MATH1000

Introduction to Mathematical Modelling

Session 1, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

Contents

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General Information

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Credit points
10

Prerequisites

Corequisites

Co-badged status

Unit description
This unit is an elementary unit designed for Engineering, Mathematics and Physics students
whose mathematics background has not met the recommended standard for students
entering these programs. One half of the unit provides an introduction to the ideas and
techniques of differentiation and integration which are pervasive in the theoretical and
practical models that underpin areas of science, engineering, economics and technology. The
other half of the unit develops the algebraic skills and techniques including exponential,
logarithmic, and trigonometric functions.

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: Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.

ULO2: Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.

ULO3: Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.

ULO4: Test mathematical conjectures involving elementary functions.

ULO5: Demonstrate foundational learning skills including active engagement in the learning process.

ULO6: Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

General Assessment Information

HURDLES: All initial assessment tasks are hurdle requirements to pass this unit. Details of the hurdle mark will be provided on the iLearn page for the unit.

TWO LEVEL ASSESSMENT: Each module's initial test will be online, via the iLearn page. Multiple attempts are allowed; the highest mark counts toward the student's grade. For Modules 2-6 inclusive, any student who achieves a sufficiently high mark in the initial test will be eligible to sit the distinction level assessment, which will take place on in the time slot labelled "Lecture 2" on your timetable (see iLearn). Passing these distinction level assessments is required for a grade of D or HD, but not for grades of P or Cr.

Assessment Tasks

Name	Weighting	Hurdle	Due
Participation in SGTA classes	0%	Yes	Ongoing
Module 1 test	0%	Yes	Ongoing
Module 2 test	20%	Yes	Ongoing / Week 5
Module 3 test	20%	Yes	Ongoing / Week 7
Module 4 test	20%	Yes	Ongoing / Week 9
Module 5 test	20%	Yes	Ongoing / Week 11
Module 6 test	20%	Yes	Ongoing / Week 13

Participation in SGTA classes

Assessment Type [1]: Participatory task
Indicative Time on Task [2]: 0 hours
Due: **Ongoing**
Weighting: **0%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Students are expected to demonstrate their ability to engage with the unit by participating in SGTA classes.

On successful completion you will be able to:
- Demonstrate foundational learning skills including active engagement in the learning process.

Module 1 test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Ongoing**
Weighting: **0%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Set of questions with multiple or short answers required (using words, numerical analysis, graphs and formulas).

On successful completion you will be able to:
- Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.
- Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.
- Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.
- Test mathematical conjectures involving elementary functions.

- Demonstrate foundational learning skills including active engagement in the learning process.
- Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

Module 2 test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Ongoing / Week 5**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Set of questions with multiple or short answers required (using words, numerical analysis, graphs and formulas).

On successful completion you will be able to:
- Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.
- Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.
- Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.
- Test mathematical conjectures involving elementary functions.
- Demonstrate foundational learning skills including active engagement in the learning process.
- Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

Module 3 test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Ongoing / Week 7**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Set of questions with multiple or short answers required (using words, numerical analysis, graphs and formulas).

On successful completion you will be able to:

- Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.
- Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.
- Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.
- Test mathematical conjectures involving elementary functions.
- Demonstrate foundational learning skills including active engagement in the learning process.
- Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

Module 4 test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Ongoing / Week 9**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Set of questions with multiple or short answers required (using words, numerical analysis, graphs and formulas).

On successful completion you will be able to:

- Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.
- Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.

- Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.
- Test mathematical conjectures involving elementary functions.
- Demonstrate foundational learning skills including active engagement in the learning process.
- Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

Module 5 test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Ongoing / Week 11**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Set of questions with multiple or short answers required (using words, numerical analysis, graphs and formulas).

On successful completion you will be able to:

- Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.
- Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.
- Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.
- Test mathematical conjectures involving elementary functions.
- Demonstrate foundational learning skills including active engagement in the learning process.
- Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

Module 6 test

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours

Due: **Ongoing / Week 13**
Weighting: **20%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

Set of questions with multiple or short answers required (using words, numerical analysis, graphs and formulas).

