

Liverpool John Moores University

Title: MATHEMATICAL METHODS
Status: Definitive
Code: **4001MATHS** (103217)
Version Start Date: 01-08-2016

Owning School/Faculty: Applied Mathematics
Teaching School/Faculty: Applied Mathematics

Team	Leader
Vincent Kwasnica	Y

Academic Level: FHEQ4 **Credit Value:** 24 **Total Delivered Hours:** 75
Total Learning Hours: 240 **Private Study:** 165

Delivery Options

Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Practical	24
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Report on functions and analysis supplemented with considerable mathematical analysis, problem solving and investigation.	15	
Report	AS2	Report on calculus, vector methods and complex methods supplemented with considerable mathematical analysis, problem solving and investigation.	15	
Exam	AS3	Examination	70	3

Aims

To provide a thorough grounding in the basic mathematical concepts and methods needed to solve a range of problems with scientific, business and statistical applications.

To introduce the appropriate use of mathematical and other software to support conceptual understanding and problem solving. e.g. DERIVE.

To develop a firm foundation for single variable calculus.

To provide a basic grounding in vector algebra.

To introduce the concepts of complex numbers and their application.

To introduce multivariate calculus.

To introduce methods for solving ordinary first and second order differential equations.

Learning Outcomes

After completing the module the student should be able to:

- 1 Formulate and solve problems using fundamental mathematical methods.
- 2 Apply mathematical analysis to investigate functions using the rules of calculus.
- 3 Apply the theory of differentiation, integration, differential equations, elementary vector algebra and complex numbers to solving problems.
- 4 Use a relevant computer package (e.g. DERIVE) to analyse functions and derive series expansions.
- 5 Use a relevant computer package (e.g. DERIVE) to investigate fundamental mathematical concepts.
- 6 Use a relevant computer package (e.g. DERIVE) to solve problems.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Functions and analysis	2	5
Maths methods	3	6
Examination	1	4

Outline Syllabus

Elementary treatment of functions: Linear; quadratic; exponential; logarithmic; trigonometric and hyperbolic functions. Application of functions to solving problems. Sketching, plotting and interpreting graphs

Differentiation: Limits, continuity, derivatives from first principles, differentiability.

Rules of Differentiation: Product, Quotient, Chain, Implicit, Parametric, Logarithmic.

Applications of Differentiation: maxima and minima, curve sketching, finding normals & tangents.

Series: Arithmetic and geometric progressions, Maclaurin series, Taylor series and regions of convergence.

The Riemann Sum, the fundamental theorem of calculus, rules of integration,

applications of integration.

Vectors: Vector algebra, equation of a line, scalar product, vector product, equation of a plane, volume of parallelepiped using determinants.

Complex Numbers: Arithmetic of, conjugates, modulus and arguments, Argand diagram, Cartesian and polar form, Euler's formula.

Multivariate calculus: Partial differentiation; chain rule, critical points, second derivative test.

Ordinary differential equations: First order; variables separable, integrating factor.

Second order; constant coefficients, complementary function, particular integral, method of undetermined coefficients.

Students will be encouraged throughout to use with understanding any appropriate software (e.g. DERIVE) to aid conceptual understanding and give confidence in problem solving.

Learning Activities

Lectures, tutorials and laboratory-based activities.

Notes

The foundations of mathematics (concentrating particularly on functions and calculus) are covered here using software support as appropriate. Development of confident use of computer algebra software is established.

The module provides an introduction to some of the mathematical methods required for the solution of problems in Applicable Mathematics. The mathematical software Derive is used extensively throughout this module.