UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics for Teaching - Algebra

2324-1-F0601Q096

Aims

The course “Matematica per l’insegnamento - Algebra” and his twin “Matematica per l’insegnamento - Geometria” are aimed at future teachers of mathematics an sciences. The aim of the course is to revisit in a rigorous way with proofs the mathematics of the elementary and secondary schools, with emphasis on the historical and didactical aspects, and connections with other sciences.

Contents

1 - Elementary logic.

2 - Elementary algebra.

3 - Arithmetics. Integer, rational, real, complex numbers.

4 - Recreational mathematics.

Detailed program

1 - Elementary logic.

2 - Elementary algebra. Literal calculus. Axioms. Equations and inequalities. Functions. Polynomials, exponentials, logarithms. Dimensional analysis in mathematics and physics.

3 - Arithmetic. Integer numbers. Decimal representation and representations in other bases. Algorithms for

elementary operations. Euclidean algorithm for computing the greatest common divisor of two integers. Prime numbers. Infinity of primes. Unique factorization in primes. Modular arithmetic. Analogies between integers and polynomials.

4 - Arithmetic. Rational numbers. Decimal representation of a rational number. Euclidean algorithm and continued fractions. Diophantine approximation. Gregorian calendar. Gears.

5 - Arithmetic. Real numbers. ?2, ?3, ?5,… are not fractions. 0,12345678910111213… is not a fraction. Intuitive and rigorous definitions of real numbers. Algebraic and transcendental numbers. Set theory and cardinality.

6 - Arithmetic. Complex numbers. Definition and operations with complex numbers. Geometrical interpretation. Fundamental theorem of algebra.

7 - Recreational mathematics. Mathematical games and puzzles.

Prerequisites

Background: Basic mathematics of the elementary and secondary schools. Prerequisites: None.

Teaching form

Classroom lectures. Individual and group study. The course is scheduled in Italian but could be held in English in the presence of foreign students.

Textbook and teaching resource

R.Courant, H.Robbins “What is mathematics? An elementary approach to ideas and methods”.

C.B.Boyer “A history of mathematics”.

G.Chrystal "Algebra: An elementary text-book".

Euclid “Elements”.

L.Euler “Elements of algebra”.

G.H.Hardy, E.M.Wright “An introduction to the theory of numbers”.

G.Polya "How to solve it".

G.Polya "Mathematics and plausible reasoning".

G.Polya "Mathematical discovery".

H.Steinhaus “Mathematical snapshots”.

J.Stillwell “Elements of Mathematics: From Euclid to Gödel”

Wikipedia.

Notes of the lecturer.

Semester

First semester.

Assessment method

Oral examination. Mark out of thirty, the exam is passed if the evaluation is at least 18/30. The student shall demonstrate to be skilled in connections among the topics of the course, in scientific vocabulary, comprehension and communication.

Office hours

On appointment.

Sustainable Development Goals

QUALITY EDUCATION