UNSW Course Outline

# MATH2011 Several Variable Calculus - 2024

Published on the 05 Feb 2024

## General Course Information

**Course Code :** MATH2011
**Year :** 2024
**Term :** Term 1
**Teaching Period :** T1
**Is a multi-term course? :** No
**Faculty :** Faculty of Science
**Academic Unit :** School of Mathematics & Statistics
**Delivery Mode :** In Person
**Delivery Format :** Standard
**Delivery Location :** Kensington
**Campus :** Sydney
**Study Level :** Undergraduate
**Units of Credit :** 6

**Useful Links**

Handbook Class Timetable

## Course Details & Outcomes

### Course Description

This course introduces students to differential, integral and vector calculus for functions of more than one variable. Topics covered in lectures and tutorials include functions of several variables, limits and continuity, differentiability, gradients, surfaces, maxima and minima, Taylor series,

Lagrange multipliers, chain rules, inverse function theorem, Jacobian derivatives. Double and triple integrals, iterated integrals, Riemann sums, cylindrical and spherical coordinates, change of variables, centre of mass. Vector calculus, line integrals, parametrised surfaces, surface integrals, del, divergence and curl, Stokes' theorem, Green's theorem in the plane, applications to fluid dynamics and electrodynamics.

## Course Aims

This course introduces the mathematics crucial to mechanics, dynamics, electromagnetism, fluid flow, financial modelling and many areas of pure and applied mathematics. The course combines and extends the ideas from one variable calculus and linear algebra to develop the calculus of functions in R^2 and R^3. The final topic is an introduction to Fourier series, which concerns the representation of functions of a single real variable by infinite trigonometric series. In this course, the connection between diagrams/visualization and symbols is particularly important. Understanding that relationship is one of the main aims of the course.

## Relationship to Other Courses

This 6UOC course is the ordinary version of the core second year mathematics topic Several Variable Calculus. Either this course or the higher version, MATH2111, is required for completion of a mathematics or statistics major. MATH2011 and MATH2111 are also compulsory or recommended for several other majors and programs. The higher version, MATH2111, is required for all maths or stats majors in advanced science and is required by all students an advanced mathematics or statistics degree.

Formally, entry to MATH2011 requires the passing either the course MATH1231 or MATH1241 or MATH1251 or DPST1014.

**Exclusions**: MATH2018, MATH2019, MATH2069, MATH2111.

## Course Learning Outcomes

| Course Learning Outcomes |
|---|
| CLO1 : Use the methods of several variable calculus to calculate, manipulate and use the relevant mathematical objects that appear in typical problems. |
| CLO2 : Solve maximum/minimum problems in several variables including those with constraints. |
| CLO3 : Set up and calculate multiple integrals in standard and adapted coordinate systems, surface integrals and verify and apply vector integral theorems. |
| CLO4 : Construct well-organized and clear solutions to multivariable calculus problems in written form, ensuring the logical flow of arguments and absence of ambiguities. |

| Course Learning Outcomes | Assessment Item |
|---|---|
| CLO1 : Use the methods of several variable calculus to calculate, manipulate and use the relevant mathematical objects that appear in typical problems. | • Test 1<br>• Test 2<br>• Exam |
| CLO2 : Solve maximum/minimum problems in several variables including those with constraints. | • Test 2<br>• Exam |
| CLO3 : Set up and calculate multiple integrals in standard and adapted coordinate systems, surface integrals and verify and apply vector integral theorems. | • Test 2<br>• Exam |
| CLO4 : Construct well-organized and clear solutions to multivariable calculus problems in written form, ensuring the logical flow of arguments and absence of ambiguities. | • Test 1<br>• Test 2<br>• Exam |

## Learning and Teaching Technologies

Moodle - Learning Management System

# Assessments

## Assessment Structure

| Assessment Item | Weight | Relevant Dates |
|---|---|---|
| Test 1<br>Assessment Format: Individual | 20% | |
| Test 2<br>Assessment Format: Individual | 20% | |
| Exam<br>Assessment Format: Individual | 60% | |

# Assessment Details

## Test 1

### Assessment Overview

Class Test 1 is designed to assess your knowledge of the topics covered in lectures in weeks 1-3 inclusive. Class Test 1 will be typically scheduled in Week 4 with a time limit of 45 minutes. Typical questions include problem solving. You will be provided with feedback with comments and/or solutions.

Feedback is provided within two weeks of completing the test.

### Course Learning Outcomes

- CLO1 : Use the methods of several variable calculus to calculate, manipulate and use the relevant mathematical objects that appear in typical problems.
- CLO4 : Construct well-organized and clear solutions to multivariable calculus problems in written form, ensuring the logical flow of arguments and absence of ambiguities.

### Detailed Assessment Description

Class Test 1 is designed to assess your knowledge of the topics covered in lectures in weeks 1-3 inclusive. Class Test 1 will be typically scheduled in Week 4 with a time limit of 45 minutes. Typical questions include problem solving. You will be provided with feedback with comments and/or solutions.

Feedback is provided within two weeks of completing the test.

### Assessment Length

45 minutes

### Submission notes

Handwritten in class test

### Assignment submission Turnitin type

This is not a Turnitin assignment

## Test 2

### Assessment Overview

Class Test 2 is designed to assess your knowledge of the topics covered in lectures in weeks 4-7 inclusive. Class Test 2 will be typically scheduled in Week 8 with a time limit of 45 minutes. Typical questions include problem solving. You will be provided with feedback with comments

and/or solutions.

