



# MATH236

## Mathematics IIB

S2 Day 2014

*Mathematics*

### Contents

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|   |    |
|---|----|
| <u>General Information</u>              | 2  |
| <u>Learning Outcomes</u>                | 3  |
| <u>Assessment Tasks</u>                 | 3  |
| <u>Delivery and Resources</u>           | 5  |
| <u>Unit Schedule</u>                    | 6  |
| <u>Learning and Teaching Activities</u> | 7  |
| <u>Policies and Procedures</u>          | 7  |
| <u>Graduate Capabilities</u>            | 8  |
| <u>Extra requirements</u>               | 15 |

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## General Information

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E7A 211

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E7A 210

By Appointment

Credit points

3

Prerequisites

MATH235

Corequisites

Co-badged status

Unit description

This unit deals with two of the most fundamental concepts in analysis – complex analysis and vector analysis. Complex analysis is the study of complex-valued functions of complex variables. Two approaches to the study of complex-valued functions of one complex variable are discussed. The first of these, usually attributed to Riemann, is based on differentiation and involves pairs of partial differential equations called the Cauchy-Riemann equations. The second approach, usually attributed to Cauchy, is based on integration and depends on a fundamental theorem known nowadays as Cauchy's integral theorem. The concept of vector analysis provides the tools for modelling physical phenomena such as fluid flow, electromagnetic and other field-based theories. We consider vector fields and integrals over paths and surfaces, and develop an understanding of the famous integration theorems of Green, Stokes and Gauss. These theorems transform physical laws expressed in differential form to integral form.

## 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:

Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.

Understanding of the breadth of the discipline, its role in other fields, and the way other fields contribute to the development of the mathematical sciences

Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning

Ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods from vector calculus and complex analysis.

Application of mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

Appropriate interpretation of information communicated in mathematical form

Appropriate presentation of information, reasoning and conclusions in a variety of modes to diverse audiences (expert and non-expert).

Demonstrate an understanding of ethical issues relating to professional mathematical work, identify and address ethical issues arising in such professional work and make ethical decisions while collecting and analysing data and reporting findings.

Ability to work effectively, responsibly and safely in an individual or team context.

## Assessment Tasks

| Name                              | Weighting | Due                           |
|-----------------------------------|-----------|-------------------------------|
| <a href="#">Six Assignments</a>   | 20%       | Weeks 3,4,8,9,11,12           |
| <a href="#">One Test</a>          | 20%       | Week 7                        |
| <a href="#">Final examination</a> | 60%       | University Examination Period |

### Six Assignments

Due: **Weeks 3,4,8,9,11,12**

Weighting: **20%**

Problem based assignments

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.
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- Appropriate presentation of information, reasoning and conclusions in a variety of modes to diverse audiences (expert and non-expert).
- Demonstrate an understanding of ethical issues relating to professional mathematical work, identify and address ethical issues arising in such professional work and make ethical decisions while collecting and analysing data and reporting findings.
- Ability to work effectively, responsibly and safely in an individual or team context.

## One Test

Due: **Week 7**

Weighting: **20%**

-

On successful completion you will be able to:

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- Application of mathematical principles, concepts, techniques and technology to solve practical and abstract problems.
- Appropriate interpretation of information communicated in mathematical form
- Appropriate presentation of information, reasoning and conclusions in a variety of modes to diverse audiences (expert and non-expert).

- Demonstrate an understanding of ethical issues relating to professional mathematical work, identify and address ethical issues arising in such professional work and make ethical decisions while collecting and analysing data and reporting findings.
- Ability to work effectively, responsibly and safely in an individual or team context.

## Final examination

Due: **University Examination Period**

Weighting: **60%**

-

On successful completion you will be able to:

- Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.
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## Delivery and Resources

### Classes

**Lectures:** you should attend two hours of each lecture stream each week, making a total of four hours.

**Tutorials:** you should attend one tutorial each week.

### Required and Recommended Texts and/or Materials

The required text for MATH236 is available for download on

- [Multivariable and Vector Analysis by W.W.L Chen](#)
- [Introduction to Complex Analysis by W.W.L Chen](#)
- [Vector Calculus notes & slides by R.R. Moore & W.W.L Chen](#)

You should download and study these.

The online notes are intended primarily as a source of reference. These are not intended to be treated as the only source for learning.

The following texts provide useful references for various sections of the course:

- Churchill and Brown; *Complex variables and applications*, (McGraw–Hill) library call number QA331 .C524
- Marsden and Tromba; *Vector Calculus*, (Wiley) library call number QA303 .M338

Other similar texts are available in the Library.

