UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Calculus I

2122-1-E4101B001

Learning objectives

The course mainly aims at enabling students to an aware use of basic techniques of infinitesimal (differential as well as integral) calculus for functions of one real variable. The skills gained through the course allow them:

1) to understand a statement concerning contents of the course and expressed in mathematical terms:

2) to make use of basic tools of differential and integral calculus (limits, derivatives, series ed integrals) for functions of one real variable;

3) to analyze properties of functions by means of the standard tools provided by the differential and integral calculus (such as asymptotic behaviour, existence of zeros, differentiability, monotonicity and symmetry, extremal properties, namely existence of minimizers/maximizers and their determination, integrability).

Contents

The contents of the course can be schematically arranged in three intertwined parts:

1) asymptotic estimates (limits of functions);

2) differential calculus (first order derivative and beyond) and its applications;

3) series;

4) Riemann integrability of functions and integral calculus.

Detailed program

Sets and functions and related terminology. Some cardinal numerals.

A peculiar set: the real number set; its fundamental metric and arithmetic properties. Upper bound of a subset of the real number set.

Scalar functions and sequences: the notion of limit and its properties; monotonicity and symmetry; the property of continuity and its relationship with the limit; infinitesimal and asymptotic behaviour.

Differential calculus for real univariate functions: first derivative, its basic properties and differentiation rules; second and further derivatives; their use in asymptotic estimates and in drawing a function graph; Taylor's formula.

Series: behaviours and convergence criteria. Main Mc Laurin's series (sin, cos, exp and log).

Integral: definite integral and anti-derivative (indefinite integral), main properties and calculation techniques.

Generalized integral: integrability criteria in the case of unbounded functions and/or in the case of unbounded integration domains.

Prerequisites

No inner prerequisite. A refreshement (guided, in case, by a tutor) is strongly advised, which should concern the main topics typically taught at the high school. More prcisely:

1) algebra: solving algebraic equations of first and second degree, polynomial identity;

2) Cartesian geometry: lines, conics, exponential and logarithmic functions;

3) trigonometry on the plane: angles in radiant, sthe main trigonometric functions and formulae.

Teaching methods

Class lectures.

During the teaching period, some exercise sessions are organized.

Assessment methods

Students are supposed to pass a written examinaton. For all those students who have passed the written examination, an oral examination is upon request. Interim assessments are also organized.

A written examination, mid-term and complete, aims at certifying the student skills about theoretical contents and calculus techniques provided in the course, as well as their capability in problem solving.

It consists of a test containing closed questions, a section containing problems and open questions.

Material for exam simulations is also provided.

Textbooks and Reading Materials

M. Bramanti, C.D. Pagani, S. Salsa, Analisi Matematica 1, Zanichelli, Bologna, 2008

S. Salsa, A. Squellati, Esercizi di Analisi matematica 1, Zanichelli, Bologna, 2011

A. Guerraggio, Matematica, Pearson, 2014.

Some additional material, in particular anthologies of exercises (with solution and comments) and exam simulations, are provided in e-learning.

Semester

First semester

Teaching language

Italian