MATH1025
Calculus and Linear Algebra II (Advanced)
Session 2, Special circumstances 2021

Department of Mathematics and Statistics

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Notice
Some on-campus classes have moved online for the first two weeks of Session, before returning to campus in Week 3. If you are studying a unit outside of the primary Session 2 timetable, please contact your teaching staff team for further details.

Some classes/teaching activities cannot be moved online and must be taught on campus. To find out if you are enrolled in one of these classes/teaching activities, you can check to see if your unit is on the list of units with mandatory on-campus classes/teaching activities.

Your Unit Convenor will provide more information via an iLearn announcement when your iLearn unit becomes available.
General Information

Unit convenor and teaching staff
Unit Convenor/Lecturer
Stuart Hawkins
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Contact via Email
Please refer to iLearn

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Credit points
10

Prerequisites
MATH1010(HD) or MATH1015 or MATH135(HD) or MATH132

Corequisites

Co-badged status

Unit description
The foundations of linear algebra and calculus introduced in MATH1015 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://students.mq.edu.au/important-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 elementary numerical techniques for root finding, function approximation and integration, in order to assess the convergence criteria or the error estimate of the method.

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.

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 submission of work: All assessment tasks must be submitted by the official due date and time. In the case of a late submission for a non-timed assessment (e.g. an assignment), if special consideration has NOT been granted, 20% of the earned mark will be deducted for each 24-hour period (or part thereof) that the submission is late for the first 2 days (including weekends and/or public holidays). For example, if an assignment is submitted 25 hours late, its mark will attract a penalty equal to 40% of the earned mark. After 2 days (including weekends and public holidays) a mark of 0% will be awarded. Timed assessment tasks (e.g. tests, examinations) do not fall under these rules.

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 (bit.ly/FSESupp) 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

<table>
<thead>
<tr>
<th>Name</th>
<th>Weighting</th>
<th>Hurdle</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGTA Participation</td>
<td>0%</td>
<td>Yes</td>
<td>Weeks 2 to 13</td>
</tr>
<tr>
<td>Major Test 1</td>
<td>20%</td>
<td>No</td>
<td>Week 5</td>
</tr>
<tr>
<td>Major Test 2</td>
<td>20%</td>
<td>No</td>
<td>Week 11</td>
</tr>
<tr>
<td>Assignment</td>
<td>10%</td>
<td>No</td>
<td>Week 12</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50%</td>
<td>No</td>
<td>Exam period</td>
</tr>
</tbody>
</table>

SGTA Participation
Assessment Type 1: Participatory task
Indicative Time on Task 2: 12 hours
Due: Weeks 2 to 13
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 elementary numerical techniques for root finding, function approximation and integration, in order to assess the convergence criteria or the error estimate of the method.

Major Test 1

Assessment Type: Quiz/Test
Indicative Time on Task: 7 hours
Due: Week 5
Weighting: 20%

This will be an online 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:

- 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 elementary numerical techniques for root finding, function approximation and integration, in order to assess the convergence criteria or the error estimate of the method.

**Major Test 2**

Assessment Type: Quiz/Test  
Indicative Time on Task: 7 hours  
Due: **Week 11**  
Weighting: **20%**

This will be an online 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:
- 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 elementary numerical techniques for root finding, function approximation and integration, in order to assess the convergence criteria or the error estimate of the method.

**Assignment**

Assessment Type: Problem set  
Indicative Time on Task: 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:
• 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 elementary numerical techniques for root finding, function approximation and integration, in order to assess the convergence criteria or the error estimate of the method.

Final Examination
Assessment Type 1: Examination
Indicative Time on Task 2: 15 hours
Due: Exam period
Weighting: 50%

This will be 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 elementary numerical techniques for root finding, function approximation and integration, in order to assess the convergence criteria or the error estimate of the method.

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 Learning Skills Unit 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:**

- Lectures: there are two one-hour lectures each week.
- SGTA classes: there is one one-hour SGTA class each week.

**Unit Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vectors, linear combinations, elementary matrices.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Inverse matrices, LU decomposition, determinants.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Determinants, adjugates, linear dependence, vector spaces and subspaces.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Bases and dimension, eigenvalues and eigenvectors.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Eigenspaces and diagonalisation, powers of matrices, linear transformations.</td>
<td>Test 1</td>
</tr>
<tr>
<td>6</td>
<td>Matrix of a linear transformation, composition of linear transformations.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Limits, improper integrals, indeterminate forms, continuity.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Intermediate value theorem, Newton's Method, Rolle's Theorem, Mean Value Theorem, numerical integration, complex numbers.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Argand plane, polar form, De Moivre's Theorem, polynomials</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Polynomials, Taylor polynomials, infinite series.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Functions of several variables, partial derivatives.</td>
<td>Test 2</td>
</tr>
<tr>
<td>12</td>
<td>Directional derivatives, extrema, second order ODEs, systems of ODEs.</td>
<td>Assignment</td>
</tr>
</tbody>
</table>

**Policies and Procedures**

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
Students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/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

**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 help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- 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
## Changes since First Published

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/07/2021</td>
<td>I have changed the general assessment section on hurdles. This now states that</td>
</tr>
<tr>
<td></td>
<td>SGTA participation is a hurdle.</td>
</tr>
</tbody>
</table>