



## UNSW Course Outline

# MATH2069 Mathematics 2A - 2024

Published on the 04 Sep 2024

## General Course Information

Course Code : MATH2069

Year : 2024

Term : Term 3

Teaching Period : T3

Is a multi-term course? : No

Faculty : Faculty of Science

Academic Unit : School of Mathematics & Statistics

Delivery Mode : Multimodal

Delivery Format : Standard

Delivery Location : Kensington

Campus : Sydney

Study Level : Postgraduate, Undergraduate

Units of Credit : 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This is a second year mathematics course for engineering students which introduces fundamental mathematical concepts that are used in many areas of physics and engineering.

This course includes two streams, vector calculus and complex analysis. The vector calculus stream studies calculus for functions involving multiple variables. Topics covered in this stream

include curves in space; optimization methods for functions of two and three variables; double and triple integration; line and surface integrals, and the theorems of Green, Gauss, and Stokes. The complex analysis stream studies differentiation and integration for functions of a complex variable. Topics in this stream include mapping problems; the Cauchy-Riemann equations; the Cauchy-Goursat Theorem and Cauchy's Integral formula; Taylor and Laurent series; and applications of complex function theory to real integration.

The course delivery includes lectures and tutorials.

Note: This course is available only to students for whom it is specifically required as part of their program.

## Course Aims

The aim of this course is to introduce students to two distinct but related branches of mathematics that are useful in many areas of physics and engineering, vector calculus and complex analysis. While the material is somewhat theoretical in nature, the main focus of the course is on conceptual understanding and applications rather than formal proofs.

## Relationship to Other Courses

Prerequisite: MATH1231 or MATH1241 or MATH1251 or DPST1014

# Course Learning Outcomes

| Course Learning Outcomes  |
|---|
| CL01 : Work with multi-dimensional geometric objects such as curves and surfaces in space, and apply this to solving problems in multivariable differentiation. |
| CL02 : Calculate integrals of functions of several variables, including using non-rectangular coordinate systems.   |
| CL03 : Apply theorems of vector calculus, including using the theorems of Green, Gauss, and Stokes to calculate line and surface integrals.                     |
| CL04 : Work with the geometry of complex numbers, including mapping regions of the complex plane.   |
| CL05 : Apply the Cauchy-Goursat Theorem and its consequences to calculate contour integrals and to compute and manipulate Taylor and Laurent series expansions  |
| CL06 : Compute real integrals using the method residues.  |

| Course Learning Outcomes  | Assessment Item   |
|---|---|
| CL01 : Work with multi-dimensional geometric objects such as curves and surfaces in space, and apply this to solving problems in multivariable differentiation. | <ul style="list-style-type: none"> <li>• Online Quizzes</li> <li>• Class tests</li> <li>• Final Exam</li> </ul> |
| CL02 : Calculate integrals of functions of several variables, including using non-rectangular coordinate systems.   | <ul style="list-style-type: none"> <li>• Class tests</li> <li>• Final Exam</li> </ul>                           |
| CL03 : Apply theorems of vector calculus, including using the theorems of Green, Gauss, and Stokes to calculate line and surface integrals.                     | <ul style="list-style-type: none"> <li>• Final Exam</li> </ul>  |
| CL04 : Work with the geometry of complex numbers, including mapping regions of the complex plane.   | <ul style="list-style-type: none"> <li>• Online Quizzes</li> <li>• Class tests</li> <li>• Final Exam</li> </ul> |
| CL05 : Apply the Cauchy-Goursat Theorem and its consequences to calculate contour integrals and to compute and manipulate Taylor and Laurent series expansions  | <ul style="list-style-type: none"> <li>• Class tests</li> <li>• Final Exam</li> </ul>                           |
| CL06 : Compute real integrals using the method residues.  | <ul style="list-style-type: none"> <li>• Final Exam</li> </ul>  |

## Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

# Assessments

## Assessment Structure

| Assessment Item                                 | Weight | Relevant Dates                                       |
|---|--------|--|
| Online Quizzes<br>Assessment Format: Individual | 10%    |  |
| Class tests<br>Assessment Format: Individual    | 30%    | Start Date: During Week 8<br>Due Date: During Week 8 |
| Final Exam<br>Assessment Format: Individual     | 60%    | Due Date: Exam Period                                |

## Assessment Details

### Online Quizzes

#### Assessment Overview

There will be 5 weekly online quizzes given during the first 5 weeks of the course. Each quiz will consist of 2 questions on vector calculus and 2 questions on complex analysis..

