MANCHESTER 1824
The University of Manchester

MATH10111 – 2014/2015

Sets, Numbers and Functions B

Unit code:	MATH10111
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

- MATH10131 - Calculus and Vectors B (Compulsory)

Aims

The aims of this course are to provide a basic introduction to various methods of proof used in mathematics and to the fundamental ideas in the study of sets, numbers and functions.

Overview

This lecture course is intended to introduce students to the concept of "proof". The objects of study, sets, numbers and functions, are basic to almost all Mathematics.

Assessment methods

- Other - 25%

- Written exam - 75%

Assessment Further Information

- Supervision attendance and participation; Weighting within unit 10%
- Coursework; 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 be

- familiar with and able to manipulate the basic concepts of Pure Mathematics such as sets and functions;
- able to construct elementary proofs of mathematical statements utilizing inductive arguments and arguments by contradiction;
- able to understand proofs of such results at the Fundamental Theorem of Arithmetic and the Euclidean Algorithm;
- familiar with the definitions and know some examples of groups and fields.

Syllabus

The language of mathematics. Mathematical statements, quantifiers, truth tables, proof.

Number theory I. Prime numbers, proof by contradiction

Proof by induction. Method and examples.

Set Theory. Sets, subsets, well known sets such as the integers, rational numbers, real numbers.Set Theoretic constructions such as unions, intersections, power sets, Cartesian products.

Functions. Definition of functions, examples, 1-1 and onto functions, bijective functions, composition of functions, inverse functions.

Counting. Counting of (mostly) finite sets, inclusion-exclusion principle, pigeonhole principle, binomial theorem.

Euclidean Algorithm. Greatest common divisor,proof of the Euclidean Algorithm and some consequences, using the Algorithm.

Congruence of Integers. Arithmetic properties of congruences,solving certain equations in integers.

Relations. Examples of various relations,reflexive, symmetric and transitive relations. Equivalence relations and equivalence classes. Partitions.

Number Theory II. Fundamental theorem of Arithmetic, Fermat's little theorem.

Binary Operations. Definition and examples of binary operations. Definition of groups and fields with examples. Proving that integers mod p (p a prime) give a finite field.

Recommended reading

The course is based on the following text:

P.J. Eccles, An Introduction to Mathematical Reasoning: Numbers, Sets and Functions, Cambridge University Press, 1997.

Study hours

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

Teaching staff

Charles Eaton - Unit coordinator