UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

## Basic Calculus - 1

**2526-1-E1806M005-T1**

### Learning objectives

The course aims at providing a set of analytical methods to deal with economic and social phenomena.

Students will be provided with tools useful to analyze simple mathematical models in economics.

In particular, students will learn how to use the mathematical tools which, starting from the function analytic formulation, allow to draw a qualitative graph of the function.

Students are supposed to be able to apply the theoretical concepts learned during the course to simple problems, similar to those solved in the lectures.

Expected Learning Outcomes (Dublin Descriptors):

1. Knowledge and understanding
   Students will acquire a solid understanding of the theoretical aspects connected with the main topics covered during the course, such as limits and derivatives.

2. Applying knowledge and understanding
   Students will be able to effectively apply mathematical methods to solve practical problems consistent with the course topics and to deal with real-world situations in the economic field.

3. Making judgements
   Students will develop logical and analytical skills useful for tackling and solving complex problems, including those interdisciplinary in nature, and for critically evaluating the obtained results.

4. Communication skills
   Students will learn how to correctly use the mathematical language, so as to accurately and coherently express the acquired theoretical notions, as well as to effectively communicate ideas, methods and results.

5. Learning skills
   Students will develop an independent study method, enabling them to approach subsequent, more advanced studies with awareness and success.

## Contents

Real functions of real variables.

## Detailed program

Introduction to functions.

Functions of one variable. Domain, image, graph. Elementary functions. Monotonicity, maxima and minima. Inverse function.

Limits and related theorems.

Continuous functions: Weierstrass, Bolzano and Darboux theorems. Discontinuity points.

Indeterminate forms in the computation of limits.

Differential calculus: definition of the derivative and geometric interpretation. Points of non-differentiability. Relationship between continuity and differentiability. Rolle, Lagrange and Fermat theorems.

L'Hospital rule. Taylor's formula and its applications.

Convexity and concavity of a function: definition and characterization based on the second order derivative.

An introduction to functions of two variables.

## Prerequisites

Elementary tools from algebra, equations and inequalities, basic knowledge of analytic geometry.

## Teaching methods

The course comprises 40 hours of lectures.

The lectures will usually take place in person and they will be based on conventional teaching methods.
However, some of the lectures might be delivered online (at most 30% of the total hours).
The teacher will communicate with adequate notice which lessons will be delivered online.

## Assessment methods

Written exam, consisting of practical exercises and of open theoretical questions.

Optional oral exam, possible only if the grade of the written exam is at least 18/30.

There will be a midterm written exam.

In grading the written exams, in addition to the correctness of the results, the ability in explaining the various steps will be considered as well.

The (optional) oral exam starts with a discussion of the written exam, followed by some questions regarding the topics of the course.
It can contribute either positively or negatively to the final grade.

## Textbooks and Reading Materials

- Guerraggio, A. , "Matematica" , second, third or (better) fourth edition. Pearson Prentice Hall.

- Brega F., G. Messineo, "Esercizi di Matematica Generale: Funzioni, Limiti , Continuità", Giappichelli Editore, 2013.

- Brega F., G. Messineo, "Esercizi di Matematica Generale: Calcolo Differenziale in R. Studio di Funzione", Giappichelli Editore, 2013.

- Brega F., G. Messineo, "Esercizi di Matematica Generale: Ottimizzazione in R2 ", Giappichelli Editore, 2013.

## Semester

First semester.

## Teaching language

Italian.

## Sustainable Development Goals

GENDER EQUALITY