



# MATH701

## Analysis

S2 Day 2014

*Mathematics*

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### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Lecturer - Unit Convenor

Xuan Duong

[xuan.duong@mq.edu.au](mailto:xuan.duong@mq.edu.au)

Contact via Consultation in office or e-mail

E7A209

Wed 2pm to 3 pm

Credit points

4

Prerequisites

Admission to MRes

Corequisites

Co-badged status

Unit description

This unit provides an advanced introduction to the key areas of research interest in modern analysis. We will study Lebesgue integration, positive Borel measures, and the all important function spaces  $L_p$ . Then we will study the elementary Hilbert space theory and Banach space techniques. This will provide familiarity with some of the major theorems which make up the analysis toolbox: Monotone and Dominated Convergence theorems; Fatou's lemma; Egorov's theorem; Lusin's theorem; Radon-Nikodym theorem; Fubini-Tonelli theorems about product measures and integration on product spaces; Uniform Boundedness; Fundamental Theorem of Calculus for Lebesgue Integrals; Minkowski's Inequality; Holder's Inequality; Jensen's Inequality; and Bessel's Inequality.

## 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:

1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.

2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
4. formulate and model practical and abstract problems in mathematical terms using a variety of methods drawn from analysis and functional analysis.
5. apply mathematical principles, concepts, techniques and technology efficiently to solve practical and abstract problems across a range of areas in analysis and functional analysis.
6. appropriately interpret mathematical information communicated in wide range of forms.
7. present mathematical ideas, information, reasoning and conclusions in forms tailored to the needs of diverse audiences.
8. 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.
9. work effectively, responsibly and safely in individual and team contexts.
10. have a good background in analysis for a PhD program in mathematics.

## Assessment Tasks

Name	Weighting	Due
<a href="#"><u>Assignment 1</u></a>	20%	29/08/2014
<a href="#"><u>Assignment 2</u></a>	20%	19/09/2014
<a href="#"><u>Assignment 3</u></a>	20%	17/10/2014
<a href="#"><u>Assignment 4</u></a>	20%	31/10/2014
<a href="#"><u>Assignment 5</u></a>	20%	14/11/2014

### Assignment 1

Due: **29/08/2014**

Weighting: **20%**

Solve 5 problems

On successful completion you will be able to:

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 4. formulate and model practical and abstract problems in mathematical terms using a variety of methods drawn from analysis and functional analysis.
- 5. apply mathematical principles, concepts, techniques and technology efficiently to solve practical and abstract problems across a range of areas in analysis and functional analysis.
- 6. appropriately interpret mathematical information communicated in wide range of forms.
- 7. present mathematical ideas, information, reasoning and conclusions in forms tailored to the needs of diverse audiences.
- 8. 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.
- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assignment 2

Due: **19/09/2014**

Weighting: **20%**

Solve 5 problems

On successful completion you will be able to:

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 4. formulate and model practical and abstract problems in mathematical terms using a

variety of methods drawn from analysis and functional analysis.

- 5. apply mathematical principles, concepts, techniques and technology efficiently to solve practical and abstract problems across a range of areas in analysis and functional analysis.
- 6. appropriately interpret mathematical information communicated in wide range of forms.
- 7. present mathematical ideas, information, reasoning and conclusions in forms tailored to the needs of diverse audiences.
- 8. 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.
- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assignment 3

Due: **17/10/2014**

Weighting: **20%**

Solve 5 problems

On successful completion you will be able to:

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 4. formulate and model practical and abstract problems in mathematical terms using a variety of methods drawn from analysis and functional analysis.
- 5. apply mathematical principles, concepts, techniques and technology efficiently to solve practical and abstract problems across a range of areas in analysis and functional analysis.
- 6. appropriately interpret mathematical information communicated in wide range of forms.
- 7. present mathematical ideas, information, reasoning and conclusions in forms tailored to the needs of diverse audiences.

- 8. 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.
- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assignment 4

Due: **31/10/2014**

Weighting: **20%**

Solve 5 problems

On successful completion you will be able to:

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 4. formulate and model practical and abstract problems in mathematical terms using a variety of methods drawn from analysis and functional analysis.
- 5. apply mathematical principles, concepts, techniques and technology efficiently to solve practical and abstract problems across a range of areas in analysis and functional analysis.
- 6. appropriately interpret mathematical information communicated in wide range of forms.
- 7. present mathematical ideas, information, reasoning and conclusions in forms tailored to the needs of diverse audiences.
- 8. 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.
- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assignment 5

Due: **14/11/2014**

Weighting: **20%**

Solve 5 problems

On successful completion you will be able to:

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
- 4. formulate and model practical and abstract problems in mathematical terms using a variety of methods drawn from analysis and functional analysis.
- 5. apply mathematical principles, concepts, techniques and technology efficiently to solve practical and abstract problems across a range of areas in analysis and functional analysis.
- 6. appropriately interpret mathematical information communicated in wide range of forms.
- 7. present mathematical ideas, information, reasoning and conclusions in forms tailored to the needs of diverse audiences.
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- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Delivery and Resources

Lecture Time: Tue 10 am - 12 noon (AGR room in Building E6A)

Main textbook: Walter Rudin's Real and Complex Analysis

References:

Rudin's Principles of Mathematical Analysis

Simmons's Introduction to Topology and Modern Analysis

Royden's Real Analysis

## 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

### PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

### Learning outcomes

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
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- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Assignment 5

## PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

## Learning outcomes

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
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- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Assignment 5

## PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

## Learning outcomes

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
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- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Assignment 5

## PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

## Learning outcomes

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
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- 9. work effectively, responsibly and safely in individual and team contexts.
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## Assessment tasks

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- Assignment 2
- Assignment 3
- Assignment 4
- Assignment 5

## PG - Engaged and Responsible, Active and Ethical Citizens

Our postgraduates will be ethically aware and capable of confident transformative action in relation to their professional responsibilities and the wider community. They will have a sense of connectedness with others and country and have a sense of mutual obligation. They will be able to appreciate the impact of their professional roles for social justice and inclusion related to national and global issues

This graduate capability is supported by:

## Learning outcomes

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
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- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Assignment 5

## PG - Capable of Professional and Personal Judgment and Initiative

Our postgraduates will demonstrate a high standard of discernment and common sense in their professional and personal judgment. They will have the ability to make informed choices and decisions that reflect both the nature of their professional work and their personal perspectives.

This graduate capability is supported by:

## Learning outcomes

- 1. demonstrate a well-developed knowledge of the principles, concepts and techniques of a broad range of areas in analysis and applied mathematics, with significant depth in analysis and functional analysis.
- 2. demonstrate an understanding of the breadth of mathematics, the multi-disciplinary role of mathematics and the way it contributes the development in other fields of study.
- 3. construct sustained logical, clearly presented and justified mathematical arguments incorporating deductive reasoning.
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- 9. work effectively, responsibly and safely in individual and team contexts.
- 10. have a good background in analysis for a PhD program in mathematics.

## Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Assignment 4
- Assignment 5

## Changes since First Published

Date	Description
04/08/2014	The section of unit outcomes was separated into 10 points