Course information 2023-24

MT1174 Calculus

General information

COURSE LEVEL: 4

CREDIT: 30

NOTIONAL STUDY TIME: 300 hours

Summary

This unit develops a student's proficiency in working with the mathematical methods of calculus, and it investigates some applications to problems in economics, management and related areas. The unit also develops the student's understanding of the theoretical concepts behind these methods.

Conditions

Exclusions: You may not register for this course in the same year as:

- MT105a Mathematics 1
- MT105b Mathematics 2
- MT1186 Mathematical methods

Aims and objectives

The objectives specifically include:

- to enable students to acquire skills in the methods of calculus (including multivariate calculus), as required for their use in further mathematics subjects and economics-based subjects
- to prepare students for further units in mathematics and/or related disciplines

Learning outcomes

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

- use the concepts, terminology, methods and conventions covered in the unit to solve mathematical problems in this subject,
- solve unseen mathematical problems involving understanding of these concepts and application of these methods
- see how calculus can be used to solve problems in economics and related subjects
- demonstrate knowledge and understanding of the underlying principles of calculus.

Essential reading

Please consult the current EMFSS Programme Regulations for further information on the availability of a course, where it can be placed on your programme's structure, and other important details.

For full details, please refer to the reading list.

Binmore, K. and J. Davies *Calculus*. (Cambridge: Cambridge University Press, 2011) second revised edition [ISBN 978-0521775410]

Anthony, M. and N. Biggs *Mathematics for Economics and Finance*. (Cambridge: Cambridge University Press, 1996) [ISBN 978-0521559133]

Assessment

This course is assessed by a three-hour and fifteen-minute closed-book written examination.

Syllabus

This unit develops basic mathematical methods and concepts of calculus and will include their applications to problems in economics, management and related areas.

Basics: Revision of basic algebra; powers; sets; functions (including trigonometric functions); graphs; factorisation; inverse and composite functions; exponential and logarithm functions; conic sections; trigonometric identities.

Differentiation: The meaning of the derivative; standard derivatives; Product rule, quotient rule and chain rule; Tangent lines; Taylor series; using derivatives for approximations; marginals; elasticities.

One-variable optimisation: First-order conditions; first and second-order tests for nature of a critical point; convexity and concavity; profit maximisation; the effects of taxation; curve sketching.

Integration: Indefinite integrals; Definite integrals; Standard integrals; Substitution method (including trigonometric substitutions); Integration by parts; Partial fractions; consumer and producer surplus.

Functions of several variables: Contours, principal sections and partial derivatives; chain rule, homogeneous functions, gradient vectors, directional derivatives, tangent planes, Taylor series.

Multivariate optimisation: unconstrained optimisation; convex and concave functions; constrained optimisation; applications of unconstrained and constrained optimisation; the meaning of Lagrange multipliers.

Differential equations: Separable equations; first-order linear equations; homogeneous equations; exact equations; second-order equations with constant coefficients; systems of first-order equations; some applications.

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