UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Basic Calculus - 1

2122-1-E3301M128-T1

Learning objectives

The course will provide the basic mathematical notions for understanding simple mathematical models in economics. Specifically the course will focus on real functions of real variables.

Contents

Real functions of real variables.

Detailed program

Unit 1- Real functions of a single real variable

Sets N,Z,Q, R. Real numbers. Infimum and supremum, maximum and minimum of subsets of R. Extended real numbers R*. Real functions of a single real variable. Main features, domain and range. Infimum and supremum, absolute maximum and minimum of a function. Injective, surjective, bijective functions. Compound and inverse function. Elementary functions. Deductible graphs.

Unit 2- Limits

Topology of R. Definition of a limit. Uniqueness of limits theorem. Permanence principle.Existence of limits

theorem:limit comparison test, existence of limit theorem for monotone functions. Continuous functions. Discontinuities. Continuous functions on closed bounded sets Weierstrass's Theorem. Bolzano's Theorem. Darboux's Theorem. Limits. Indeterminate forms. notable special limits and applications. Infinite and infinitesimal and their comparisons. Landau symbol: o (o piccolo), ~ (asintotico). Asyntotics.

Unit 3- Derivatives

Derivative of a function. Geometrical meaning of the derivative and tangent line equation. Non-derivability points. Derivability and continuity. Elementary functions derivatives. Derivation rule. higher order derivates. De l'Hôpital Theorem. Compound and inverse function derivative. Sufficient condition for derivability. Fermat Theorem. Rolle Theorem. Lagrange Theorem and corollaries. Taylor andMc Laurin formulas and applications. Convexity and concavity of a function and inflection points.

Unit 4- Study of a function and real functions in two variables

Study of a function. Real functions in two real variables: domain, level and partial derivatives.

Prerequisites

Set theory. Powers, logarithms, exponentials and their properties. First and second degree inequalities, rational inequalities, logarithmic and exponential inequalities. Cartesian equations of the line, of the circumference, of the parabola, equation of the line passing through two points. Basics of trigonometry.

Teaching methods

Frontal lessons.

Frontal exercises.

Tutoring meetings.

If the Covid-19 emergency will continue, the lessons, exercises and tutoring will be carried out according to the procedures indicated by the university.

Assessment methods

Written exam with 5 exercises and 3 theory questions. The outline of the exercises is as follows:

Exercise 1: Transformations of graphs of elementary functions;

Exercise 2: Limits;

Exercise 3: Various;

Exercise 4: Two-variable functions;

Exercise 5: Full Function Study.

Once the written exam has been passed, the professor or student can request a supplementary oral exam. The oral exam focuses on the entire program of the course and can contribute both positively and negatively to the final grade.

The course does NOT include the splitting of the exam into intermediate tests.

Textbooks and Reading Materials

- Slides provided by the professor
- Torriero, A., Scovenna M., Scaglianti, L.: Manuale di matematica. Metodi e applicazioni. CEDAM
- Scovenna, M., Grassi, R.: Matematica – Esercizi e temi d'esame. CEDAM.

Further reading material:

- 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.