UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Basic Calculus - 2

2122-1-E1802M115-E1802M108M-T2

Learning objectives

The course aims at giving to the student the basical mathematics tools in order to treat simple mathematical models in economics: after the course the student must have capability in infinitesimal calculus in one variable, with outlines to the calculus in two variables.

Contents

Real functions of real variables and outlines of real functions of two real variables.

Detailed program

Real numbes. Supremum an infimum of subsets in R. The expanded System of real numbers R*
Real functions of one real variable. General facts, domain, codomain. Supremum, infimum, absolute maximum and

minimum of a function. Injective, surjective and bijective functions. Composite function and inverse function. Elementary functions. Graphs of functions that can be deduced from graphs of elementary functions. Topology in R. Definition of limit. Excess limit and limit by default. Theorem on the uniqueness of the limit. Theorem of sign permanence. Theorems on the existence of the limit: comparison theorem, existence theorem for monotone functions. Continuity for a function. Discontinuity points. Properties of continuous functions in a bounded and closed interval. Weierstrass Theorem. Darboux Theorem. Evaluation of the limits. Indeterminate forms. Notable special limits and applications. Infinite, infinitesimal and their comparison. Landau symbols, asymptotic expansion. Asymptotes. Derivative: definition and geometric meanings, equation of the tangent line. Points of non differentiability. Relation between differentiability and continuity. Derivatives of the elementary functions. Derivation

rules. Derivatives of higher order. De l'Hôpital theorem. Derivatives of composite and inverse functions. Sufficient condition for differentiability. Fermat Theorem(necessary condition for the existence of local extreme points inside the domain of a differentiable function). Rolle and Lagrange Theorems. Consequences of the Lagrange Theorem. Taylor and Mc Laurin formula and their applications. Concavity, convexity and inflections points. Study of functions. Real functions of two real variables: domain, sign and partial derivatioves.

Prerequisites

Algebra and analytic geometry at an elementary level

Teaching methods

Traditional: lectures and exercise classes.

Assessment methods

Written exam with 5 exercises and at least 2 theory questions and oral exam (optional or at the request of the teacher). The oral exam can contribute in a positive or negative way to the final evaluation. To encourage student learning, the teacher reserves the right to leave exercises, also in the form of quizzes, to be carried out and, if required, delivered on the elearning platform during the course.

Textbooks and Reading Materials

A. Guerraggio, (2014): Matematica. Prentice Hall, second edition.

G. Monti, R. Pini: Lezioni di matematica generale: funzioni reali di variabile reale, L.E.D.

L. Scaglianti, M. Scovenna, A. Torriero: Manuale di matematica. Metodi e applicazioni, CEDAM

M. Scovenna, R. Grassi, Esercizi di matematica. Esercitazioni e temi d’esame, CEDAM

Semester

First semester, first year

Teaching language

Italian