UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics - 2

2324-1-E3303M003-T2

Learning objectives

The course aims to give to the student the basic mathematical tools in order to treat simple economic phenomena. In particular, the course provides mathematical tools that allow the students, starting from the analytic formula of the function, to study properties such as monotonicity, convexity, maximum and minimum, in order to sketch a qualitative plot of the function.
Students should be able to apply theory to solve problems. Moreover, the course will provide tools for describing mathematical finance problems, in particular series and integrals

Contents

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

Detailed program

Unit 1 - Real functions of a real variable:
Definition and image set, graph of a function. Elementary functions. Monotonicity, maximum and minimum. Inverse function. Transformations of graphs.
Unit 2 - Limits:
Definition of limit and related theorems. Computing limits, indeterminate forms.
Unit 3 - Sequences and Series
Definition (types and summation), necessary condition for convergence, geometric series, telescopic series,

harmonic series, series with non-negative terms (convergence criteria), alternating series (Leibniz criterion).
Unit 4 – Continuous functions
Definition. Weierstrass theorem, Zero's theorem, theorem of Intermediate values. Discontinuity.
Unit 5 – Differential calculus
Definition of the derivative and geometric interpretation. Non differentiability. Link between continuity and differentiability. Theorems for differentiable functions: Rolle, Lagrange and Fermat. L'Hospital's rule. Taylor's formula. Convexity of a function: definition and characterization based on the second order derivative. Functions with more than one variable: definition set, level curves, partial derivatives, critical points.
Unit 6 – Integral calculus
Indefinite integral, definition and main properties, antiderivative computation (integration by parts, by substitution, integration of rational functions), Riemann integral, theorems on integrals, improper integrals, convergences criteria for improper integrals.

Prerequisites

Algebra, equations and inequalities, basic knowledge of geometry.

Teaching methods

Theoretical lectures and practical sessions in presence.

Assessment methods

Final written exam and (subsequent optional) oral exam.
In the written part the students have to solve 5 exercises and to answer to 2 open questions (it is required to formulate and prove theorems and to provide definitions presented during the course).
The structure of the exercises is the following:
Exercise 1: Transformations of graphs for basic functions:
Exercise 2: a) Limits b) Series (with limits)
Exercise 3: a) Various b) Functions of two variables
Exercise 4: Integrals
Exercise 5: Study of a function
In the oral part should be able to discuss all the topics presented in the course and the optional oral examination can contribute both positively and negatively to the final grade.

Textbooks and Reading Materials

Slides and teaching material at disposal on the couse site
Textbooks
Bianchi M., Messineo G., Miglierina E., Vassallo S. "Note di Matematica", Giappichelli
Torriero, A., Scovenna M., Scaglianti, L.: Manuale di matematica. Metodi e applicazioni. CEDAM
Scovenna, M., Grassi, R.: Matematica – Esercizi e temi d'esame. CEDAM.
Additiona textbooks

Guerraggio, A. (2009): Matematica. Prentice Hall, seconda edizione.
Monti, G., Pini, R.: Lezioni di matematica generale: funzioni reali di variabile reale, L.E.D.

Semester

First semester

Teaching language

Italian

Sustainable Development Goals