UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Financial Mathematics - 2

**2526-2-E1803M051-T2**

## Learning area

## Learning objectives

The course aims to foster a critical understanding of mathematical concepts, helping students to recognize and use formal tools in their education, particularly with a view to their application in the economic, statistical, and financial fields. The course provides the fundamental notions of linear algebra, numerical sequences and series, integral calculus, financial mathematics, and an introduction to derivative instruments, presenting them as useful tools for analyzing and interpreting phenomena related to economics and finance. The theoretical component will be complemented by classroom exercises, with the goal of supporting the development of an independent approach to problem-solving.

**Expected Learning Outcomes (Dublin Descriptors):**

**1. Knowledge and understanding**
Students will acquire a solid understanding of the main topics covered, including numerical sequences and series, integral calculus, linear algebra, linear programming, traditional financial mathematics, bonds, and derivative instruments.

**2. Applying knowledge and understanding**
Students will be able to effectively apply mathematical methods to solve practical problems consistent with the course syllabus and to interpret real-world situations in the economic and financial domains.

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

**4. Communication skills**
Students will be able to use clear and precise mathematical and financial language, enabling them to accurately and coherently express the knowledge acquired and to communicate ideas, procedures, and results effectively.

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

## Contents

Sequences and series, integrals, linear algebra and programming, choice under uncertainty, basic notions on financial mathematics and on derivatives

## Detailed program

1) Sequences and series: definitions and analysis of the character of series by means of the main criteria.

2) Integrals: definitions, main results and computation.

3) Linear algebra: matrices, vectors and linear systems.

4) Linear programming.

5) Financial mathematics.

6) Bonds and immunization.

7) Introduction to derivatives: binomial model and Black-Scholes model.

## Prerequisites

Functions in one and more variables, basic notions of Probability and Statistics.

The exam of the present course can be done only after passing and completing the Matematica Generale I's examination.

## Teaching methods

The lessons will be held mainly in presence with traditional lectures and exercises. A small percentage (anyway, smaller than 30%) could be taken online (in streaming) in case of necessity.

The course consists in:

-56 hours of lectures;
-24 hours of exercises.

Around 80% of the course will be done in erogative mode, the remaining 20% in interactive mode.

## Assessment methods

The final exam is composed by a written part (divided in open questions and exercises) and an optional oral part. The final mark takes into account the scores of the parts above.

For the students that have already passed the exam of Matematica Generale I, two written "in itinere" exams and a further optional oral exam are provided. The second "in itinere" exam is accessible only by students who passed the first one.

## Textbooks and Reading Materials

- “Successioni, serie e integrali”, Manuale modulare di Metodi Matematici, vol. 5, a cura di Giovanna Carcano, edizioni Giappichelli Torino

- “Algebra lineare”, Manuale modulare di Metodi Matematici, vol. 4, a cura di Maria Ida Bertocchi, edizioni Giappichelli Torino

- “Elementi di Matematica Finanziaria e cenni di Programmazione Lineare”, S. Stefani, A. Torriero e G. Zambruno, edizioni Giappichelli Torino

- “Matematica Finanziaria classica e moderna”, F. Cacciafesta, edizioni Giappichelli Torino

- "Opzioni e futures", J. Hull

- "Esercizi di matematica per l'economia: Serie, integrali, algebra lineare, programmazione lineare", E. Mastrogiacomo, 2018, Ledizioni

## Sustainable Development Goals

QUALITY EDUCATION | DECENT WORK AND ECONOMIC GROWTH