On successful completion you will be able to:

- Perform calculations, including rates of changes and integrals, of elementary functions used in science and economics (including linear, polynomial, exponential, logarithmic, and trigonometric) and interpret results of these calculations.
- Communicate mathematical concepts, pertaining to foundation level science topics, in a variety of forms including graphically, numerically, in writing and by using equations.
- Apply mathematical reasoning to simple problem solving in the context of elementary algebra and calculus.
- Test mathematical conjectures involving elementary functions.
- Demonstrate foundational learning skills including active engagement in the learning process.
- Create, communicate and interpret the content of mathematical models relevant to foundation level science topics.

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[1] 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.

[2] 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

ONLINE MATERIAL: Basic material for the unit will be presented online (access through links on iLearn). Students are expected to work through the material in their own time, before the lectures and SGTAs. All the material required to achieve a Pass or Credit in this unit is available in the online material.

LECTURES: There is 1 timetabled lecture each week, on Mondays, which will cover material

required to achieve Distinction or High Distinction for this unit.

ASSESSMENT: P/Cr level assessment tasks are available online. The assessment tasks for Distinction/High Distinction level will be timetabled on Thursdays (in the slot marked "Lecture 2" in the timetable).

SGTAs: Students should enrol in one 2 hour small group class each week. These classes will discuss solutions to problems presented in lectures and provide students with an opportunity to ask their tutors for assistance with understanding the unit material.

RESOURCES: No single book covers the content of MATH1000 precisely. Each of the following books contains material useful and relevant to the unit.

Main textbook (highly recommended but not compulsory) *Calculus - single & multivariable*, Hughes-Hallett, Gleason & McCallum (7th edition), John Wiley. See http://www.wileydirect.com.au/buy/calculus-single-multivariable-7th-edition/

The library allow you to download a significant portion of the book. On the "advanced search" link for multisearch, put in the title "calculus" and the author "hughes-hallett", and it is the first result. (You will see "7 versions of this record exist.") Choosing the seventh edition takes you to where you can obtain online access, and download or view pdfs.

As indicated by the title, the text is predominantly calculus. However, Chapter 1 contains excellent material for the algebra part of the unit, covering exponentials, logarithms, trigonometry, and polynomials. Later sections in the text cover geometric series.

Recommended books

1. Active Prelude to Calculus by Boelkins. Extensive videos here.

2. Active Calculus by Boelkins et al

3. Modeling Life by Garfinkel et al (free download from Macquarie University internet connection)

4. MUMS modules. Material from the Numeracy Centre.

5. Precalculus by Stitz and Zeager. See 3rd corrected edition.

6. Calculus by Strang

Unit Schedule

Week	Material	Assessment Due
1	*Module 1:* • Sets • Algebra Skills	
2	Module 1 continued	

Week	Material	Assessment Due
3	*Module 2:* • Common functions • Domain and range • Transformations • Compositions • Linear functions • Quadratics • Polynomials Inequalities	
4	Module 2 continued	
5	*Module 3:* • Degrees and radians • Unit circle definition • Special triangles • Trig functions • Inverse trig functions • Applications	Distinction Test (Module 2)
6	Module 3 continued	
7	*Module 4:* • Rates of change • Derivative rules • The second derivative • Curve sketching • Applications	Distinction Test (Module 3)
8	Module 4 continued	
9	*Module 5:* • Proportionality • Exponentials • Logarithms • Series and Sequences • Applications	Distinction Test (Module 4)
10	Module 5 continued	
11	*Module 6:* • Numerical integration • Fundamental theorem of calculus • Integration by substitution • Applications	Distinction Test (Module 5)
12	Module 6 continued	
13		Distinction Test (Module 6)

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (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). 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) 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 or if you are a Global MBA student contact 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 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/.

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.

Unit information based on version 2022.04 of the Handbook