

MATH0012 Mathematical Methods for Arts and Sciences

<i>Year:</i>	2024–2025
<i>Code:</i>	MATH0012
<i>Level:</i>	4 (UG)
<i>Normal student group(s):</i>	UG: Students outside Mathematics
<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: 85% examination, 15% weekly coursework.
<i>Normal Pre-requisites:</i>	A in A-level Mathematics
<i>Lecturer:</i>	Dr L Rila

Course Description and Objectives

The aim of this course is to bring students from a background of diverse A-level (and similar) syllabuses to a uniform level of confidence and competence in basic calculus, a subject which is of basic importance not only in most areas of mathematics, but also in science in general. It is designed for BAsc students, and covers topics with an eye kept on both the other first-year modules and the options available further down students' chosen pathways. The course covers complex numbers, standard functions of a real variable, methods of integration and an introduction to ordinary differential equations. Each topic is given a formal treatment and illustrated by examples of varying degrees of difficulty. It is intended that the approach to the subject matter should also stimulate those with an extensive A-level background. It is a demanding course, intending to bring students to a level where they are able to join courses offered by departments in the MAPS faculty with the rest of that department's cohort.

Recommended Texts

The recommended texts are (i) Robert C. Wrede and Murray R. Spiegel, *Advanced Calculus* (Schaum Outline Series, 3rd edition); (ii) Frank Ayres, *Differential Equations* (Schaum Outline Series, 5th edition); (iii) Erwin Kreyszig, *Advanced Engineering Mathematics* (Wiley, 9th edition); (iv) Grossman and Derrick, *Advanced Engineering Mathematics* (Harper and Rowe); and (v) G. Stephenson, *Mathematical Methods for Science Students* (Longman).

Students are advised not to purchase books until the first lecture, when the merits of doing so will be discussed. Realistically, all of the topics covered in the course can be found in any first-year undergraduate calculus book, not to mention online. The recommended texts can be found (in some edition) in either the maths department or science libraries.

Detailed Syllabus

Differentiation: from first principles, revision of material from A-level, hyperbolic functions, Taylor series.

Integration: from first principles, partial fractions, integration by substitution, integration by parts, integration by reduction formulæ, improper integrals.

Complex numbers: history and motivation, Argand diagram, exponential representation (feat. Euler's identity), roots of complex numbers.

Differential equations: linear and nonlinear first order ordinary differential equations, linear second order ordinary differential equations with constant coefficients (complementary function and particular integral).

Matrices: matrix operations, matrix transformations, inverse matrices, eigenvalues and eigenvectors, invariant lines and points

March 2024 MATH0012