

S1, 2020

## Mathematics II

Wednesday, Friday 10:25-12:10

April 3, 2020

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The aim of this course is to provide students with basic tools in Analysis that are needed in advanced level micro and macro economics. The course covers the main part of the Mathematical Appendix in Mas-Colell, Whinston, and Green.

Course information will be posted at

<http://www.oyama.e.u-tokyo.ac.jp/mathii20/>

### Topics

1. Real numbers (Debreu 1.5)
2. Continuous functions and compact sets (MWG M.F; Debreu 1.6, 1.7)
3. Correspondences (MWG M.H; Debreu 1.8)
4. Convex sets and (quasi-)concave functions (MWG M.C; Debreu 1.9)
5. Differentiation (MWG M.A, M.B, M.E)
6. Negative (semi-)definite matrices (MWG M.D)
7. Separating hyperplane theorems (MWG M.G, M.M; Debreu 1.9)
8. Optimization (MWG M.J, M.K)
9. Envelope theorem (MWG M.L; Oyama and Takenawa)
10. Fixed point theorems (MWG M.I; Debreu 1.10)
11. Dynamic programming (MWG M.N; Stokey-Lucas 4; Puterman 5, 6)

### Textbook

- A. Mas-Colell, M.D. Whinston, and J.R. Green, *Microeconomic Theory*, Oxford University Press, 1995.

## References

- G. Debreu, *Theory of Value*, Yale University Press, 1959.
- D. M. Kreps, *Microeconomic Foundations I*, Princeton University Press, 2012.
- D. Oyama and T. Takenawa, “On the (Non-)Differentiability of the Optimal Value Function When the Optimal Solution Is Unique,” *Journal of Mathematical Economics* 76, 21-32, 2018.
- N.L. Stokey and R.E. Lucas, *Recursive Methods in Economic Dynamics*, Harvard University Press, 1989.
- M.L. Puterman, *Markov Decision Processes: Discrete Stochastic Dynamic Programming*, Wiley-Interscience, 2005.

## Grading

Final exam (to be held end of July)