



# MATH6904

## Mathematical Modelling

Session 2, In person-scheduled-weekday, North Ryde 2023

*School of Mathematical and Physical Sciences*

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### Disclaimer

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## General Information

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Credit points

10

Prerequisites

Corequisites

Co-badged status

Unit description

This unit introduces students to a range of mathematical techniques from algebra and calculus. Its focus is on the modern application of these ideas, with a particular emphasis on applications to problems in economics, business and finance, and provides a sound mathematical basis for further study in these areas. A key focus of the unit is the development of a sound grasp of how mathematics is used to provide sophisticated modelling of complex real problems. The algebra content of the unit includes topics such as linear systems, matrices, determinants, vector spaces, eigenvalues and eigenvectors. The study of these topics is applied to model various economic problems such as Leontief input-output models and dynamical systems used to predict long-term behaviours. The calculus content includes the development of the techniques of differentiation and integration with applications to constrained and unconstrained optimisation, including multivariable cases, and the development and application of a variety of useful approximation techniques. The techniques studied in the calculus are used to study and solve a wide variety of economic and financial problems.

## 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:

**ULO1:** Develop of a range of algebraic skills and proficiency in algebraic techniques

applicable to economics, finance and statistics.

**ULO2:** Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.

**ULO3:** Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.

**ULO4:** Investigate a range of optimisation problems using the techniques of calculus.

**ULO5:** Formulate models of a variety of real world situations using techniques from differential equations.

## General Assessment Information

### Requirements to Pass this Unit

To pass this unit you must:

- Achieve a total mark equal to or greater than 50%

### Late Assessment Submission Penalty

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day a written report or presentation assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted.

The submission time for all uploaded assignments is 11:55 pm. A 1-hour grace period will be provided to students who experience a technical concern. For any late submission of time-sensitive tasks, including the homework quizzes and midterm tests, please apply for Special Consideration.

Assessments where Late Submissions will be accepted:

- Assignment – YES, Standard Late Penalty applies
- Homework Quizzes - NO, unless Special Consideration is Granted
- Midterm Test 1 and 2 - NO, unless Special Consideration is Granted

### Special Consideration

The Special Consideration Policy aims to support students who have been impacted by short-term circumstances or events that are serious, unavoidable and significantly disruptive, and which may affect their performance in assessment.

**Written Assessments/Quizzes/Tests:** If you experience circumstances or events that affect your ability to complete the written assessments in this unit on time, please inform the convenor and submit a Special Consideration request through [ask.mq.edu.au](https://ask.mq.edu.au).

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#">Major Test 2</a>	12%	No	Sunday, Week 11
<a href="#">Weekly Quiz</a>	16%	No	Weeks 2, 3, 4, 6, 7, 8, 9, 10, 12
<a href="#">Major Test 1</a>	12%	No	Sunday, Week 5
<a href="#">Matlab Assignment</a>	10%	No	Friday, Week, 12
<a href="#">Final Examination</a>	50%	No	exam period

### Major Test 2

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 7 hours

Due: **Sunday, Week 11**

Weighting: **12%**

This will test the ability of students to analyse and solve mathematical problems using concepts and techniques in linear algebra and calculus.

On successful completion you will be able to:

- Develop of a range of algebraic skills and proficiency in algebraic techniques applicable to economics, finance and statistics.
- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
- Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
- Investigate a range of optimisation problems using the techniques of calculus.
- Formulate models of a variety of real world situations using techniques from differential equations.

### Weekly Quiz

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 9 hours

Due: **Weeks 2, 3, 4, 6, 7, 8, 9, 10, 12**

Weighting: **16%**

The subject will have nine weekly online (iLearn) quizzes containing one to three short questions. The quizzes will last for one hour, and be available for a duration of one week. The quizzes will not run in Week 1, or weeks containing a midterm test. Each quiz is worth 2%, with the best eight quizzes counted to the overall grade.

On successful completion you will be able to:

- Develop of a range of algebraic skills and proficiency in algebraic techniques applicable to economics, finance and statistics.
- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
- Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
- Investigate a range of optimisation problems using the techniques of calculus.
- Formulate models of a variety of real world situations using techniques from differential equations.

## Major Test 1

Assessment Type <sup>1</sup>: Quiz/Test

Indicative Time on Task <sup>2</sup>: 7 hours

Due: **Sunday, Week 5**

Weighting: **12%**

This will test the ability of students to analyse and solve mathematical problems using concepts and techniques in linear algebra and calculus.

