

# Mathematics and its Didactics I

## Bachelor's degree in Primary Education – 1<sup>st</sup> year (6 cr.)

Lecturer: Joxemari Sarasua

✉ [joxemari.sarasua@ehu.eus](mailto:joxemari.sarasua@ehu.eus)

### BASIC COMPETENCES

1. Analysing, arguing, justifying and communicating in Mathematics following arguments, identifying fundamental ideas and assessing their validity.
2. Making sense of the role of induction and deduction in Mathematics, understanding the general form of a deductive proof and being able to justify basic statements in a variety of ways.
3. Being aware that problem solving is the bedrock of mathematical competency, distinguishing between different types of mathematical activities.

### CONTENTS

0. A brief introduction to ancient Mathematics: Mesopotamia, Greece, Egypt, ...
1. Set theory and numbers
  - a. Logical quantifiers, operations on sets and graphic representations.
  - b. Sets of numbers: naturals, integers, rationals, irrationals.
2. Numeration systems: historical development and analytical structure.
3. Problems in context
  - a. Concepts, procedures and problems from a curricular perspective
  - b. Types of problems: exercises, open-ended and close-ended problems
4. Mathematical reasoning
  - a. Mathematical reasoning vs. empirical reasoning: distinctive aspects
  - b. Inductive and deductive reasoning
    - i. Patterns
    - ii. Conjectures
    - iii. Venn diagrams as an aid for deductive reasoning
  - c. Mathematical proof: need, meaning and general structure.
  - d. Types of proofs: direct proving, backward proving, reduction to absurdity, visual proofs, proving by counterpositive, proving by cases, ...
  - e. Mathematical reasoning in Primary: learning and teaching aspects.

### METHODOLOGY

Visual Lectures, Group Tasks, Problem Solving Sessions, Individual Work, Tutorials.

### ASSESSMENT

Final exam: 83%

Interdisciplinary Assignment (along with other subjects): 17%

These two items can be complemented through continuous assessment activities.

## **BIBLIOGRAPHY**

Cirre Torres, F. J. *Matemática Discreta*. Anaya. Madrid, 2004.

Cofman, J. *What to Solve? Problems and Suggestions for Young Mathematicians*. Oxford University Press. Oxford, 1990.

Cofman, J. *Numbers and Shapes Revisited More Problems for Young Mathematicians*. Oxford University Press. Oxford, 1990.

De Guzmán, M. *Cómo hablar, demostrar y resolver en Matemáticas*. Anaya. Madrid, 2003.

García, J.; Ruiz de Gauna, J.G.; Sarasua, J. *Matemáticas y su didáctica I*. EHU. Leioa, 2012. [<https://web-argitalpena.adm.ehu.es/pdf/UWLGMA7116.pdf>]

NCTM. *Principles and Standards for School Mathematics*. National Council of Teachers of Mathematics, 2000. [Spanish translation: *Principios y Estándares para la Educación Matemática*. Sociedad Andaluza de Educación Matemática Thales. Sevilla, 2003.]

Masson, J.; Burton, L.; Stacey, K. *Thinking Mathematically (2<sup>nd</sup> Edition)*. Pearson. Essex, 2010.

Musser, G. L.; Burger, W.F.; Peterson, B.E. *Mathematics for Elementary Teachers. A Contemporary Approach (Ninth Edition)*. Wiley. 2010.

NCTM. *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics. National Council of Teachers of Mathematics*. Reston, 2006.

Polya, G. *How to solve it*. Princenton University Press, 1945.

Poya, G. *Let us teach guessing*, 1966. (VIDEO). <https://vimeo.com/48768091>.

Sarasua, J.; Ruiz de Gauna, J.G.; García, J. *Arrazoibide matematikoa eta problemagintza*. Erein. Donostia, 2013.

Scheinerman, E. R. *Mathematics. A Discrete Introduction (Third Edition)*. Brooks/Cole. Boston, 2013.

Soifer, A. *Mathematics as Problem Solving (2<sup>nd</sup> Edition)*. Springer. New York, 2009.

Tao, T. *Solving mathematical problems. A personal perspective*. Oxford University Press. New York, 2006.