Course information 2018–19
MT2176 Further calculus (half course)

This half course provides students with useful techniques and methods of calculus and enables students to understand why these techniques work. Throughout, the emphasis is on the theory as well as the methods.

Prerequisite

If taken as part of a BSc degree, courses which must be passed before this course may be attempted:

MT1174 Calculus

Exclusion

This half course may not be taken with MT3095 Further mathematics for economists.

Aims and objectives

The objectives specifically include:
- enable students to acquire further skills in the techniques of calculus,
- enable understanding of the principles underlying the subject of calculus,
- prepare students for further courses in mathematics and/or related disciplines (e.g. economics, actuarial science).

Assessment

This course is assessed by a two-hour unseen written examination.

Learning outcomes

At the end of the course and having completed the essential reading and activities students should be able to:

- ☑ demonstrate knowledge of the subject matter, terminology, techniques and conventions covered in the subject,
- ☑ demonstrate an understanding of the underlying principles of the subject,
- ☑ demonstrate the ability to solve problems involving an understanding of the concepts.

Essential reading

For full details, please refer to the reading list

Adam Ostaszewski *Advanced Mathematical Methods.* (Cambridge: Cambridge University Press, 1990) [0521289645].

Ken Binmore and Joan Davies *Calculus: Concepts and Methods.* (Cambridge (Cambridge: Cambridge University Press, 2002) [0521775418].

Syllabus

This is a description of the material to be examined. On registration, students will receive a detailed subject guide which provides a framework for covering the topics in the syllabus and directions to the essential reading

This course follows on from Calculus and Algebra, and continues further the study of calculus techniques and theory. The course will develop further the theory of functions, and will also include some new practical skills, such as how to evaluate double integrals and how to use Laplace transforms to solve differential equations.

***Functions of one variable*:** Limits; continuity; differentiability; Taylor's Theorem; L'Hôpital's rule.

***The Riemann integral*:** The definition of the Riemann integral; the Fundamental Theorem of Calculus.

Improper integrals: The definition of an improper integral; tests for the convergence of an improper integral with a positive integrand (including the direct comparison test and the limit comparison test); absolute convergence of improper integrals with an integrand of variable sign.

***Double integrals*:** Double integrals; repeated integrals; change of variable techniques.

***Manipulation of integrals*:** Joint continuity and the manipulation of proper integrals; dominated convergence and the manipulation of improper integrals; the Leibniz rule for differentiating an integral.

Laplace transforms: The definition of the Laplace transform; functions of at most exponential growth; standard Laplace transforms; properties of the Laplace transform; the Gamma function; using Laplace transforms to solve differential equations; convolutions and the Convolution Theorem; the Beta function.