

## Math 4A3-6A3 / Real Analysis II

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<https://ms.mcmaster.ca/courses/20182019/term1/math4a03/>

This course continues the study of functions of a real variable that was started in Math 3A03. The unifying concept in this class is the idea of a Metric Space. The most familiar metric spaces are the real number line and Euclidean space, but our real interest is in function spaces: metric spaces whose points are actually functions, such as the space of continuous functions on an interval. We will see in which ways these metric spaces are similar to familiar Euclidean spaces, and also how they are different. I hope to give some examples of how to use analysis to solve linear or nonlinear differential equations; to discuss Fourier Series and its convergence; and to give a brief introduction to Lebesgue measure theory. As for Math 3A03, this is a theoretical course in the foundations of analysis: the emphasis will be on making rigorous definitions, proving theorems, and illustration via key examples.

### Course Objectives:

Students will be expected...

- to learn precise statements of definitions and theorems in analysis and to use examples and counterexamples to illustrate their content.
- to give complete, logical proofs of simple propositions related to the definitions and theorems presented in class

A further goal of the course is to prepare students for graduate study in mathematics.

### Format:

This is a lecture course meeting 3 times per week. The lectures form the essential content of the course, and you are responsible for all material covered in lectures (unless otherwise indicated.) Most of the material can be found in the textbook, but the lectures will deviate from the book in content or ordering of material. If you miss a lecture, it is your responsibility to find out (from a classmate) what has been covered in your absence.

### Homework and Preparedness:

Practice problems will be assigned each week. You are expected to be able to solve them yourselves, as the only way to master mathematics is by doing enough examples and exercises that you feel comfortable with the material. Solutions will not be posted. On certain days, a problem will be **announced in class**, and the class will be asked as a group to **provide a solution on the following class day**. The test and exam questions will resemble the practice problems.

### Text:

"Real Analysis", by N.L. Carothers. Cambridge University Press (publishers), ISBN 0-521-49756-6.

## Topics:

This is meant as a general outline of topics. The actual material may differ slightly according to the pace of the course. The order and timing is approximate and is very likely to change. A selection of the material in these chapters of the text will be covered.

1. Metric space theory.  
Chapters 3--8
2. Spaces of continuous functions  
Chapters 10--12
3. Application: Fourier Series  
Chapter 15
4. An introduction to Lebesgue integration  
Chapters 16--18 (selections)

## Evaluation:

- 🌐 Three tests during the semester. The tentative test dates are:

Thursday September 27<sup>th</sup> in class

Tuesday October 30<sup>th</sup> in class

Thursday November 22<sup>nd</sup> in class

- 🌐 Cumulative final exam.

## Grading:

The formula for the course grade is as follows:

3 tests @ 22% each	=66%
Final Examination	=34%
	100%

Other formulae may be considered; your final grade will not be less than the result of the scheme given above.

As per the **McMaster Undergraduate Course Management Policies**, included below are the statements on:

1. Academic Integrity,
2. Academic Accommodation of Students with Disabilities,
3. the Requests for Relief for Missed Academic Term Work statement,
4. the Academic Accommodation for Religious, Indigenous or Spiritual Observances and
5. the Extreme Circumstances.

1. You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic

credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at <http://www.mcmaster.ca/academicintegrity>.

The following illustrates only three forms of academic dishonesty:

- Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

2. Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca). For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

3. In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

4. Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

5. The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.