On successful completion you will be able to:

- Develop of a range of algebraic skills and proficiency in algebraic techniques applicable to economics, finance and statistics.
- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
- Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
- Investigate a range of optimisation problems using the techniques of calculus.
- Formulate models of a variety of real world situations using techniques from differential

equations.

## Matlab Assignment

Assessment Type <sup>1</sup>: Problem set

Indicative Time on Task <sup>2</sup>: 7 hours

Due: **Friday, Week, 12**

Weighting: **10%**

The problem set will be aimed at introducing Matlab as a mathematical tool. It will ask students to perform various tasks using Matlab, such as plotting functions, computing derivatives and integrals, performing Gaussian elimination, and solving linear optimisation problems.

On successful completion you will be able to:

- Develop of a range of algebraic skills and proficiency in algebraic techniques applicable to economics, finance and statistics.
- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
- Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
- Investigate a range of optimisation problems using the techniques of calculus.
- Formulate models of a variety of real world situations using techniques from differential equations.

## Final Examination

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 15 hours

Due: **exam period**

Weighting: **50%**

This will be an invigilated exam, held during the final exam period. It will test the ability of students to synthesise the concepts taught in the course in order to analyse and solve mathematical problems with various applications.

On successful completion you will be able to:

- Develop of a range of algebraic skills and proficiency in algebraic techniques applicable

to economics, finance and statistics.

- Demonstrate knowledge of linear equations and linear models to solve problems in economics, finance and statistics.
  - Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data.
  - Investigate a range of optimisation problems using the techniques of calculus.
  - Formulate models of a variety of real world situations using techniques from differential equations.
- 

<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

### Classes

Lectures (beginning in Week 1): There are two one-hour lectures each week.

SGTA classes (beginning in Week 2): Students must register in one two-hour class per week.

### Resources

#### Algebra

- Lay, Linear Algebra and its Applications, 5th edition.
- [Linear Algebra \(Waldron, Cherney, and Denton\)](#)

#### Calculus

- [Calculus \(OpenStax\) by Gilbert Strang & Edwin “Jed” Herman](#) (freely available online)
- Stewart, Calculus (Metric Version), 8th edition (other editions are also fine)

### Methods of Communication

We will communicate with you via your university email or through announcements on iLearn. Queries to convenors can either be placed on the iLearn discussion board or sent to your

lecturers from your university email address.

## COVID Information

For the latest information on the University's response to COVID-19, please refer to the Coronavirus infection page on the Macquarie website: <https://www.mq.edu.au/about/coronavirusfaq>. Remember to check this page regularly in case the information and requirements change during semester. If there are any changes to this unit in relation to COVID, these will be communicated via iLearn.

## Unit Schedule

Week	Lecture 01	Lecture 02	Assessment
1	Sets and Vectors	Dot Product and Orthogonality	
2	Matrix Operations	Linear Systems and Gauss-Jordan Elimination	Weekly Quiz
3	Gauss-Jordan Elimination and Consistency	Homogeneous Equations	Weekly Quiz
4	Determinants and Vector/Scalar Product	Equations of Lines	Weekly Quiz
5	Equations of Planes	Functions and Trigonometry	Test 1
6	Composite and Inverse Functions	Monotonic and Exponential Functions	Weekly Quiz
7	Limits	One-Sided and Infinite Limits	Weekly Quiz
8	Continuity	Differentiation	Weekly Quiz
9	Differentiation rules	Extreme Values	Weekly Quiz
10	Integration	Fundamental Theorem of Calculus	Weekly Quiz
11	Integral Substitutions	Integration By Parts	Test 2
12	Differential Equations	Differential Equations	Matlab Assignment / Weekly Quiz
13	Revision	Revision	

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au). 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](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies](https://students.mq.edu.au/support/study/policies) (<https://students.mq.edu.au/support/study/policies>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/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)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)

- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support including information about finances, tenancy and legal issues](#)
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via [AskMQ](#), or contact [Service Connect](#).

## 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.

## Changes from Previous Offering

We value student feedback to be able to continually improve the way we offer our units. As such we encourage students to provide constructive feedback via student surveys, to the teaching staff directly, or via the FSE Student Experience & Feedback link in the iLearn page. Student feedback from the previous offering of this unit was very positive overall, with students pleased with the clarity around assessment requirements and the level of support from teaching staff. As such, no change to the delivery of the unit is planned, however we will continue to strive to improve the level of support and the level of student engagement.