UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics for Teaching - Geometry

2425-1-F0601Q097

Aims

This course “Matematica per l’insegnamento - Geometria” and his twin “Matematica per l’insegnamento - Algebra” are aimed at future teachers of mathematics an sciences. The two courses are completely independent. The aim of these courses 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 - Euclid “Elements”.

2 - Perimeter, area, volume, barycenter.

3 - Trigonometry.

4 - Analytical geometry.

5 - Geometry and astronomy.

5 - Recreational mathematics.

Detailed program

1 - Euclid “Elements”, Book I and Book VI. Axioms and postulates. Theorems of Pythagoras and Thales. Eudoxus’ theory of ratio and proportion and exhaustion, and Dedekind’s definition of real numbers. Platonic and

Archimedean polyhedra. Lunulae of Ippocrathes and Leonardo da Vinci.

2 - Axiomatic definition of measure. Cavalieri principle. Perimeter, area, volume of elementary figures. Parallelograms, triangles, circles, prisms, cylinders, cones, spheres. Isoperimetric problem. Barycenter. Floating bodies.

3 – Trigonometry. Theorems of Pythagoras and Thales. Measure of angles in radians. Sine, cosine, tangent. Measure of triangles. Measure of the circle of Archimedes: 3+10/71<?<3+1/7. Measure of the cosmos.

4 - Analytical geometry. Geographical coordinates. Polar and Cartesian coordinates. Theorem of Thales and equation of a straight line. Theorem of Pythagoras and equation of a circle. The Cartesian plane satisfies the Euclidean postulates. Non Euclidean geometries. Geometrical loci. Parabola, hyperbola, ellipse. Folium of Descartes: x3+y3-3xy=0.

5 - Geometry and astronomy. Sizes and distances of the Earth, Sun, Moon, planets. Calendar. Kepler laws.

6 - 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”.

Euclid “Elements”.

E.Moise “Elementary geometry from an advanced standpoint”.

G.Polya "How to solve it".

G.Polya "Mathematics and plausible reasoning".

G.Polya "Mathematical discovery".

H.Steinhaus "Mathematical Snapshots".

H.Steinhaus “Mathematical snapshots”.

Wikipedia.

Notes of the lecturer.

Semester

First semester.

Assessment method

Oral examination. No intermediate tests. 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. E-Mail: leonardo.colzani@unimib.it

Sustainable Development Goals

QUALITY EDUCATION