MATH13217 *Advanced Calculus*
Term 1 - 2021

Profile information current as at 25/04/2024 04:30 pm

General Information

Overview

In this unit, you will study topics in multivariable calculus - differential and integral calculus as applied to scalar and vector functions of more than one variable. After reviewing vectors and the geometry of space, you will investigate derivatives and integrals of vector functions with applications to arc length, curvature of space curves and motion in space. Partial differentiation is studied by defining limits and continuity in two dimensions, and is used to define tangent planes, linear approximations and differentials. The chain rule is developed for functions of more than one variable as well as directional derivatives and the gradient vector, which leads into multivariate optimisation with and without constraints. You will study multiple integrals by expanding the concept of single variable integrals to double and triple integrals which are evaluated as iterated integrals. These ideas are further developed to show you how to calculate volumes, surface areas, masses and centroids of very general regions in two and three dimensional space as well as probability for bivariate distributions. Finally you will investigate the calculus of vector fields, line integrals and surface integrals. The connection between these new types of integrals and multiple integrals is given in three theorems - Green's Theorem, Stokes' Theorem and the Divergence Theorem - which turn out to be higher-dimensional versions of the Fundamental Theorem of Calculus. Mathematical software is used to investigate and solve most problems in the unit.

Details

Career Level: *Undergraduate*
Unit Level: *Level 3*
Credit Points: *6*
Student Contribution Band: *7*
Fraction of Full-Time Student Load: *0.125*

Pre-requisites or Co-requisites

Prerequisite: MATH12224 Anti-requisite: MATH12172
Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the Assessment Policy and Procedure (Higher Education Coursework).

Offerings For Term 1 - 2021

- Online

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website

This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

Regional Campuses
Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

Metropolitan Campuses
Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Written Assessment**
Weighting: 25%
2. **Written Assessment**
Weighting: 25%
3. **Examination**
Weighting: 50%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the University's Grades and Results Policy for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the CQUniversity Policy site.
You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the CQUniversity Policy site.

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Student unit and teaching evaluation

Feedback

Students greatly appreciated the support able to be offered individually due to the small number of enrolled students in the cohort, along with the expertise of the lecturer.

Recommendation

Continue to foster the current learning and teaching environment.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Solve geometric problems in three dimensional space using vectors and their operators
2. Differentiate and integrate of vector functions to solve problems involving arc length and curvature of space curves
3. Apply the concept of the limit, continuity and partial derivative of a function of many variables to calculate tangent planes, linear approximations and differentials
4. Optimise multivariable problems, either with or without constraints, using the chain rule, directional derivatives and the gradient vector
5. Calculate double and triple integrals over general regions, and also in polar, cylindrical and spherical coordinates
6. Simplify the evaluation of a double or triple integral by applying the change of variables technique
7. Solve problems involving the curl and divergence of a vector field
8. Investigate the calculus of vector fields, line integrals and surface integrals through Green's theorem, Stokes' Theorem and the Divergence Theorem
9. Use mathematical software to visualise, analyse and solve problems in multivariable calculus.

Alignment of Learning Outcomes, Assessment and Graduate Attributes

— N/A Level ∘ Introductory Level • Intermediate Level • Graduate Level ∘ Professional Level ∘ Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes								
	1	2	3	4	5	6	7	8	9
1 - Written Assessment - 25%	•	•	•	•					•
2 - Written Assessment - 25%					•	•			•
3 - Examination - 50%	•	•	•	•	•	•	•	•	

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes								
	1	2	3	4	5	6	7	8	9
1 - Communication	•	•	•	•	•	•	•	•	•
2 - Problem Solving	•	•	•	•	•	•	•	•	•
3 - Critical Thinking	•	•	•	•	•	•	•	•	•
4 - Information Literacy	•	•	•	•	•	•	•	•	•
5 - Team Work									
6 - Information Technology Competence	•	•	•	•	•	•	•	•	•
7 - Cross Cultural Competence									
8 - Ethical practice	•	•	•	•	•	•	•	•	•
9 - Social Innovation									
10 - Aboriginal and Torres Strait Islander Cultures									

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 25%	•	•	•	•		•		•		
2 - Written Assessment - 25%	•	•	•	•		•		•		
3 - Examination - 50%	•	•	•	•		•		•		

Textbooks and Resources

Textbooks

There are no required textbooks.

Additional Textbook Information
Teaching and learning materials will be provided by the coordinator according to the topics covered in this unit.

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

William Guo Unit Coordinator
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Schedule

Week 1 - 08 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Vectors and complex numbers (1)	Section 9.1 (p. 234-240): Parallelogram method [Textbook you used for MATH11246/12223/12224]	Read Section 9.1 (p. 234-240); complete Week 1 exercises

Week 2 - 15 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Vectors and complex numbers (2)	Section 9.1 (the rest): The Cartesian method and applications [Textbook you used for MATH11246/12223/12224]	Read Section 9.1 (the rest); complete Week 2 exercises

Week 3 - 22 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Vectors and complex numbers (3)	Section 9.2: Complex numbers [Textbook you used for MATH11246/12223/12224]	Read Section 9.2; complete Week 3 exercises

Week 4 - 29 Mar 2021

Module/Topic	Chapter	Events and Submissions/Topic
Derivatives of parametric and implicit functions	Section 10.4: Derivatives of special functions [Textbook you used for MATH11246/12223/12224]	Read Section 10.4; complete Week 4 exercises

