



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Istituzioni di Matematica I

2526-1-E3006Q001

---

#### Aims

1. Knowledge and understanding. By attending the course's classes and passing the final exams, the students will have developed the ability to understand the theoretical basics of one-variable calculus, as listed in the section "Contents" and "Program". The mathematical topics have been selected to provide the students with ability to take Optics and Optometry courses.
2. Applying knowledge and understanding. Concepts in the classes and lab activities regarding Optics and Optometry are being taught by means of the mathematical language. The exercise sessions of the course of Istituzioni di Matematica I are designed to apply the mathematical theoretical concepts previously introduced to get numerical results out of proposed problems.

#### Contents

Numerical sets: natural, integer, rational, real and complex numbers. Functions of one real variable, limits, continuity, differentiability. Derivative of a function. Riemann integral and improper integral. Elementary notions of ordinary differential equations.

#### Detailed program

1. Natural numbers, integer numbers, rational numbers, real numbers. Complex numbers: cartesian and polar

forms, De Moivre formula, roots of a complex number.

2. Real valued functions of one real variable. Domain, codomain, and image of a function. Injectivity, surjectivity, inverse of a function. Increasing and decreasing functions. Graph and main properties of elementary functions.

3. Limit of a function at a point. Computation of limits. Continuity; points of discontinuity.

4. Derivative of a function at a point, geometrical and physical interpretations. Tangent line. Differentiation rules. Non-differentiable points.

5. Maxima and minima of a function. Weierstrass theorem, Fermat theorem, Lagrange theorem, de l'Hospital rule. Convexity and inflection points.

6. Primitives of a function. Area of plane figures and the Riemann integral. Computation of definite integrals. Fundamental theorem of calculus. Integration by parts and by substitution. Improper integrals.

7. Ordinary differential equations. General solution and Cauchy problem. Linear equations of the first order. Method of separation of variables. Second order linear equations with constant coefficients.

## **Prerequisites**

Elementary algebra, geometry, and trigonometry, as covered in high school classes or in this University's preliminary courses.

## **Teaching form**

The course comprises 76 hours altogether, partitioned in 5 CFU lessons and 3 CFU exercises sessions. A part of those activities will be held remotely and asynchronously uploaded to the course's elearning site. The rest will be held in classroom with occasional interactive students involvement.

Lectures and exercise sessions will be held in Italian. Further references, such as some texts or the narration of some videos could be in English.

## **Textbook and teaching resource**

Textbook:

Matematica per le scienze della vita.

E.N. Bodine, S. Lenhart, L.J. Gross

UTET Università

## **Semester**

First semester, October - January

## **Assessment method**

The exam consists in a written part - in which students are required to solve some exercises - and an oral part. In order to take the oral exam, students must have been admitted, following the written exam in the same session. The written exam includes multiple-choice questions, and at least one open question, through Esamionline's platform. The oral examination is mandatory for students who have been admitted but their written exam has been considered insufficient. For them, the oral exam consists in a question, possibly comprising few parts, concerning basic results covered in the course. The allowed time is 20 minutes. A discussion of the given answer will follow. The oral exam is discretionary for students having received a passing grade in the written examination. For them, the oral exam may cover any part of the course.

Under special circumstances and by a student's request, the oral examination may be held in english.

## **Office hours**

By appointment: [simone.borghesi@unimib.it](mailto:simone.borghesi@unimib.it)

## **Sustainable Development Goals**

QUALITY EDUCATION

---