Feedback is provided within two weeks of completing the test.

**Course Learning Outcomes**

- CLO1 : Use the methods of several variable calculus to calculate, manipulate and use the relevant mathematical objects that appear in typical problems.
- CLO2 : Solve maximum/minimum problems in several variables including those with constraints.
- CLO3 : Set up and calculate multiple integrals in standard and adapted coordinate systems, surface integrals and verify and apply vector integral theorems.
- CLO4 : Construct well-organized and clear solutions to multivariable calculus problems in written form, ensuring the logical flow of arguments and absence of ambiguities.

**Detailed Assessment Description**

Class Test 2 is designed to assess your knowledge of the topics covered in lectures in weeks 4-7 inclusive. Class Test 2 will be typically scheduled in Week 8 with a time limit of 45 minutes. Typical questions include problem solving. You will be provided with feedback with comments and/or solutions.

Feedback is provided within two weeks of completing the test.

**Assessment Length**

45 minutes

**Submission notes**

Hand-written in-class test

**Assignment submission Turnitin type**

This is not a Turnitin assignment

## 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, tutorials and workshops. The exam is typically 2 hours and consists of mathematical problems that you are asked to solve and write down your workings in sufficient detail. The examination will occur during the official university examination period.

Feedback is available through inquiry with the course convenor.

**Course Learning Outcomes**

- CLO1 : Use the methods of several variable calculus to calculate, manipulate and use the relevant mathematical objects that appear in typical problems.
- CLO2 : Solve maximum/minimum problems in several variables including those with constraints.
- CLO3 : Set up and calculate multiple integrals in standard and adapted coordinate systems, surface integrals and verify and apply vector integral theorems.
- CLO4 : Construct well-organized and clear solutions to multivariable calculus problems in written form, ensuring the logical flow of arguments and absence of ambiguities.

**Detailed Assessment Description**

The final exam is designed to summarise your learning and problem-solving skills on all topics delivered across the term, including material from lectures, tutorials and workshops. The exam is typically 2 hours and consists of mathematical problems that you are asked to solve and write down your workings in sufficient detail. The examination will occur during the official university examination period.

Feedback is available through inquiry with the course convenor.

**Assessment Length**

2 hours

# General Assessment Information

**Grading Basis**

Standard

**Requirements to pass course**

A composite mark of at least 50 (after any recalibration) is required to pass the course. There are no specific hurdle requirements.

# Course Schedule

| Teaching Week/Module | Activity Type | Content |
|---|---|---|
| Week 1 : 12 February - 18 February | Lecture | Vectors, Curves and Surfaces |
| Week 2 : 19 February - 25 February | Lecture | Partial Derivatives, Chain Rules, Gradient |
| Week 3 : 26 February - 3 March | Lecture | Normal and Tangent; Taylor Series; Multivariable Critical Points |
| Week 4 : 4 March - 10 March | Lecture | Lagrange Multipliers; Jacobian Matrix |
| | Assessment | Test 1 |
| Week 5 : 11 March - 17 March | Lecture | Inverse Functions; Double Integrals |
| Week 6 : 18 March - 24 March | Other | Flexability Week |
| Week 7 : 25 March - 31 March | Lecture | Double Integrals in Polar Coordinates; Triple Integrals; Spherical and cylindrical coordinates |
| Week 8 : 1 April - 7 April | Lecture | General Coordinates Changes; Grad, div and curl; Line Integrals |
| | Assessment | Test 2 |
| Week 9 : 8 April - 14 April | Lecture | Green's Theorem and Surface Integrals |
| Week 10 : 15 April - 21 April | Lecture | Stokes and Divergence Theorem |

## Attendance Requirements

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

## General Schedule Information

Lecture are delivered live in a lecture theatre, the recordings will be made available on Moodle for revision purposes only. Lectures may be live-steamed, but the online question and answer section might not be actively monitored during lectures.

# Course Resources

## Prescribed Resources

There is no set textbook. The lectures will comprehensively cover the material and the lectures will define the course.

Lecture notes will be made available through Moodle. The lecturers typically provide skeleton lecture notes with gaps which will be filled during the lectures. It is probably best to print the lectures notes and bring them to lectures, where you can write on them the solutions to problems etc. The notes may have colours but a black-and-white printout is fine.

## Recommended Resources

There is no set textbook for this course, however a list contains supplementary resources will be made avaible on Moodle.

## Additional Costs

There are no additional costs.

## Course Evaluation and Development

The School of Mathematics and Statistics evaluates each course each time it is run. We carefully consider the student responses and their implications for course development. Feedback is very important to us, so please don't leave it to the end of the course to pass on any ideas.

# Staff Details

| Position | Name | Email | Location | Phone | Availability | Equitable Learning Services Contact | Primary Contact |
|---|---|---|---|---|---|---|---|
| Convenor | Joshua Capel | | H13-E-5107 | 93858817 | See Moodle, or enquire via email | Yes | Yes |
| Lecturer | Daniel Han | | H13-E-4074 | 9385 7111 | See Moodle | No | No |

# 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.

### Academic Honesty and Plagarism

**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,
- The ELISE training site, and
- The 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

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

P: 9385 7011 or 9385 7053

**Postgraduate**

E: 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.**