## Technology Used and Required

Students are expected to have access to an internet enabled computer with a web browser and Adobe Reader software. Several areas of the university provide wireless access for portable computers. There are computers for student use in the Library and in the [Numeracy Centre \(C5A 255\)](#).

**Difficulties with your home computer or internet connection do not constitute a reasonable excuse for lateness of, or failure to submit, assessment tasks.**

## Unit Schedule

| WEEK | COMPLEX ANALYSIS  | VECTOR CALCULUS       | TASK DUE     |
|------|---|-----------------------|--------------|
| 1    | Complex numbers, polar representation, polynomials, functions | Paths                 |              |
| 2    | Sequences and limits, series                                  |                       |              |
| 3    | Series and convergence tests                                  | Vector Fields         | Assignment 1 |
| 4    | Exponential, logarithm and trigonometric functions            |                       | Assignment 2 |
| 5    | Continuity and differentiation, Cauchy-Riemann equations      | Integrals over paths  |              |
| 6    | Harmonic functions, power series                              |                       |              |
| 7    | Contours and contour integrals, path independence             | Parametrised surfaces | Test 1       |
|      | MID-SEMESTER BREAK  |                       |              |

|    |   |   |              |
|----|---|---|--------------|
| 8  | Cauchy's Theorem, Cauchy's Integral Formula                       | Integrals over surfaces   | Assignment 3 |
| 9  | Applications, Liouville's Theorem, Fundamental Theorem of Algebra |   | Assignment 4 |
| 10 | Singularities, residues, Taylor and Laurent series                | Integration theorems: Green's theorem, Stokes' theorem and Gauss' theorem |              |
| 11 | Evaluation of trigonometric integrals                             |   | Assignment 5 |
| 12 | Further evaluation of real integrals                              |   | Assignment 6 |
| 13 | Revision  | Revision  |              |

## Learning and Teaching Activities

### Lectures

4 one hour lectures per week

### Tutorial

1 one hour tutorial per week

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of 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/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## 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](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

#### Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.
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fields contribute to the development of the mathematical sciences

- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning
- Appropriate interpretation of information communicated in mathematical form
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- Demonstrate an understanding of ethical issues relating to professional mathematical work, identify and address ethical issues arising in such professional work and make ethical decisions while collecting and analysing data and reporting findings.
- Ability to work effectively, responsibly and safely in an individual or team context.

## Assessment tasks

- Six Assignments
- One Test
- Final examination

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

## Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

## Learning outcomes

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## Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

## Learning outcomes

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## Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

### Learning outcomes

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### Learning and teaching activities

- 4 one hour lectures per week
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## Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

## Learning outcomes

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- Application of mathematical principles, concepts, techniques and technology to solve practical and abstract problems.

## Assessment tasks

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- One Test
- Final examination

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

## Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

## Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.
- Understanding of the breadth of the discipline, its role in other fields, and the way other fields contribute to the development of the mathematical sciences
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning
- Ability to formulate and model practical and abstract problems in mathematical terms using a variety of methods from vector calculus and complex analysis.
- Application of mathematical principles, concepts, techniques and technology to solve

practical and abstract problems.

## Assessment tasks

- Six Assignments
- One Test
- Final examination

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

## Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

## Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.
- Understanding of the breadth of the discipline, its role in other fields, and the way other fields contribute to the development of the mathematical sciences
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning
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- Appropriate presentation of information, reasoning and conclusions in a variety of modes to diverse audiences (expert and non-expert).

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- One Test
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## Learning and teaching activities

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- 1 one hour tutorial per week

## Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

### Learning outcomes

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- Ability to work effectively, responsibly and safely in an individual or team context.

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- Final examination

### Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

## Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

## Learning outcomes

- Demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in vector calculus and complex analysis.
- Understanding of the breadth of the discipline, its role in other fields, and the way other fields contribute to the development of the mathematical sciences
- Ability to construct logical, clearly presented and justified mathematical arguments incorporating deductive reasoning
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## Assessment tasks

- Six Assignments
- One Test
- Final examination

## Learning and teaching activities

- 4 one hour lectures per week
- 1 one hour tutorial per week

## Extra requirements

Satisfactory performance on supervised assessment tasks, such as tests and the final exam, is necessary to pass this unit. If there is a significant difference between a student's marks on supervised assessment tasks and on unsupervised assessment tasks, the scaling of these tasks may be adjusted when determining the final grade, to reflect more appropriately that student's performance on supervised tasks.