UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Basic Calculus

**2021-1-E3301M128**

## 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

Algebra and analytic geometry at an elementary level.

## Teaching methods

E-learning lessons and exercises classes.

## Assessment methods

Written exam with 5 exercises and 3 questions on the theory, an oral exam (if required by the student or by the professor). The final mark can improve or get worse with the oral exam.

## 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.