MATH0003 (Analysis 1)

Year:	2019–2020
Code:	MATH0003
Old code:	MATH1101
Level:	4 (UG)
Normal student group(s):	UG: Year 1 Mathematics degrees
Value:	15 credits (= 7.5 ECTS credits)
Term:	1
Structure:	3 hours lectures and 1 hour problem class per week, plus 2 hour optional help class. Small group tutorials. Weekly assessed coursework.
Assessment:	The final weighted mark for the module is given by: 90% examination, 10% coursework. The coursework mark is obtained from exercise sheet marks (5%) and the mid-sessional examination result (5%). In order to pass the module you must have at least 40% for both the examination mark and the final weighted mark.
Normal pre-requisites:	A* in A-level Mathematics and Further Mathematics
Lecturer:	Prof L Parnovski
Problem class teacher:	Dr C Bellettini

Course Description and Objectives

Starting only with the basic properties of real numbers, rigorous proofs are given of the main results in elementary differential calculus. Topics covered include sequences, series, continuity and differentiability of functions and the properties of the exponential function.

This course has two main aims:

(a) To begin the study of analysis, continued in MATH0004 (previously MATH1102) and MATH0013 (previously MATH2101). Mathematical analysis is one of the most important and well-developed strands of pure mathematics with many elegant and beautiful theorems, and also with applications to many areas of mathematics and mathematical physics.

(b) To introduce students to the ideas of *formal* definitions and *rigorous* proofs (one of the fundamental features of modern mathematics, and something that is not familiar from A-level), and to develop their powers of logical thinking.

Recommended Texts

The recommended text is Haggarty, *Fundamentals of Mathematical Analysis* (2nd edition). Other recommended books are (i) Binmore, *Introduction to Mathematical Analysis* (CUP); (ii) M. Spivak, *Calculus* (Publish or Perish); (iii) R. Bartle and D. Sherbert, *Introduction to Real Analysis* (Wiley); (iv) M H Protter and C B Morrey, *A first course in real analysis* (Springer).

Detailed Syllabus

- Basic properties of $\mathbb{R}$: least upper bounds.
- Sequences and convergence. Monotone sequences. The Bolzano-Weierstrass theorem.

- Series and convergence tests. The binomial theorem and the exponential series.
- Functions. Boundedness and continuity, the intermediate value theorem and inverses. The logarithm and powers.
- Differentiation. Definition and basic properties; the chain rule etc. The derivatives of the exponential and logarithm.
- Rolle's Theorem and the Mean Value Theorem.