



MATH1020

Calculus and Linear Algebra II

Session 2, In person-scheduled-weekday, North Ryde 2022

School of Mathematical and Physical Sciences

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General Information

Unit convenor and teaching staff

Convener/Lecturer

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Credit points

10

Prerequisites

MATH1010 or MATH1015 or MATH132 or MATH135

Corequisites

Co-badged status

Unit description

The foundations of linear algebra and calculus introduced in MATH1010 are further explored and extended. Topics covered in algebra include: inverse matrices, determinants, vector spaces & subspaces, eigenvalues and eigenvectors and linear transformations. In calculus the topics include: the further development of the concepts of limits, continuity and the derivative, numerical integration, polynomials, sequences & series and differential equations. In addition, complex numbers and the calculus of two or more variables are introduced. Students utilise mathematical software throughout the course to support and enhance problem solving for a variety of 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: Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.

ULO2: Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.

ULO3: Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.

ULO4: Analyse the convergence of a wide range of infinite series, including Taylor series.

ULO5: Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

General Assessment Information

HURDLES: Attendance at, and reasonable engagement in, Small Group Teaching Activities (SGTA) classes in all first year mathematics and statistics units is **compulsory**. Attendance and reasonable engagement in the class activities in at least 10 out of 12 of the SGTA classes are requirements to pass the unit. This is a hurdle requirement.

ATTENDANCE and PARTICIPATION: Please contact the unit convenor as soon as possible if you have difficulty attending and participating in any classes. There may be alternatives available to make up the work. If there are circumstances that mean you will miss a class, you can apply for Special Consideration via ask.mq.edu.au

ASSIGNMENT SUBMISSION: Assignment submission will be online through the iLearn page.

Submit assignments online via the appropriate assignment link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

- Assignment submission is via iLearn. You should upload this as a single scanned PDF file.
- Please note the quick guide on how to upload your assignments provided on the iLearn page.
- Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.
- It is your responsibility to make sure your assignment submission is legible.
- If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each

submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

Late Assessment Submission Penalty

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following university standard late penalty applied. Please see <https://students.mq.edu.au/study/assessment-exams/assessments> for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written 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. Submission time for all written assessments is set at **11:55 pm**. A 1-hour grace period is provided to students who experience a technical concern.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for [Special Consideration](#).

Assessments where Late Submissions will be accepted

In this unit, late submissions will accepted as follows:

- Major Test 1 - NO, unless Special Consideration is Granted
- Major Test 2 - NO, unless Special Consideration is Granted
- Matlab Assignment - YES, Standard Late Penalty applies
- Weekly Quiz - NO, unless Special Consideration is Granted
- SGTA participation - NO, unless Special Consideration is Granted
- Final Examination - NO, unless Special Consideration is Granted

FINAL EXAM POLICY: It is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is, the final day of the official examination period. The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances, you may apply for special consideration via ask.mq.edu.au.

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the regular exam period and the start of the next session. By making a special consideration application for the final exam you are declaring yourself available for a resit during this supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application.

You can check the supplementary exam information page on FSE101 in iLearn for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination.

Assessment Tasks

Name	Weighting	Hurdle	Due
Major Test 1	12%	No	Week 5
Final examination	50%	No	University Examination period
Major Test 2	12%	No	Week 11
SGTA Participation	0%	Yes	Weekly (from Week 2)
Matlab Assignment	10%	No	Week 12
Weekly Quiz	16%	No	Weekly (from Week 2)

Major Test 1

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 7 hours

Due: **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:

- Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.
- Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.
- Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.
- Analyse the convergence of a wide range of infinite series, including Taylor series.
- Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

Final examination

Assessment Type ¹: Examination

Indicative Time on Task ²: 15 hours

Due: **University Examination period**

Weighting: **50%**

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:

- Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.
- Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.
- Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.
- Analyse the convergence of a wide range of infinite series, including Taylor series.
- Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

Major Test 2

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 7 hours

Due: **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:

- Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.
- Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.
- Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.
- Analyse the convergence of a wide range of infinite series, including Taylor series.

- Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

SGTA Participation

Assessment Type ¹: Participatory task

Indicative Time on Task ²: 0 hours

Due: **Weekly (from Week 2)**

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:

- Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.
- Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.
- Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.
- Analyse the convergence of a wide range of infinite series, including Taylor series.
- Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

Matlab Assignment

Assessment Type ¹: Problem set

Indicative Time on Task ²: 7 hours

Due: **Week 12**

Weighting: **10%**

The problem set will be aimed at further developing the ability to use Matlab to solve mathematical problems and perform mathematical operations. It will ask students to use Matlab to perform tasks such as solving linear systems, perform linear transformations, determine the values of series and integrals, and plot functions of more than one variable.

On successful completion you will be able to:

- Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.
- Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.
- Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.
- Analyse the convergence of a wide range of infinite series, including Taylor series.
- Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

Weekly Quiz

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 9 hours

Due: **Weekly (from Week 2)**

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:

- Apply matrix inversion and decomposition methods to determine solutions to systems of linear equations.
- Analyse vectors and linear maps in spaces of arbitrary dimension, developing concepts such as vector spaces and eigenspaces.
- Utilise complex numbers and techniques of differentiation and integration to determine and compare properties of single variable and multivariable functions.
- Analyse the convergence of a wide range of infinite series, including Taylor series.
- Evaluate problems from a wide variety of applications and apply appropriate algorithmic techniques to obtain solutions.

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

Classes: There are 2 one-hour lectures each week and a 2hr SGTA class each week. Students are strongly encouraged to attend both lectures each week.

SGTA: You should attend and participate in one Small Group Teaching Activity (SGTA) each week, from Week 2. Students must participate in the SGTA in which they are enrolled. Any variation to this has to be approved by the convenor. **This is a hurdle requirement.**

IMPORTANT: Off-shore students must email the convenor as soon as possible to discuss study options.

This unit will use: iLearn; students need regular access to a reliable internet connection. MATLAB; students need regular access to the computer program MATLAB (available for download onto personally owned devices, and on computers around campus).

Textbook: Algebra - *Lay*, Linear Algebra and its Applications. Calculus - *Stewart*, Calculus (Metric Version).

Unit Schedule

Unit Schedule

Week		Assessment Due
	Stream 1 – Algebra	
1	Matrices (Review), Vectors, Linear Combinations, Elementary Matrices	
2	Inverse Matrices, Matrices, LU Decomposition, Determinants	
3	Linear Dependence, Vector Spaces & Subspaces, Bases	
4	Dimension, Eigenvalues & Eigenvectors, Eigenspaces	
5	Diagonalisation, Linear Transformations	Test 1
6	Matrix of a Linear Transformations, Composition of Linear Transformations	
	Stream 2 – Calculus	
7	Limits, Improper Integrals, Continuity	

8	IVT, Newton's Method, Rolle's Theorem, MVT, Numerical Integration, Complex Numbers	
9	Argand Plane, Polar Form, De Moivre's Theorem, Polynomials	
10	Polynomials, Taylor Polynomials, Infinite Series	
11	Functions of Several Variables, Partial Derivatives	Test 2
12	Directional Derivatives, Extrema, 2nd order ODEs, Systems of ODEs	Assignment
<i>Note: this schedule is provisional and may vary from the delivered content</i>		

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 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](#)

The Numeracy Centre

The Numeracy Centre supports students enrolled in statistics and mathematics units, in fact any unit with a mathematical or statistical component.

They are open from Week 2, located in 14SCO 188.

For information about their free drop-in service or free workshops, please visit <https://students.mq.edu.au/support/study/numeracy> or contact them directly at fse.numeracy@mq.edu.au.

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.