You will have at least 10 days to complete each quiz. You will be given instant automated feedback on each quiz attempt, and you are allowed unlimited attempts for each quiz.

The purpose of these quizzes is to develop your understanding of the concepts discussed in the lectures and tutorials, and to help you keep up with the rapid pace of the course.

Only the best 4 out of 5 weekly quiz marks will count for each of the vector calculus and complex analysis components.

#### Course Learning Outcomes

- CL01 : Work with multi-dimensional geometric objects such as curves and surfaces in space, and apply this to solving problems in multivariable differentiation.
- CL04 : Work with the geometry of complex numbers, including mapping regions of the complex plane.

#### Assignment submission Turnitin type

This is not a Turnitin assignment

#### Generative AI Permission Level

**Not Applicable**

Generative AI is not considered to be of assistance to you in completing this assessment. If you

do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **Class tests**

### **Assessment Overview**

You will complete two 40 minute tests taken in class during week 8, one covering vector calculus and one covering complex analysis.

These tests will provide an opportunity to demonstrate your learning and gauge your progress before the end of the term; the results of these tests may help you prepare for the final exam.

Feedback will be provided within two weeks.

### **Course Learning Outcomes**

- CLO1 : Work with multi-dimensional geometric objects such as curves and surfaces in space, and apply this to solving problems in multivariable differentiation.
- CLO2 : Calculate integrals of functions of several variables, including using non-rectangular coordinate systems.
- CLO4 : Work with the geometry of complex numbers, including mapping regions of the complex plane.
- CLO5 : Apply the Cauchy-Goursat Theorem and its consequences to calculate contour integrals and to compute and manipulate Taylor and Laurent series expansions

### **Assignment submission Turnitin type**

This is not a Turnitin assignment

### **Generative AI Permission Level**

**Not Applicable**

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **Final Exam**

### **Assessment Overview**

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across the term, including material from lectures and tutorials. The exam will be two hours in duration, and will consist of 4 questions. You will write your solutions in free form. The examination will occur during the official university examination period.

Note. In order to pass this course, your overall final mark must be greater or equal to 50% AND you must have at least 40% in each of the two components Vector Calculus and Complex Analysis.

Feedback is available through inquiry with the course convenor.

### Course Learning Outcomes

- CLO1 : Work with multi-dimensional geometric objects such as curves and surfaces in space, and apply this to solving problems in multivariable differentiation.
- CLO2 : Calculate integrals of functions of several variables, including using non-rectangular coordinate systems.
- CLO3 : Apply theorems of vector calculus, including using the theorems of Green, Gauss, and Stokes to calculate line and surface integrals.
- CLO4 : Work with the geometry of complex numbers, including mapping regions of the complex plane.
- CLO5 : Apply the Cauchy-Goursat Theorem and its consequences to calculate contour integrals and to compute and manipulate Taylor and Laurent series expansions
- CLO6 : Compute real integrals using the method residues.

### Assignment submission Turnitin type

This is not a Turnitin assignment

### Generative AI Permission Level

**Not Applicable**

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.

For more information on Generative AI and permitted use please see [here](#).

## **General Assessment Information**

### Grading Basis

Standard

### Requirements to pass course

To pass the course, students need at least 40 marks in each of the two strands (Vector Calculus and Complex Analysis), as well as a combined mark of at least 50.

