UNIVERSITY OF LINCOLN

Ideas of Mathematical Proof 2023-24

1. Basic Module Data

Module Title	Ideas of Mathematical Proof
School/Department	School of Mathematics and Physics
Academic Year	2023-24
Module Code	MTH1003M
Subject	100403: Mathematics
Credit Rating	15
Level	Level 4
Pre-Requisites	No Pre-requisites have been specified for this module
Co-Requisites	No Co-requisites have been specified for this module
Barred Combinations	No Barred Combinations have been specified for this module
Module Coordinator	Evgeny Khukhro
Approval Status	Approved
Programmes in which module appears	Mathematics BSc (Hons) 2023-24 Mathematics MMath 2023-24 Mathematics with Philosophy BSc (Hons) 2023-24

2. Module Synopsis

The purpose of this module is to introduce students to basic mathematical reasoning such as rigorous definitions and proofs, logical structure of mathematical statements. Students will be learning the set-theoretic notation, getting acquainted with various strategies of mathematical proofs such as proof by mathematical induction or proof by contradiction. Rigorous definitions of limits of sequences and functions will form a foundation for other courses on calculus and differential equations. The importance of definitions and proofs will be illustrated by examples of "theorems" which may seem obvious but are actually false, as well as certain mathematical "paradoxes".

3. Outline Syllabus

Mathematical notation, statements and proofs.

Mathematical Induction.

Basic Set Theory.

Elementary Logic and Proof Strategies.

Further Set Theory.

Limits of Sequences and Functions.

4. Module Learning Outcomes

On successful completion of this module a student will be able to:

LO1	Formulate and use standard set-theoretic and logical notation
LO2	Construct proofs by contradiction and by mathematical induction
LO3	Formulate the definitions of various types of mappings, prove standard results on cardinalities
LO4	State the rigorous definition of a limit of a sequence or a function; find limits by using their arithmetic properties

5. Learning and Teaching Strategy/Methods

The total student effort for this module is 150 hours on average. This total includes: lectures, during which students will also be directed towards recommended reading materials and online resources; tutorials, where students are encouraged to attempt related problems in advance of the session and to be prepared to ask and answer questions relating to the material; the remaining time is allocated for student-centred learning, the completion of coursework and exam preparation.

6. Assessment

The module will be assessed by the written exam and portfolio. The portfolio component will consist of the students being continuously assessed throughout the module on specified discrete elements associated with problem-solving tasks.

Assessment Method	Weighting	LO's tested	Assessment Hand In Week	Group Work?	Final Assessment (✓)
Portfolio	40 %	LO1, LO2, LO3	30	No	
In-class Test	60 %	LO2, LO3, LO4	EP 2 (Wks 33, 34, 35)	No	✓

7. Professional, Statutory and Regulatory Body Requirements

There are no PSRB requirements for this module

8. Indicative Reading

Below is a list of the learning resources for the module taken from the University's Talis Aspire system.

To view the resources in more detail for this module in the Talis Aspire system please copy and paste the below URL into your internet browser:

https://lincoln.rl.talis.com/search.html?q=MTH1003M

An introduction to mathematical reasoning: numbers, sets, and functions
Eccles, P.J. (1997) An introduction to mathematical reasoning: numbers, sets, and functions. Cambridge: Cambridge University Press.

Fermat's last theorem: the story of a riddle that confounded the world's greatest minds for 358 years
Singh, S. (2002) Fermat's last theorem: the story of a riddle that confounded the world's greatest minds for 358 years. London: Fourth Estate.

How to solve it: a new aspect of mathematical method
Pâolya, G. (2004) How to solve it: a new aspect of mathematical method. Expanded Princeton Science Library edition. Princeton: Princeton UNiversity Press.

Polya, G. and Conway, J.H. (2004) How to solve it: a new aspect of mathematical method. Expanded Princeton Science Library edition. Princeton, New Jersey: Princeton University Press.

Understanding mathematical proof

Taylor, J., Garnier, R. and ProQuest (Firm) (2014) Understanding mathematical proof. Boca Raton, Florida: CRC Press.

9. Version History

Version	Date	Details
2.0	15 August 2022	Module assessment “Exam” method changed to a more authentic assessment method - approved via College of Science CAAC.