MATH604
Mathematical Modelling
S1 Online 2016
Dept of Mathematics

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## General Information

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<thead>
<tr>
<th>Unit convenor and teaching staff</th>
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<tbody>
<tr>
<td>Unit Convenor</td>
</tr>
<tr>
<td>Audrey Markowskei</td>
</tr>
<tr>
<td><a href="mailto:audrey.markowskei@mq.edu.au">audrey.markowskei@mq.edu.au</a></td>
</tr>
<tr>
<td>Contact via <a href="mailto:audrey.markowskei@mq.edu.au">audrey.markowskei@mq.edu.au</a></td>
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<tr>
<td>AHH, Level 2</td>
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<table>
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<tr>
<th>Credit points</th>
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<td>4</td>
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<tr>
<th>Prerequisites</th>
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<tr>
<th>Corequisites</th>
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<th>Co-badged status</th>
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<table>
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<tr>
<th>Unit description</th>
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<tr>
<td>This unit covers algebra and calculus. The algebra content discusses linearity and applications to geometry. Algebraic techniques involving matrices and determinants are developed and used to study geometrical problems. Linearity is then developed via the notion of vector spaces and used to study systems of linear equations. The notion of a limit is developed and used to study the differential and integral calculus involving functions of one real variable. This is then extended to functions of two real variables. The notion of a limit is enhanced by the study of sequences and series. Numerical techniques for integration are also discussed.</td>
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## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at [http://students.mq.edu.au/student_admin/enrolmentguide/academicdates/](http://students.mq.edu.au/student_admin/enrolmentguide/academicdates/)

## Learning Outcomes

1. Development of a range of algebraic skills and proficiency in algebraic techniques applicable to Economics, Finance and Statistics
2. Systematic understanding of linear equations and the properties of linear models applicable to Economics, Finance and Statistics
3. Apply a wide range of techniques and ideas from differential and integral calculus to the analyse business, economic and financial data
4. Investigate a range of optimisation problems using the techniques of calculus
5. Formulate models of a variety of real world situations using techniques from differential equations.

General Assessment Information
No extensions will be granted for any assessment activities. Students who have not submitted a task prior to the deadline for that component will be awarded a mark of 0, except for cases where an application for special consideration is made and approved.

Assessment Tasks

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Due</th>
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<tbody>
<tr>
<td>Assessed Coursework</td>
<td>40%</td>
<td>See iLearn for schedule</td>
</tr>
<tr>
<td>Project</td>
<td>20%</td>
<td>2nd May, 2016 (Monday)</td>
</tr>
<tr>
<td>Final Assessment</td>
<td>40%</td>
<td>15th June, 2016 (Wednesday)</td>
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Assessed Coursework
Due: See iLearn for schedule
Weighting: 40%

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

This Assessment Task relates to the following 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.

Project
Due: 2nd May, 2016 (Monday)
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.

This Assessment Task relates to the following Learning Outcomes:

• 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: 15th June, 2016 (Wednesday)
Weighting: 40%

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

This Assessment Task relates to the following 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

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:

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.
- Course material and assessments are available on the learning management system (iLearn), WileyPlus and Pearson MyMathLab.

## Unit Schedule

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<th>Week</th>
<th>Starting</th>
<th>Activity</th>
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| 1    | 29/02/16 | Familiarise yourself with the unit materials in iLearn  
       |          | Watch the Welcome Video and read the Welcome Booklet  
       |          | Unit 0 - Are you ready? |
| 2    | 7/03/16  | Unit 1 - The Derivative I |
| 3    | 14/03/16 | Unit 2 - The Derivative II |
| 4    | 21/03/16 | Unit 3 - Integration |
| 5    | 28/03/16 | Unit 4 - Functions of Two Variables |
| 6    | 4/04/16  | Unit 5 - Differential Equations |
|      | 11/04/16 | Start working on the project |
| 7    | 25/04/16 | Complete the project |
| 8    | 2/05/16  | Unit 6 - Linear Systems and Matrices I |
| 9    | 9/05/16  | Unit 7 - Matrices II and Applications of Linear Systems |
| 10   | 16/05/16 | Unit 8 - Determinants and Vectors |
| 11   | 23/05/16 | Unit 9 - Vector Spaces |
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


Disruption to Studies Policy 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/

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.businessandeconomics.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 Enquiry Service

For all student enquiries, visit Student Connect at ask.mq.edu.au

Equity 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.

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

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

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

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
- 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
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

**Compulsory requirements**

In order to obtain a passing grade in this unit, students must provide a satisfactory demonstration of the attainment of the learning outcomes in the final assessment.

**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.