# Course Schedule

| Teaching Week/Module                 | Activity Type | Content   |
|--------------------------------------|---------------|---|
| Week 1 : 9 September - 15 September  | Lecture       | • CA: Introduction: Revision, basic topology, functions and mappings.<br>• VC: Vectors, curves, and surfaces.   |
| Week 2 : 16 September - 22 September | Lecture       | • CA: Limits, continuity, differentiability.<br>• VC: Partial derivatives and continuity; Chain rule.   |
| Week 3 : 23 September - 29 September | Lecture       | 1. CA: Analytic and harmonic functions. Exponential, trigonometric and hyperbolic functions. 2. VC: Gradient and directional derivatives; Normal vectors and tangent planes; Error estimates and critical points on surfaces. |
| Week 4 : 30 September - 6 October    | Lecture       | 1. CA: Principal logarithms and complex exponents. Introduction to complex integration. 2. VC: Lagrange multipliers; Double integrals.  |
| Week 5 : 7 October - 13 October      | Lecture       | 1. CA: Arcs, contour integrals and antiderivatives. Cauchy- Goursat theorem. Homotopy version of Cauchy-Goursat theorem. 2. VC: Double integrals continued (including polar coordinates); Triple Integrals.                   |
| Week 7 : 21 October - 27 October     | Lecture       | 1. CA: The Cauchy integral formula. The generalised Cauchy integral formula. Taylor Series. 2. VC: Triple integrals continued (including cylindrical and spherical coordinates)   |
| Week 8 : 28 October - 3 November     | Lecture       | 1. CA: Laurent series. Zeroes and singularities. 2. VC: Change of variables; Line integrals; Green's Theorem.   |
| Week 9 : 4 November - 10 November    | Lecture       | 1. CA: The method of Residues. 2. VC: Surface integrals; Flux Integrals.  |
| Week 10 : 11 November - 17 November  | Lecture       | 1. CA: Real Improper integrals. Trigonometric integrals.<br>2. VC: Divergence and curl; Stokes Theorem; Divergence Theorem.   |

## Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## Course Resources

### Prescribed Resources

Lecture notes will be provided. There will be moodle forums to discuss questions relatd to course administration and course content.

## Course Evaluation and Development

Course feedback will be gathered through MyExperience.

## Staff Details

| Position | Name             | Email | Location  | Phone | Availability | Equitable Learning Services Contact | Primary Contact |
|----------|------------------|-------|---|-------|--------------|-------------------------------------|-----------------|
| Convenor | Pinhas Gro ssman |       | Anita B. Lawrence Centre, East Wing, Room 6112A |       |              | No                                  | Yes             |

# Other Useful Information

## Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the [UNSW Student Code of Conduct Website](https://student.unsw.edu.au/conduct).

## Academic Honesty and Plagiarism

**Referencing** is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at <https://student.unsw.edu.au/referencing>

**Academic integrity** is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The [Current Students site](https://student.unsw.edu.au/current-students),
- The [ELISE training site](https://student.unsw.edu.au/elise), and
- The [Use of AI for assessments](https://student.unsw.edu.au/use-of-ai-for-assessments) site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: <https://student.unsw.edu.au/conduct>

## Submission of Assessment Tasks

### Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

***Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.***

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

### Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: <https://student.unsw.edu.au/special-consideration>

**Important note:** UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

### Faculty-specific Information

#### Additional support for students

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)
- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)

## School-specific Information

### School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site. Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the web site starting at: [The School of Mathematics and Statistics assessment policies](#)

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

### Special Consideration - Short Extension Policy

The School of Mathematics and Statistics has carefully reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. Upon comprehensive examination of our course offerings that incorporate these types of assessments, we have concluded that our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School of Mathematics and Statistics has decided to universally opt out of the Short Extension provision for all its courses, having pre-emptively integrated flexibility into our assessment deadlines. The decision is subject to revision in response to the introduction of new course offerings. Students may still apply for Special Consideration via the usual procedures.

## Computing Lab

The main computing laboratory is room G012 of the Anita B. Lawrence Centre (formerly Red Centre). You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is Room M020, located on the mezzanine level through the glass door (and along the corridor) opposite the School's entrance.

For more information, including opening hours, see the [computing facilities webpage](#). Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

## School Contact Information

Please visit the [School of Mathematics and Statistics website](#) for a range of information.

For information on Courses, please go to "Student life & resources" and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within "Student life & resources" page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

## Undergraduate

E: [ug.mathsstats@unsw.edu.au](mailto:ug.mathsstats@unsw.edu.au)

P: 9385 7011 or 9385 7053

## Postgraduate

E: [pg.mathsstats@unsw.edu.au](mailto:pg.mathsstats@unsw.edu.au)

P: 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. It is your responsibility to regularly check your university email account. Please use your UNSW student email and state your student number in all emails to us.