Math Camp Syllabus

Brown University
Department of Economics

Summer 2025

Instructor: Cole Davis
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Office Hours: After class and by appointment

Times: 8/11, 8/12, 8/13, 8/14, 8/18, 8/19 from 9AM–12:30PM (time includes a 10 min break)
Location: Robinson Hall Rm 301
Website: cj-davis99.github.io

1 Course Description

The goal of this course is to present many of the mathematical tools that you will typically encounter throughout your first year at the PhD program.

Keep in mind that this course should serve as a warm-up for the challenging first year that you'll have. We expect that, at the end of the Math Camp, students will be familiarized with the theory presented and will be able to apply it throughout the first year. A loose outline of content is highlighted in the tentative schedule below.

Finally, many of the topics we will cover will be presented in a "Cookbook" way, perhaps without the details a rigorous and formal student ideally would want. A more rigorous presentation of the topics we will expose will come shortly (ECON 2010).

2 Recommended Reading

The course does not follow a particular textbook; hence you are not required to have any. In case you would like to read more about some topics, we suggest the following references: *Real Analysis with Economic Applications* by Efe Ok (henceforth Ok) and *Math for Economists* by Simon and Blume (henceforth SB). In past years these two books (primarily Ok) have been used in ECON 2010[1]. *Microeconomic Theory* by Mas-Collel, Whinston and Green (henceforth MWG) is the quintessential graduate economics textbook that will be referenced heavily throughout the first year micro theory sequence and contains some useful mathematical appendices.

[1]The professor for ECON 2010 is changing this fall, and textbook preferences may also change.

Additional reading for introductory mathematical logic: there are plenty of books available that cover this topic, but my personal favorite is Richard Hammack's *Book of Proof* which is freely available here.

Additional reading for linear algebra: *Linear Algebra Done Right* by Sheldon Axler is arguably the most famous linear algebra textbook and *Linear Algebra* by Jim Hefferon is a solid theory-heavy covering of the material that is freely available here.

Additional readings for real analysis: *Principles of Mathematical Analysis* (aka baby Rudin) by Walter Rudin is a classic analysis textbook, but *Analysis I* and *Analysis II* by Terrence Tao are my preferred references and they are freely available for download through Brown's library.

3 Homework Assignments

There will be a problem set every two lectures. The assignments will not be collected (though students are free to submit solutions and ask for feedback). The problem sets will consist of basic (and not-so-basic) questions regarding every topic we see. Their goal is to ensure you are aware of (and hopefully comfortable with) the math level that will be required throughout your first year, and to push you towards working with your peers for the first time.

4 Tentative Schedule

Lecture		Topic	References
8/11 (Mon)	1st half	Introduction, Mathematical Proofs	Lecture Notes
	2nd half	Intro to Topology, Limits	Ok A.1–A.3, B.1, C.1
8/12 (Tue)	1st half	Sequences	Ok A.1–A.3, C.1, C.5
	2nd half	Continuity	Ok D.1, D.3
8/13 (Wed)	1st half	Compactness, Extreme Value Thm	Ok C.3–C.4, MWG M.I
	2nd half	Correspondences, Maximum Thm, Fixed Points	Ok E.1–E.3, MWG M.H
8/14 (Thu)	1st half	Differentiation, Implicit Function Thm	Ok K.1–K.2, MWG M.E
	2nd half	Unconstrained Optimization	SB 17, MWG M.D, M.J
8/18 (Mon)	1st half	Constrained Optimization	SB 18, MWG M.K
	2nd half	Envelope Thm	See above
8/19 (Tue)	1st half	Linear Algebra	SB 10–11
	2nd half	Eigenvalues	See above