

Math Brush-Up IDEA 2024-2025

Syllabus

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Schedule

- 5, 6 September: 10:00–13:00
- 9, 10, 12, 13 September: 9:00–11:00 and 12:00–14:00

Note: The last session on Friday, 13 September, from 12:00–13:30, will be an exam. The exam will cover all materials up to and including those from 12 September.

Objectives

The list of objectives for this Brush-Up course is:

- Familiarize students with the language and tools for mathematical proofs.
- Recall concepts and techniques that were used in undergraduate economics courses.
- Introduce mathematical techniques used in graduate economics courses.
- (Re-)introduce basics of statistics.

Contents

We will cover the following concepts (not necessarily in this order):

- Preliminaries
 - Logical statements and quantifiers
 - Proving techniques
 - Set theory
 - Convergence and compactness
 - Functions
 - Limits and continuity
 - Convexity
- Differentiation

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- Differentiability
 - Rules of differentiation
 - Taylor polynomials
 - Multivariate differentiation
 - Optimization
 - Unconstrained optimization
 - Necessary and sufficient conditions
 - Constrained optimization/ Lagrange problems
 - Kuhn-Tucker conditions
 - Integration
 - Fundamental theorem of calculus
 - Immediate integrals
 - Integration by parts, integration by substitution
 - Improper integrals
 - Multivariate integration
 - Differentiation of integrals
 - Linear Algebra
 - Matrix operations
 - Matrix properties
 - Determinants and eigenvalues/eigenvectors
 - Matrix calculus
 - Statistics
 - Descriptive statistics
 - Distributions and densities

Course materials

You will receive the following materials over the duration of the course:

- Lecture notes
- In-class exercises (pen & paper)

Evaluation

The course does not have a grade which will appear on your IDEA report card. However, participation in the final exam is mandatory and the exam will be graded and the grades will be communicated to the IDEA directors. Most importantly, the course is meant to signal to you if there are areas that you may need to revise in some more detail.

Office hours

You can reach me at any time under my email address `joan.margalef@uab.cat` and I am happy to arrange office hours whenever works during the week.

Additional materials to study:

Here are a few brush-up type sources and some not so brush-up:

- Brush-up undergraduate math: *Essential Mathematics for Economic Analysis* by Knut Sydsaeter, Peter Hammond, Arne Strom, Andrés Carvajal
- More advanced: *Further Mathematics for Economic Analysis* by Knut Sydsaeter, Peter Hammond
- Similar, but more applied: *Fundamental Methods of Mathematical Economics* by Alpha Chiang and Kevin Wanwright
- Lots of proofs: *Foundations of Mathematical Economics* by Michael Carter+
- A bit more advances statistics: *Introduction to Mathematical Statistics* by Robert Hogg, Joseph McKean and Allen Craig
- Very detailed statistics: *Probability and Statistics* by Morris DeGroot and Mark Schervish
- More on proofs: <https://math.berkeley.edu/~hutching/teach/proofs.pdf>