



MATH604

Mathematical Modelling

S1 Online 2017

Dept of Mathematics

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General Information

Unit convenor and teaching staff

Unit Convenor

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AHH, Level 2

By appointment

Rod Yager

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Credit points

4

Prerequisites

Admission to MAppStat or GradDipAppStat or MSc

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 course 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 course 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:

Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics

Systematic understanding of linear equations and the properties of linear models applicable to 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.

General Assessment Information

The course is designed to allow students flexibility in planning their workload throughout the semester. Course material and assessment tasks are made available well in advance to enable students to schedule their study with their other commitments. Timetabling of assessment tasks is designed to ensure students make evenly-paced progress throughout the semester.

Students should contact the unit convenor if extraordinary circumstances arise that may affect their ability to complete an assessment task on time. Often they are able to arrange some way forward.

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Assessed Coursework</u>	40%	No	See iLearn for schedule
<u>Project</u>	20%	No	1st May, 2017
<u>Final Assessment</u>	40%	No	11am 14th June, 2017

Assessed Coursework

Due: **See iLearn for schedule**

Weighting: **40%**

There are ten major topics. Each has an associated on-line topic quiz containing a number of selected exercises to enable students to demonstrate mastery of the presented techniques and ideas. These are to be completed by the due date specified in iLearn.

Students who have not submitted an on-line quiz by the due date specified will be awarded a mark of 0 except for cases where an application for special consideration is made and approved.

On successful completion you will be able to:

- Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics
- Systematic understanding of linear equations and the properties of linear models applicable to 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.

Project

Due: **1st May, 2017**

Weighting: **20%**

The project is an extended application where students apply the mathematical skills they have learned to model and solve a number of real world problems.

Late projects will incur a penalty of 20% of the assignment total each day (or part thereof) after the due date unless an extension has been granted by the unit convenor or disruption to studies provisions apply.

On successful completion you will be able to:

- 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 Assessment

Due: **11am 14th June, 2017**

Weighting: **40%**

This is a time limited final assessment at the end of the course covering all the topics studied during the semester.

The assessment questions will be made available in iLearn at 9am on Tuesday 13th June, 2017. The 26-hour time frame allows for students who are working or have other commitments that impact their availability during the allocated time period. The assessment task, for adequately prepared students, takes about 4 hours to complete.

On successful completion you will be able to:

- Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics
- Systematic understanding of linear equations and the properties of linear models applicable to 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

Delivery and Resources

Classes

This is an online course - there are no classes. The schedule that material is to be completed is available in iLearn.

Required Texts and Materials

There are two textbooks that are required for this course:

- Margaret Lial, Raymond N. Greenwell & Nathan P. Ritchey: "**Calculus with Applications: Pearson Global Edition**" (11e) (ISBN: 9781488686368)
- Howard Anton & Chris Rorres: "**Elementary Linear Algebra: Applications Version**", 11th Edition (ISBN: 9781118938881)

Access to MyMathLab and WileyPLUS for the two texts is a compulsory requirement. Students will not be able to complete the required assessment tasks without access. Details of access/textbook options are provided in iLearn.

Technology requirements

Students will require a computer with internet access to enable participation in the course. A calculator with a range of mathematical functions will also be needed. There is no need for a graphing or programmable calculator.

Course material and assessments are provided via the learning management system (iLearn), WileyPlus and Pearson MyMathLab.

Unit Schedule

Week	Starting	
1	27/02/17	Familiarise yourself with the unit materials in iLearn Watch the Welcome Video and read the Welcome Booklet Unit 0 - Are you ready?

2	06/03/17	Unit 1 - The Derivative I
3	13/03/17	Unit 2 - The Derivative II
4	20/03/17	Unit 3 - Integration
5	27/03/17	Unit 4 - Functions of Two Variables
6	03/04/17	Unit 5 - Differential Equations
7	10/04/17	Start working on the project
Mid-semester Break	17/04/17	Continue the project during the break (if necessary)
8	01/05/17	Unit 6 - Linear Systems and Matrices I
9	08/05/17	Unit 7 - Matrices II and Applications of Linear Systems
10	15/05/17	Unit 8 - Determinants and Vectors
11	22/05/17	Unit 9 - Vector Spaces
12	29/05/17	Unit 10 - Eigenvalues, Eigenvectors and More Applications
13	05/06/17	Revise all units in preparation for the Final Assessment

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

Assessment Policy http://mq.edu.au/policy/docs/assessment/policy_2016.html

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): <https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration>

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/

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>.

Supplementary Exams

Further information regarding supplementary exams, including dates, is available here http://www.businessandconomics.mq.edu.au/current_students/undergraduate/how_do_i/special_consideration

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>

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:

Assessment task

- Project

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

- Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics
- Systematic understanding of linear equations and the properties of linear models applicable to 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.

Assessment tasks

- Assessed Coursework
- Project
- Final Assessment

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

- Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics
- Systematic understanding of linear equations and the properties of linear models applicable to 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
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Assessment tasks

- Assessed Coursework
- Project
- Final Assessment

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

- Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics
- Systematic understanding of linear equations and the properties of linear models applicable to 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.

Assessment tasks

- Assessed Coursework
- Project
- Final Assessment

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 outcome

- Formulate models of a variety of real world situations using techniques from differential equations.

Assessment task

- Project

Readiness for Unit

This unit aims to make you familiar with concepts in calculus and linear algebra and their applications. These topics are typically covered in first year mathematics courses.

If it has been some time since you last studied mathematics, or you have never studied calculus, it is recommended that you do some preparatory work prior to the commencement of this unit.

Macquarie University Numeracy Centre offers an appropriate bridging course (Extension Stream of the Preparatory Course in Mathematics) for this purpose. The course is offered two weeks prior to the commencement of each semester: [numeracy centre course details](#).

There are also preparatory and revision exercises in iLearn, available for enrolled students two weeks prior to the commencement of semester.

Students who prepare (and persevere) successfully complete this course even after entry into the unit with a non-calculus mathematics background.

Research and Practice

The development of appropriate mathematical models, and an understanding of their properties, together with an appreciation of the underlying assumptions and the impact that any discrepancy between these assumptions and reality may have on the results are key aspects of practice and research in Actuarial science.

This unit focuses on equipping students with these skills and providing opportunities for students to develop and demonstrate these skills through the exploration of a range of techniques applied to case studies. While many of these will be contrived to reduce the complexity to a level that can be analysed with the limited range of tools that can be developed in a one-semester gateway unit, there will be an emphasis on real world problems and the development of good research and professional practice.