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# Syllabus

## Convex Analysis for Mathematical Finance

Spring 2010

**Objectives:** Tools from Convex Analysis, in particular duality methods, arise frequently in Mathematical Finance and Economics. In this course, we will review and motivate some basic concepts in Convex Analysis (Hahn-Banach theorem, biconjugation theorem, subdifferentials, Fenchel-Rockafellar duality theorem).

These tools are going to be applied to a special type of functions which frequently appears in Finance and Economics, in particular when it comes to pricing, risk evaluation or utility measurement. Examples are coherent and convex risk measures, no arbitrage price bounds, good deal bounds and optimized certainty equivalents, among many others. Duality concepts will be discussed and examples including risk measures, portfolio optimization, the Fundamental Theorem of Asset Pricing, hedging and capital/risk allocation problems will be studied.

**Textbooks:** As a reference for Mathematical Finance, in particular for risk measures, we refer to:

- Föllmer, Schied (2004) Stochastic Finance, 2nd edition, de Gruyter.

As a reference for Convex Analysis, we refer to the following books:

- J. Borwein, A. Lewis, Convex Analysis and Nonlinear Optimization, CMS Books in Mathematics, SpringerVerlag 2000.
- C. Zalinescu, Convex Analysis in General Vector Spaces, World Scientific 2002

**Assessment:** The final grade will be comprised of:

- 40% Homework assignments
- 20% Midterm Exam

- 40% Final Exam

Both exams will be closed book but you may bring one double-sided, letter sized "cheat sheet" with you.