Week 5 - 05 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Taylor polynomials and series	Section 16.2: Taylor polynomials and series for approximations [Textbook you used for MATH11246/12223/12224]	Read Section 16.2; complete Week 5 exercises

Vacation Week - 12 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Vacation Week (no class)		

Week 6 - 19 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Function analysis (1)	The asymptotes [The reading material is provided on Moodle by the coordinator.]	Read the Reading material; complete Week 6 exercises **Assignment 1** Due: Week 6 Friday (23 Apr 2021) 11:59 pm AEST

Week 7 - 26 Apr 2021

Module/Topic	Chapter	Events and Submissions/Topic
Function analysis (2)	The x-intercepts and New ton's method [The reading material is provided on Moodle by the coordinator.]	Read the Reading material; complete Week 7 exercises

Week 8 - 03 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Function analysis (3)	Characteristic features of a function as a curve [The reading material is provided on Moodle by the coordinator.]	Read the Reading material; complete Week 8 exercises

Week 9 - 10 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Multivariable calculus (1): Partial derivatives	Reading materials: Sections 2.1 and 2.2 [The reading material is provided on Moodle by the coordinator.]	Read the Reading material: Sections 2.1 and 2.2; complete Week 9 exercises

Week 10 - 17 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Multivariable calculus (2): Minima and maxima of two variable functions	Reading materials: Section 2.5 [The reading material is provided on Moodle by the coordinator.]	Read the Reading material: Section 2.5; complete Week 10 exercises

Week 11 - 24 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Multivariable calculus (3): Multiple integrals	Reading materials: Sections 3.1 and 3.2 [The reading material is provided on Moodle by the coordinator.]	Read the Reading material: Sections 3.1 and 3.2; complete Week 11 exercises **Assignment 2** Due: Week 11 Friday (28 May 2021) 11:59 pm AEST

Week 12 - 31 May 2021

Module/Topic	Chapter	Events and Submissions/Topic
Unit review and examination preparation		

Review/Exam Week - 07 Jun 2021

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 14 Jun 2021

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 Assignment 1

Assessment Type
Written Assessment

Task Description
This is an individual assignment.
This assignment is to test student's learning outcomes of topics studied in Weeks 1-5. The assignment details are provided on the Moodle website.

Assessment Due Date
Week 6 Friday (23 Apr 2021) 11:59 pm AEST

Extension request must be lodged before the assignment due. No extension can be granted to this assignment once the solution is released.

Return Date to Students
Week 8 Friday (7 May 2021)
It is envisaged that feedback and solutions will be available in two weeks, or as soon as the marking process is completed.

Weighting
25%

Assessment Criteria
The final mark is out of 25. Questions are awarded the full marks allocated if they are error-free, partial marks if there are some problems, and no marks if not attempted or contain so many errors as to render the attempt to be without value. To ensure maximum benefit, answers to all questions should be neatly and clearly presented and all appropriate working should be shown. Assignments will receive NO marks if submitted after the solutions are released.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submit one PDF file through the Moodle website.

Learning Outcomes Assessed

- Solve geometric problems in three dimensional space using vectors and their operators
- Differentiate and integrate of vector functions to solve problems involving arc length and curvature of space curves
- Apply the concept of the limit, continuity and partial derivative of a function of many variables to calculate tangent planes, linear approximations and differentials
- Optimise multivariable problems, either with or without constraints, using the chain rule, directional derivatives and the gradient vector
- Use mathematical software to visualise, analyse and solve problems in multivariable calculus.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence
- Ethical practice

2 Assignment 2

Assessment Type
Written Assessment

Task Description
This is an individual assignment.
This assignment is to test student's learning outcomes of topics studied in Weeks 6-10. The assignment details are provided on the Moodle website.

Assessment Due Date
Week 11 Friday (28 May 2021) 11:59 pm AEST
Extension request must be lodged before the assignment due. No extension can be granted to this assignment once the solution is released.

Return Date to Students
Review/Exam Week Wednesday (9 June 2021)
It is envisaged that the feedback and solutions will be available before the exam if all students submitted this assignment on time.

Weighting
25%

Assessment Criteria
The final mark is out of 25. Questions are awarded the full marks allocated if they are error-free, partial marks if there

are some problems, and no marks if not attempted or contain so many errors as to render the attempt to be without value. To ensure maximum benefit, answers to all questions should be neatly and clearly presented and all appropriate working should be shown. Assignments will receive NO marks if submitted after the solutions are released.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
Submit one PDF file through the Moodle website.

Learning Outcomes Assessed

- Calculate double and triple integrals over general regions, and also in polar, cylindrical and spherical coordinates
- Simplify the evaluation of a double or triple integral by applying the change of variables technique
- Use mathematical software to visualise, analyse and solve problems in multivariable calculus.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence
- Ethical practice

Examination

Outline
Complete an invigilated examination.

Date
During the examination period at a CQUniversity examination centre.

Weighting
50%

Length
180 minutes

Minimum mark or grade
40% (20 marks or higher out of the 50 marks available in the exam)

Exam Conditions
Open Book.

Materials
Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).
Calculator - all non-communicable calculators, including scientific, programmable and graphics calculators are authorised

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?
A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?
A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?
For academic advice and guidance, the Academic Learning Centre (ALC) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?

Be Honest
If your assessment task is done by someone else, it would be dishonest of you to claim it as your own

Seek Help
If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)

Produce Original Work
Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem