervised tasks.