MATH1015

Calculus and Linear Algebra I (Advanced)

Session 1, In person-scheduled-weekday, North Ryde 2023

School of Mathematical and Physical Sciences

Contents

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General Information

Unit convenor and teaching staff
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Credit points
10

Prerequisites
(HSC Mathematics Extension 1 Band E3 and above or HSC Mathematics Extension 2) or admission to BMathSci or BAdvSc in Advanced Mathematics or BActStud or BActStudBSc or BAppFinBActStud or BActStudBProfPrac or BActStudProfPrac(Hons)

Corequisites

Co-badged status

Unit description
This is the first mainstream university mathematics unit and is presented at a more advanced level than MATH1010. The material covered is essential for students studying mathematical or actuarial sciences. This subject provides an introduction to basic concepts and techniques in linear algebra and calculus. In algebra, topics covered include matrices, systems of linear equations and their applications, including the use of vectors in two and three-dimensional Euclidean geometry and linear optimisation. In calculus, the concept of a function of one variable is explored, and the notions of limit and continuity are developed. The concept of the derivative as a suitable construct to describe rates of change is defined and techniques of differential and integral calculus of functions of a real variable are developed. Some simple differential equations and their role as quantitative models for dynamic processes, are discussed. Students are also introduced to the use of computers in mathematics, and develop modelling and problem solving skills through theoretical and practical 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: Determine solutions to linear systems of equations using matrix tools and techniques.

ULO2: Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.

ULO3: Analyze a mathematical problem using concepts of limits, continuity and differentiability.

ULO4: Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.

ULO5: Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

General Assessment Information

Requirements to Pass this Unit

To pass this unit you must:

- Achieve a total mark equal to or greater than 50%, and
- Participate in a minimum of 10 of the 12 SGTA classes.

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

Hurdle Assessment

Participation in SGTA Classes: Development of knowledge and skills requires continual practice. During SGTAs you will practice a range of mathematical techniques. To pass this hurdle assessment, you must be able to demonstrate your progress in developing and communicating knowledge and skills in 10 of the 12 SGTAs. This is a hurdle assessment meaning that failure to meet this requirement may result in a fail grade for the unit. Students are permitted up to two

absences: additional absences will require a Special Consideration to be applied for (see below).

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.

Weekly SGTA participation: To pass the unit you need to demonstrate ongoing development of skills and application of knowledge in 10 out of 12 of the weekly SGTA classes. If you miss a weekly practical class due to a serious, unavoidable and significant disruption, contact your convenor ASAP as you may be able to attend another class that week. If it is not possible to attend another class, you should still contact your convenor for access to class material to review in your own time. Note that a Special Consideration should **only be applied for** if you miss more than two of the weekly SGTA classes.

Assessment Tasks

Name	Weighting	Hurdle	Due
Test 1	12%	No	Week 5
Assignment	10%	No	Week 12
Test 2	12%	No	Week 11
Participation in SGTA classes	0%	Yes	Weekly
Weekly Quiz	16%	No	Weekly
Examination	50%	No	Exam Period

Test 1

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 7 hours
Due: **Week 5**
Weighting: **12%**

This will be an invigilated test held during the semester. It 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:

- Determine solutions to linear systems of equations using matrix tools and techniques.
- Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.
- Analyze a mathematical problem using concepts of limits, continuity and differentiability.
- Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.
- Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

Assignment

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 7 hours
Due: **Week 12**
Weighting: **10%**

This assignment will test the ability of students to solve theoretical mathematical problems using concepts and techniques from linear algebra and calculus, and prove mathematical statements.

On successful completion you will be able to:

- Determine solutions to linear systems of equations using matrix tools and techniques.
- Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.
- Analyze a mathematical problem using concepts of limits, continuity and differentiability.
- Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.
- Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

Test 2

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 7 hours
Due: **Week 11**
Weighting: **12%**

This will be an invigilated test held during the semester. It 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:

- Determine solutions to linear systems of equations using matrix tools and techniques.
- Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.
- Analyze a mathematical problem using concepts of limits, continuity and differentiability.
- Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.
- Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

Participation in SGTA classes

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

Development of knowledge and skills requires continual practice. During SGTAs you will practice a range of mathematical techniques. To pass this hurdle assessment, you must be able to demonstrate your progress in developing and communicating knowledge and skills in 10 out of 12 SGTAs.

On successful completion you will be able to:

- Determine solutions to linear systems of equations using matrix tools and techniques.
- Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.
- Analyze a mathematical problem using concepts of limits, continuity and differentiability.
- Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.
- Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

Weekly Quiz

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 9 hours
Due: **Weekly**
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:

- Determine solutions to linear systems of equations using matrix tools and techniques.
- Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.
- Analyze a mathematical problem using concepts of limits, continuity and differentiability.
- Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.
- Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

Examination

Assessment Type [1]: Examination
Indicative Time on Task [2]: 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:

- Determine solutions to linear systems of equations using matrix tools and techniques.
- Employ techniques from linear algebra to analyse structures in 2- and 3-D Euclidean space, including vectors, lines and planes.

- Analyze a mathematical problem using concepts of limits, continuity and differentiability.
- Utilise the techniques of differentiation and integration with proficiency to a wide range of functions.
- Evaluate the context of a mathematical statement in order to determine the validity of a given argument, and to construct mathematical proofs.

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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

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 and attend one one-hour class per week. **This is a hurdle requirement. Missing more than two SGTA classes will result in failure of the unit.**

Course Notes: Student notes will be posted on iLearn.

Suggested textbooks:

The following textbooks are useful as supplementary resources, for additional questions and explanations. They are available from the Macquarie University library:

- Algebra - *Lay*, Linear Algebra and its Applications, 5th edition.
- Calculus - *Stewart*, Calculus (Metric Version), 8th edition.

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 emailed to your lecturers from your university email address. Please include the unit code (MATH1015) in the subject line of your email.

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/coronavirus-faqs. 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

Planned Unit Schedule

Week	Lecture 1	Lecture 2
1	Sets & Vectors	Linear Systems
2	Matrices	Vector Spaces
3	Gaussian Elimination	Gaussian Elimination
4	Norms & Orthogonality	Determinants
5	Determinant Properties	Projection and Cross Products
6	Lines and Places	Functions
7	Limits	Continuity
8	Derivatives	Implicit Differentiation
9	Antiderivatives	Indefinite Integration
10	Definite Integration	Fundamental Theorem of Calculus
11	Substitution & Integration by Parts	Differential Equations
12	First-Order Differential Equations	Second-Order Differential Equations
13	Revision (Linear Algebra)	Revision (Calculus)

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 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/.

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.