The University of Manchester

MATH10131 – 2014/2015

Calculus and Vectors B

Unit code:	MATH10131
Credit Rating:	15
Unit level:	Level 1
Teaching period(s):	Semester 1
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

Co-Requisite

- MATH10111 - Sets, Numbers and Functions B (Compulsory)

Aims

The course unit unit aims to provide an introduction to the basic elements of calculus.

Overview

This lecture course introduces the basic ideas of complex numbers relating them the standard transcendental functions of calculus. The basic ideas of the differential and integral calculus are revised and developed. Vectors in two and three dimensions are introduced and this leads on to the calculus of functions of more than one variable and the beginnings of vector calculus.

Assessment methods

- Other - 25%
- Written exam - 75%

Assessment Further Information

Supervision attendance and participation; Weighting within unit 10%

Coursework; One in-class test, weighting within unit 15%

Two and a half hours end of semester examination; Weighting within unit 75%

Learning outcomes

On successful completion of this module students will have acquired an active knowledge and understanding of some basic concepts and results in calculus.

Syllabus

- Numbers and Functions. Basic algebra of real and complex numbers; real line and complex plane; graphs and curve sketching; functions, domain and range, inverse functions; standard functions and inverse functions; basic algebra of real and complex numbers.
- Limits and Differentiation. Basic notion of limit and continuity; discontinuities, left and right limits; finding some limits; definition of derivative; derivatives of standard functions and their inverses; sums, products, quotients and the chain rule; implicit functions; logarithmic differentiation; higher derivatives (use in curve sketching).
- Infinite Series. Notation, basic notions of convergence, radius of convergence; infinite Taylor's series; expansions for standard functions.
- More on Complex Numbers. Euler's Theorem and De Moivre's Theorem; polar form of complex numbers (polar representation of the plane); roots of unity; complex forms of sin and cos, relationship to trigonometric identities.
- Integration. Definite and indefinite integrals; Fundamental Theorem of Calculus; techniques: linearity, integration by parts, partial fractions, substitution; lengths of curves, surfaces and volumes of revolution.
- Vectors in 2 and 3 Dimensions. Representation as directed line segments (magnitude, direction); choice of axes, components, Cartesian representation; basic properties, addition, subtraction, polar representation and relationship with complex numbers in 2 dimensions; scalar and vector product; representation of lines, planes, curves and surfaces.
- Functions of more than One Variable. Partial derivative, chain-rule, Taylor expansion; turning points (maxima, minima, saddle-points); grad, div and curl and some useful identities in vector calculus; integration in the plane, change of order of integration; Jacobians and

change of variable; line integrals in the plane; path-dependence, path independence; Stokes' theorem and Green's theorem.

Recommended reading

The course is based on the following text:

- James Stewart, Calculus, Early Transcendentals, Thomson, fifth edition (international student edition), 2003.

Notes will be issued for the material not covered in the course text.

Study hours

- Lectures - 33 hours
- Tutorials - 11 hours
- Independent study hours - 106 hours

Teaching staff

Sergei Fedotov - Unit coordinator