



MATH20122

General Information

- Title: Metric Spaces
- Unit code: MATH20122
- Credit rating:10
- Level: 2
- Pre-requisite units:MATH 20101 or MATH 20111
- Co-requisite units:
- School responsible: Mathematics
- Member of staff responsible:Roger Plymen

Unit specification

Aims

The programme unit aims to introduce the basic ideas of metric spaces.

Brief description

A metric space is a set together with a good definition of the distance between each pair of points in the set. Metric spaces occur naturally in many parts of mathematics, including geometry, fractal geometry, topology, functional analysis and number theory. This lecture course will present the basic ideas of the theory, and illustrate them with a wealth of examples and applications.

This course unit is strongly recommended to all students who intend to study pure mathematics and is relevant to all course units involving advanced calculus or topology.

Intended learning outcomes

On completion of this unit successful students will be able to:

- deal with various examples of metric spaces;
- have some familiarity with continuous maps;
- work with compact sets in Euclidean space;
- work with completeness;
- apply the ideas of metric spaces to other areas of mathematics.

Future topics requiring this course unit

A wide range of course units in analysis, dynamical systems, geometry, number theory and topology.

Syllabus

1. Metric spaces. Euclidean metric, Manhattan metric, discrete metric, post office metric, chessboard distance, word metric, sup metric, p-adic metric. Bounded sets, open sets, closed sets, sequences and convergence. Closure points, frontier. Dense sets. Equivalent metrics. [8]

2. Uniform Convergence. Examples. [2]

3. Continuous maps. Definition and examples. Relationship with open sets, sequences. [4]

4. Compactness. Continuous maps on compact sets in Euclidean space. [4]

5. Completeness. Cauchy sequences and completeness. Banach' s fixed point theorem (the contraction mapping theorem).

Textbooks

F. Morgan, Real Analysis, American Mathematical Society, 2005. (Parts I, II and IV).

Learning and teaching processes

Two lectures and one example class each week.

Assessment

Coursework Weighting within unit 20%

2 hours end of semester examination; Weighting within unit 80%

Arrangements
