UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics - 1

2324-1-E3303M003-T1

Learning objectives

This course aims at giving to the students the mathematical foundations of the models that describe the economic phenomena. In particular, students receive the mathematical instruments that allow, starting from the analytic formula of the function, to analyze properties such as monotonicity, convexity, maximum and minimum. The final aim is to be able to produce a qualitative plot of the function.
Students should be able to apply theory to solve problems.

Contents

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

Detailed program

Introduction to functions.

Definition and image set, graph of a function. Simple functions. Monotonicity, maximum and minimum. Inverse function.

Limits and theorems related to the topic.

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).

Continuous functions: Weierstrass theorem, Zero's theorem, theorem of Intermediate values. Discontinuities.

Indeterminate forms in the computation of the limits. Landau's symbol.

Differential calculus: definition of the derivative and geometric interpretation. Points of non differentiability. Link between continuity and differentiability. Some theorems: 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.

Integrals: definition and main properties, teorems on integrals, primitive integral (integration by parts, by substitution, intregration of rational functions), improper integrals, convergences criteria for improper integrals

Prerequisites

Elements of algebra, equations and disequalities, basic knowledge of geometry.

Teaching methods

Theoretical lectures and practical sessions.

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: Trasformations of plots 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 will be uploaded in the elearning course webpage.

Suggested textbooks:

Pini. R, Monti, G. "Lezione di Matematica Generale" LED Edizioni Universitarie
Scaglianti, L., Torriero, A., Scovenna, M. "Manuale di Matematica- Metodi e applicazioni" Edizioni CEDAM
Guerraggio, A. "Matematica", seconda o terza edizione. Pearson Prentice Hall
Scovenna, M., Grassi, R.: Matematica – Esercizi e temi d’esame. CEDAM.

Semester

First term

Teaching language

Italian

Sustainable Development Goals