

MA259-10 Multivariable Calculus

26/27

Department

Warwick Mathematics Institute

Level

Undergraduate Level 2

Module leader

Tim Sullivan

Credit value

10

Module duration

10 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

Mathematical Analysis is the heart of modern Mathematics. This module is the final in a series of modules where the subject of Analysis is rigorously developed in many dimensional setting.

Module aims

extend the analysis of one variable from the first year to the multivariable context.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Different notions of continuity of functions of several variables
- Quantitative Linear Algebra in terms of norms
- Different notions of differentiability of functions of several variables
- Chain rule, (generalised) mean value inequality and other properties of differentiable functions
- Inverse Function Theorem and Implicit Function Theorem, with applications to regular curves and hypersurfaces

- Vector Fields and the theorems of Green, Gauss and Stokes, with some applications to PDEs.
- Maxima, minima and saddles and constrained critical points.

Learning outcomes

By the end of the module, students should be able to:

- learn the basic concepts, theorems and calculations of multivariable analysis
- understand the Implicit and Inverse Function Theorems and their applications
- acquire a working knowledge of vector fields and the Integral Theorems of Vector Calculus
- learn how to analyse and classify critical points using Taylor expansions

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

Multivariable Analysis gives students tools to do rigorous Analysis in higher dimensional spaces. Students will learn definitions, theorems and calculations with vector-valued functions of many variables, for instance, Inverse and Implicit Function Theorems, vector fields, maxima, minima and saddles.

Transferable skills

Students will acquire key reasoning and problem solving skills, empower them to address new problems with confidence.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (30%)
Seminars	9 sessions of 1 hour (9%)
Private study	11 hours (11%)
Assessment	50 hours (50%)
Total	100 hours

Private study description

Self review of lecture notes

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D1

	Weighting	Study time	Eligible for self-certification
Assignments	15%	20 hours	Yes (waive)
Centrally-timetabled examination (On-campus)	85%	30 hours	No

- Answerbook Pink (12 page)

Assessment group R1

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit	100%		No

Feedback on assessment

Marked homework (both assessed and formative) is returned and discussed in smaller classes. Exam feedback is given.

[Past exam papers for MA259](#)

Availability

Courses

This module is Optional for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- Year 2 of UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
 - Year 2 of GF13 Mathematics and Physics
 - Year 2 of FG31 Mathematics and Physics (MMathPhys)
- Year 2 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 2 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)

This module is Option list B for:

- Year 2 of UCSA-G4G1 Undergraduate Discrete Mathematics
- UCSA-G4G3 Undergraduate Discrete Mathematics
 - Year 2 of G4G1 Discrete Mathematics
 - Year 2 of G4G3 Discrete Mathematics
- Year 3 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 3 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics
- Year 4 of USTA-Y603 Undergraduate Mathematics, Operational Research, Statistics, Economics (with Intercalated Year)

This module is Option list C for:

- Year 2 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- Year 2 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics