



MATH2010

Calculus and Linear Algebra III

Session 1, Online-scheduled-In person assessment 2026

School of Mathematical and Physical Sciences

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General Information

Unit convenor and teaching staff

Unit Convenor

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Credit points

10

Prerequisites

MATH1020 or MATH1025 or WMAT1020

Corequisites

Co-badged status

Unit description

The idea of a vector space first introduced in MATH1020 and MATH1025 is enriched in this unit by the introduction of an inner product. This leads to the important notion of orthogonality that underpins many areas of mathematics. The idea of linear transformations which transfer linearity from one space to another is also discussed. The results and techniques are then applied to problems such as approximation, quadratic forms and Fourier series. Differential and integral calculus involving functions of two real variables introduced in MATH1020 and MATH1025 are generalised to multivariable calculus including vector-valued functions, multivariable Taylor approximations, constrained optimization and multiple integrals in various coordinate systems. The ideas introduced in the unit are central to the development of many areas of modern areas of mathematics and to mathematical modelling of real world phenomena encounter in scientific and engineering 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 the rates of change of systems that vary over space and time and construct approximate representations for them (multi-variable Taylor series).

ULO2: Formulate and solve simple physical problems through the use of linear techniques.

ULO3: Develop multiple representations for a system and justify the best choice physically (eg. Fourier Series).

ULO4: Successfully communicate how the mathematical methods developed in the unit relate to real world systems.

General Assessment Information

Requirements to Pass this Unit

Achieve a total mark equal to or greater than 50% across all assessments.

Attendance and participation

We strongly encourage all students to actively participate in all learning activities. Regular engagement is crucial for your success in this unit, as these activities provide opportunities to deepen your understanding of the material, collaborate with peers, and receive valuable feedback from instructors, to assist in completing the unit assessments. Your active participation not only enhances your own learning experience but also contributes to a vibrant and dynamic learning environment for everyone.

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 assessments 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, such as scheduled tests/exams, assignments, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration: <https://connect.mq.edu.au>

Assessments where Late Submissions will be accepted:

- Skills exercise, Assignment – YES, Standard Late Penalty applies

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. If you experience circumstances or events that affect your ability to complete the assessments in this unit on time, please inform the

convenor and submit a Special Consideration request through <https://connect.mq.edu.au>.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Final examination	50%	No	Exam period	Individual	No	Observed
Assignment	20%	No	07/06/2026	Individual	Yes	Open
Skills exercise	30%	No	24/05/2026	Individual	No	Observed

Final examination

Assessment Type ¹: Examination

Indicative Time on Task ²: 20 hours

Due: **Exam period**

Weighting: **50%**

Groupwork/Individual: Individual

Short extension ³: No

AI Approach: Observed

The exam will test the ability of students to utilise concepts and techniques learnt in the unit.

On successful completion you will be able to:

- Determine the rates of change of systems that vary over space and time and construct approximate representations for them (multi-variable Taylor series).
- Formulate and solve simple physical problems through the use of linear techniques.
- Develop multiple representations for a system and justify the best choice physically (eg. Fourier Series).
- Successfully communicate how the mathematical methods developed in the unit relate to real world systems.

Assignment

Assessment Type ¹: Problem-based task

Indicative Time on Task ²: 12 hours

Due: **07/06/2026**

Weighting: **20%**

Groupwork/Individual: Individual

Short extension ³: Yes

AI Approach: Open

The assignment will test the ability of students to solve mathematical problems using concepts and techniques learnt in the unit.

On successful completion you will be able to:

- Determine the rates of change of systems that vary over space and time and construct approximate representations for them (multi-variable Taylor series).
- Formulate and solve simple physical problems through the use of linear techniques.
- Develop multiple representations for a system and justify the best choice physically (eg. Fourier Series).
- Successfully communicate how the mathematical methods developed in the unit relate to real world systems.

Skills exercise

Assessment Type ¹: Practice-based task

Indicative Time on Task ²: 18 hours

Due: **24/05/2026**

Weighting: **30%**

Groupwork/Individual: Individual

Short extension ³: No

AI Approach: Observed

Exercises designed to develop and assess mathematical skills, reinforcing theoretical knowledge through consistent practice to promote mastery of essential concepts.

On successful completion you will be able to:

- Determine the rates of change of systems that vary over space and time and construct approximate representations for them (multi-variable Taylor series).
- Formulate and solve simple physical problems through the use of linear techniques.
- Develop multiple representations for a system and justify the best choice physically (eg. Fourier Series).
- Successfully communicate how the mathematical methods developed in the unit relate to real world systems.

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
- Academic Success 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.

³ An automatic short extension is available for some assessments. Apply through the Service

[Connect Portal.](#)

Delivery and Resources

Classes

- Lectures (beginning in Week 1): There are two one-hour lectures each week.
- SGTA classes (beginning in Week 2): There is one two-hour sgta each week.

Suggested textbooks

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

- Algebra: Anton & Rorres, *Elementary Linear Algebra*, applications version, 11th edition, Wiley 2013.
- Calculus: Stewart, *Calculus: Metric Version*, 8th edition, or Stewart, *Calculus: Early Transcendentals*, 8th edition

Methods of 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 sent to your lecturers from your university email address.

Unit Schedule

Stream 1 - Algebra	
1	Systems of linear equations; vector spaces; subspaces; basis; dimension
2	Change of basis; linear transformations; matrices for linear transformations
3	Kernel and range of linear transformation; column space; eigenvalues and eigenspaces of linear transformations; matrices of linear transformations in different bases.
4	Similar matrices, diagonalisation; inner product; norm; orthogonality; Fourier series.
5	Gram-Schmidt process, orthogonal and symmetric matrices, quadratic forms, orthogonal subspaces.
6	Orthogonal projections, least squares approximations, and complex vector spaces.
	<i>SEMESTER BREAK</i>
	<i>Stream 2 - Calculus</i>
7	Euclidean spaces. Functions of many variables. Graphs of functions. Lines, planes and hyperplanes.
8	Limits and continuity in one and many variables. Arithmetic of limits. Polar coordinates.
9	Partial derivatives, directional derivatives, and gradients for real-valued and vector-valued functions.

10	Multivariate differentiability. Arithmetic of differentiable functions. The chain rule. Tangent and normals to level-sets.
11	Second-order partial derivatives. Multivariate Taylor approximations. Finding local extrema. Constrained optimisation (Lagrange multipliers).
12	Multiple integration. Fubini's theorem. Double integrals over irregular regions. Change of coordinates for multiple integrals.
13	Revision

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 connect.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/>

Academic Success

[Academic Success](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Ask a Study Coach](#)
- [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 the [Service Connect Portal](#), or contact [Service Connect](#).

IT Help

For help with University computer systems and technology, visit <https://students.mq.edu.au/support/technology/service-desk>.

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 2026.01R of the [Handbook](#)