UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Mathematics

2627-1-E3304M002

Learning objectives

Knowledge and understanding: the course aims to provide students with the basic mathematical tools necessary to analyze simple economic, physical, or natural phenomena. In particular, it introduces the mathematical knowledge that allow, starting from the analytical expression of a function, the study of its properties such as monotonicity, convexity, and maximum and minimum values, in order to sketch a qualitative graph. Furthermore, the course will introduce essential tools for applications in scientific and statistical fields, such as series and integrals. By the end of the course, students should be able to apply theoretical concepts to solve problems using mathematics.
Applying knowledge and understanding: tt the end of the course, students should be able to apply the theoretical concepts they have acquired to analyze the opportunities and critical issues of the economic, physical, or natural contexts in which they operate.
Making judgements: students will be encouraged to develop the ability to formalize and solve problems related to the topics covered in the course, reasoning critically about the results in order to interpret them correctly.
Learning skills: through the structuring of the lessons and the materials provided to students, the course will offer the tools needed to develop an effective study method, enabling them to analyze and interpret problems from a mathematical perspective.

Contents

• Study of functions with one variable
• Introduction to functions with more than one variable.
• Series
• Integrals

Detailed program

Real Functions of a Real Variable
• Definition, domain, and range; graph of a function.
• Elementary functions with graphs.
• Monotonicity, maximum and minimum values.
• Inverse functions.
• Graph transformations.

Limits and Continuity
• Definition of a limit and related theorems.
• Computing limits and handling indeterminate forms.
• Definition of continuity.
• Properties and theorems for continuous functions.
• Types of discontinuities.

Sequences and Series
• Definition and necessary conditions for convergence.
• Geometric and harmonic series.
• Convergence theorems for series with positive terms
• elements of series with non-negative terms and convergence criteria.

Multidimensional Functions
• Functions of multiple variables: domain and level curves.
• Partial derivatives and critical points.

Differential Calculus
• Definition of the derivative and its geometric interpretation.
• Cases of non-differentiability.
• Link between continuity and differentiability.
• Taylor’s formula.
• Classification of Monotonicity, maxima and minima using derivatives.
• Convexity of a function: definition and characterization based on the second derivative.

Integral Calculus
• Indefinite integrals: definition, main properties, and antiderivative computation.
• Definite integral, Riemann integral, properties and computation.
• Elements of improper integral.

Prerequisites

Algebra, equations and inequalities, basic knowledge of geometry.

Teaching methods

Lectures and in-class exercises. All 40 hours of lectures and 12 hours of exercises are delivered in a traditional (instructor-led) format.
20 lectures of 2 hours each, 6 exercise sessions of 2 hours each.
Based on the academic calendar, class schedule, and students’ needs, up to a maximum of 15 hours of lectures may be delivered remotely.

Assessment methods

The final assessment consists of a written exam and an optional oral exam, with possible partial exams also taking place. In the written exam, students are required to solve exercises and may also need to answer open questions. The exercises cover topics such as function graphs and properties, limits and continuity, differentiability, series, functions of two variables, integrals, and function analysis. In the oral exam, students should be able to discuss all the topics covered in the course, including both theoretical and practical aspects. The optional oral examination can have both a positive and negative impact on the final grade.

Textbooks and Reading Materials

Slides, teaching material, exercises and solutions at disposal on the elearning page of the course site.
Textbooks
"Principles of Mathematics for Economics and Business", A. Cambini, L. Carosi, G. D'Inverno, L. Martein, Giappichelli editore
"Principles of Mathematics and Economics", S. Cerreia Vioglio, M. Marinacci and E. Vigna, Egea
"Mathematics for Economists", C.P. Simon and L. Blume, W. W. Norton Company

Semester

First Semester

Teaching language

English

Sustainable Development Goals

QUALITY EDUCATION