

# MATH0010 Mathematical Methods 1

<i>Year:</i>	2021–2022
<i>Code:</i>	MATH0010
<i>Level:</i>	4 (UG)
<i>Normal student group(s):</i>	UG: Year 1 Mathematics degrees
<i>Value:</i>	15 credits (= 7.5 ECTS credits)
<i>Term:</i>	1
<i>Assessment:</i>	The final weighted mark for the module is given by: 80% examination, 5% online elementary techniques test, 10% coursework, 5% mid-term problem sheet. The coursework mark is obtained from exercise sheet marks and the mid-session examination result. In order to pass the module you must have at least 40% for both the examination and the final weighted mark, and must also pass the elementary techniques test.
<i>Normal Pre-requisites:</i>	A* in A-level Mathematics and Further Mathematics
<i>Lecturer:</i>	Prof R Halburd

## *Course Description and Objectives*

The aim of the course is to bring students from a background of diverse A-level syllabuses to a uniform level of confidence and competence in vectors, complex numbers, calculus and differential equations. The course covers vectors, complex numbers, standard functions of a real variable, methods of integration, ordinary differential equations and probability. Each topic is given a formal treatment and illustrated by examples of varying degrees of difficulty.

The *elementary techniques test* will be run online and may be taken multiple times during the term. It will consist of 10 basic calculational questions; you must get at least 9 correct answers to pass. It is necessary to pass this test **in order to pass the module**.

## *Recommended Texts*

- (i) Safier, *Precalculus*.
- (ii) Spiegel, *Advanced Calculus*.
- (iii) Ayres, *Differential Equations* (all Schaum's Outline Series).
- (iv) Gilbert, Jordan, Towers *Guide to Mathematical Methods* (Palgrave Macmillan).
- (v) Riley, Hobson, and Bence, *Mathematical Methods for Physics and Engineering* (Cambridge University Press).
- (vi) Kreyszig, *Advanced Engineering Mathematics* (Wiley).
- (vii) Stephenson, *Mathematical Methods for Science Students* (Prentice Hall).
- (viii) Stirzaker, *Probability and Random Variables: A Beginner's Guide* (Cambridge University Press).

*Detailed Syllabus*

**Vector algebra:** Scalar and vector products including triple products. Cartesian components. Applications to 3-dimensional geometry: lines and planes.

**Complex numbers:** Argand diagram, loci, roots of unity, geometry.

**Revision of simple functions:** Powers, exponentials, trig, hyperbolic. Differentiation. Maclaurin and Taylor series. Elementary properties of plane curves, curve sketching.

**Systematic revision of integration:** Partial fractions, by parts, substitution. Definite and indefinite integrals. Improper integrals.

**Functions of several variables:** Surface sketching, partial and directional derivatives, gradient of a function, level surfaces and tangent planes.

**Introduction to ordinary differential equations:** First order (linear and non-linear). Second order reducible to first order. Linear equations of second and higher order (particular integral and complementary function).

**Probability:** Sets. Sample spaces. Probability. Binomial distribution. The Poisson distribution. Normal distribution.