UAB
Universitat Autònoma de Barcelona

Foundations of Mathematics I

Code: 107926
ECTS Credits: 6

2025/2026

Degree	Type	Year
Mathematics	FB	1

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Apart from a good practical knowledge of integer arithmetic and the manipulation of algebraic expressions, no prior mathematical knowledge is required for this course. However, it is essential to have the willingness to thoroughly understand the reasoning and to maintain a critical mindset towards mathematical statements, both one's own and those of others.

Objectives and Contextualisation

In this course, we will present fundamental objects that will be used throughout the entire mathematics curriculum. The two main concepts we will study are sets and complex numbers. At the same time, we will place strong emphasis on the correct use of mathematical language and how to properly write a proof-this is a process that takes time and should begin as early as possible.

A good command of the language is essential for understanding, doing, and communicating mathematics. Ideas are fundamental, and language is powerful-so much so that some problems are solved once they are properly formulated in the appropriate language. Following and revisiting, thinking and rethinking proofs-discovering and enjoying the details-will be an important part of the work throughout the course.

A recurring theme will tie together the various parts of the course: the problem of solving equations, and what this means in different contexts (numerical equations, polynomial equations, equations between sets, in geometry, etc.). This is a historically fundamental theme that has shaped large areas of mathematics over the centuries.

Learning Outcomes

1. CM06 (Competence) Discriminate between statements of results and their proofs to identify situations in which a counterexample is needed.
2. KM11 (Knowledge) Identify the basic principles of classical logic, as well as their relationship to the use of sets.
3. KM14 (Knowledge) Describe the processes for solving Diophantine equations and calculating polynomial roots.
4. SM09 (Skill) Handle the basic concepts of set theory and functions, relating them to the analogous concepts encountered in other basic subjects.
5. SM10 (Skill) Use the methods of some proofs to perform specific calculations, such as solving Diophantine equations and congruences, and factoring polynomials with known roots.
6. SM11 (Skill) Use the axiomatic method in the construction of the hierarchy of numbers, and in particular, in the justification of the introduction of complex numbers.

Content

1. Introduction.
   Hierarchy of numbers.
   Principle of induction.
   The problem of solving equations.
3. Elementary set theory.
   Definition of sets by extensionality.
   Operations between sets.
   The empty set.
   Subsets of a set.
5. Relations in sets.
   Order relations.
   Equivalence relations.
   Example: congruences modulo *n*.
7. Mappings between sets.

   - Injectivity, surjectivity, bijectivity.
   - Graphical interpretation.
   - Example: the symmetric group.
   - Polynomials, polynomial equations.

5. Commplex numbers.

   - Solving second-degree polynomial equations.
   - Geometric interpretation. Polar form.
   - Modulus, argument.
   - Roots of unity.
   - Descriptions of geometric sets using complex numbers.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	30	1.2	KM11, SM09, SM11, KM11

Problems sessions	14	0.56	CM06, KM11, KM14, SM09, SM10, SM11, CM06
Seminars	6	0.24	CM06, KM11, KM14, SM09, SM10, SM11, CM06
Studying theoretical concepts and solving problems	89	3.56	CM06, KM11, KM14, SM09, SM10, SM11, CM06

The methodology and training activities are adapted to the learning objectives of the subject: to introduce mathematical language, to learn how to use it correctly, to observe demonstrations and methods of proof. To achieve these objectives, it is important that first-year students not only see and understand the development of the theory, but also-and perhaps more importantly-attempt the exercises themselves, writing them out correctly, imitating what they have seen in the theory classes.

In the problem-solving classes, some of the problems from the lists (which students will have previously worked on independently) will be discussed and solved on the board.

During seminar sessions, the professor will provide material with exercises to practice writing proofs. Students may ask the professor for help as many times as needed (if they do not understand a question, if they are stuck, if they want feedback on their solution, etc.). Finally, the professor will explain the resolution of some key points. In some seminars, exercises will be handed in at the end and graded. See the "Assessment" section.

It should be kept in mind that proper understanding of the course material requires dedication, continuous and sustained work from the student. As a guideline, students should devote as many hours of personal study per week as there are class hours for the subject. In case of doubts, it is important to consult with the professors, whether they are teaching theory or problem-solving classes.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final exam	40%	3	0.12	CM06, KM11, KM14, SM09, SM10, SM11
Midterm Exam	40%	3	0.12	CM06, KM14, SM09
Remedial Exam	80%	3	0.12	CM06, KM11, KM14, SM09, SM10, SM11
Seminar	20%	2	0.08	CM06, KM11, KM14, SM09, SM10, SM11

Continuous Assessment:

1. Seminar Exercise Submissions: There will be 3 submissions, scheduled in advance. Students must submit part of the work done in class. The first two submissions will not count toward the final grade, but a professor will review and return them with feedback. Some students may be called for a personal interview with the professor to review their submissions. Attending this interview, if summoned, is mandatory. The third submission will be longer and will count toward the final grade. The seminar component accounts for 20% of the final grade.

2. Midterm Exam: 40% of the final grade.

3. Final Exam: 40% of the final grade.

4. Remedial Exam: Students who do not pass the course based on the weighted sum of the grades from points 1), 2), and 3) may take a comprehensive remedial exam. Students who achieve a final average of 5 or higher from 80% of the final exam score and 20% from the seminar grade will receive a final grade of 5 and the status PASSED. If they do not pass this exam, their final grade will be the higher of either the pre-recovery or post-recovery grades. Grade improvement is not allowed.

   5. "Not presented/evaluated" A student who does not attend the final exam will receive a final grade of "Not evaluated"

Single Assessment:

Students who opt for single assessment must still submit the seminar exercises as usual (20% of the final grade), and will take a single exam on the day of the final exam, which will count for 80%. The recovery process is the same as above.

AI usage:

In this course, the use of Artificial Intelligence (AI) technologies is not allowed at any stage. Any work that includes AI-generated content will be considered a breach of academic integrity and may result in a partial or total penalty on the grade for the activity, or more serious sanctions in severe cases.

Bibliography

P.J. Eccles, An introduction to mathematical reasoning, numbers, sets and functions. Cambridge University Press, Cambridge, 2007.
A. Reventós, Temes diversos de fonaments de les matemàtiques. Apunts.
C. Schumacher, Chapter Zero, Addison Wesley, 2001.

Software

NA.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	first semester	morning-mixed
(SEM) Seminars	1	Catalan	first semester	morning-mixed

(SEM) Seminars	2	Catalan	first semester	morning-mixed
(SEM) Seminars	3	Catalan	first semester	morning-mixed
(SEM) Seminars	4	Catalan	first semester	morning-mixed
(TE) Theory	1	Spanish	first semester	morning-mixed