

**GENERAL INFORMATION**

<b>Dates</b>	August 18 to September 5, Monday through Friday	
<b>Times</b>	10:00 AM – 11:30 AM (Linear Algebra sequence) 1:00 PM – 2:30 PM (Real Analysis sequence)	
<b>Classroom</b>	North Hall 2111 (Thormahlen Family Seminar Room)	
<b>Instructor</b>	Camilo Abbate	Sofia Olguin
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<b>Office Hours</b>	Thursday 3:00–4:00 PM (NH 2041)	Tuesday 3:00–4:00 PM (NH 2037)

**COURSE DESCRIPTION**

Math Camp is designed to bridge materials and concepts you encountered during your undergraduate preparation and new technical skills that will be covered extensively in your first-year Ph.D. sequences. The focus of the class is on mathematical concepts, tools, and skills useful in your classes (and more generally during your career as an economist). Most topics should be familiar to most students and are presented as a refresher; others will be new material that will be useful moving forward.

The course assumes that you have some familiarity with multivariate calculus, linear algebra, probability theory, and mathematical statistics. Brief reviews of these subjects will be provided, along with material from real analysis, set theory, optimization, and other relevant fields. When possible, topics will be motivated by their usefulness within the economics profession (e.g. as they relate to preference theory, econometrics, etc.).

The course will be split by subjects:

- Analysis Sequence: Logic, Proof Strategy, Real Analysis, and Optimization
- Linear Algebra and Statistics Sequence: Linear Algebra, Probability, and Statistics

We will also provide a brief introduction to  $\text{\LaTeX}$  and  $\text{\R}$ ; the former is one of the most popular document preparation software systems, and the latter is one of the most used statistical analysis software nowadays. We will have a couple of sections introducing the basics of programming in these languages.

**ASSIGNMENTS AND WORKLOAD**

To (re)familiarize yourself with this material, six problem sets will be provided for the topics covered in class. For each problem set, you will be assigned to a small group (2-3 people). Each group must work together to turn in one set of answers, typed neatly in  $\text{\LaTeX}$  and submitted by Tuesday the following week.

You are strongly encouraged to work in groups in your first-year coursework, either with your office mates or others that you work well with. Our hope is that by assigning you to groups during Math Camp, you can get to know one another and get comfortable working together.

Note that everything in the first year should be oriented towards passing the preliminary exams. You need to understand when you are comfortable with a particular concept, so that you can move on to other material (there is always something else to study). Prioritize understanding core concepts over turning in perfect problem sets.

## TEXTBOOKS

Below are some textbooks that you may find helpful during Math Camp and beyond. You are ***not required to purchase any materials for Math Camp!*** However, you may find them useful to have on hand, and future classes will make use of some of them. (Many are available for free online, as are answer keys. You should also check the [library](#).)

- Casella, George, and Roger L. Berger. *Statistical Inference* (2<sup>nd</sup> edition). Brooks/Cole, 2002. ***(used in Econ 241A)***
- Chiang, Alpha C., and Kevin Wainwright. *Fundamental Methods of Mathematical Economics* (4<sup>th</sup> edition). McGraw Hill, 2005.
- Hansen, Bruce. *Probability and statistics for economists*. Princeton University Press. 2022 ***(used in Econ 241A)***
- Hansen, Bruce E. *Econometrics*. 2022.
- Mas-Colell, Andreu, Michael D. Whinston, and Jerry R. Green. *Microeconomic Theory*. Oxford University Press, 1995. ***(used in Econ 210A)***
- Simon, Carl P., and Lawrence Blume. *Mathematics for Economists* (7<sup>th</sup> edition). New York: Norton, 1994.
- Smith, Douglas, Maurice Eggen, and Richard St. Andre. *A Transition to Advanced Mathematics* (8<sup>th</sup> edition). Cengage Learning, 2014.

## OTHER RESOURCES

- Jonathan Levin notes “Useful Math for Economists” ([here](#), his other first quarter micro notes may be useful for 210A)
- 3Blue1Brown Channel for Linear Algebra Intuition ([here](#))
- Nolan’s Miller Notes on Microeconomic Theory ([here](#), very useful for the 210 track)
- University of Arizona Math Camp Videos ([UAMathCamp on YouTube](#))

## EVALUATION

There is no grade for this class. While Math Camp will not directly affect your grades or academic standing, the class is provided as a tool for you. Use it as the first step towards preparing for the preliminary exams.

## SOME GENERAL ADVICE FOR THE PHD

The first year of the program can be challenging. However, think of it as a necessary condition for becoming a researcher. Although doing research is very different from studying and cramming for assignments and exams — which is what you'll primarily face during your first year — putting in the effort to succeed at this stage helps develop systematic thinking and resilience, both of which are invaluable for completing a PhD. As experienced students (in our 4th and 6th years), here are some tips we've found helpful:

- **Work by yourself.** Attempting problem sets and studying on your own not only promotes critical thinking but also helps identify gaps in understanding that may be hidden in a group setting. Some of the learning process requires focused, solitary work, which allows you to internalize complex concepts and develop the self-discipline needed to navigate the challenges of research.
- **Work together.** Your understanding of the material deepens when you discuss it and try to teach it to your classmates. Moreover, because we all come from different backgrounds, we may benefit from our complementary strengths and diverse perspectives. One last thing: enjoy these moments with your cohort — this is a special time when you're all learning and growing together. After the first year, as everyone moves into their own fields of study, you may see each other a bit less often.
- **Go to office hours.** Both TAs and faculty are happy to help and provide guidance. While it's a good idea to first spend some time working through the problem yourself, it can be very useful to check in with an instructor or TA after a while to get their input.
- **Treat yourself well.** Maintaining a healthy routine, including good sleep, nutrition, and mental health, is also an important component of a successful first year. UCSB offers Counseling & Psychological Services (CAPS) to all registered students, along with other resources (such as a gym with a pool). Set aside time for hobbies or activities that you enjoy. And don't hesitate to seek help, whether from CAPS, your mentors, colleagues, or faculty. All upper-year students have gone through this process and would love to help you!

**TOPIC LIST AND SCHEDULE**

		Mon	Tue	Wed	Thu	Fri
<b>Week 1</b> August 18 to August 22	AM	(CA) Vectors, Matrices, and Operations	(CA) Quadratic Forms, Eigenvalues and Eigenvectors	(CA) Vector Spaces and Norms	(CA) Orthogonality, Projections, and OLS	(SO) Topics on Proofs for Economics
	PM	(SO) Sets and Logic	(SO) Proof Strategies	(SO) Functions	(SO) Limits and Sequences	(CA and SO) L <sup>A</sup> T <sub>E</sub> X R Programming
<b>Week 2</b> August 25 to August 29	AM	(SO) Measure, Counting, Independence	(SO) Random Variables and Distribution Functions	(SO) Transformation and Moments	(SO) Multiple Random Variables	(CA) Topics on Proofs for Economics
	PM	(CA) Continuity and Differentiation	(CA) Topology on Metric Space	(CA) Topology on Metric Space	(CA) Multivariate Derivatives	(CA and SO) R Programming
<b>Week 3</b> September 1 to September 5	AM	<b>Labor Day</b>  <b>No Class</b>	(CA) Statistics and Estimation	(CA) Convergence and Hypothesis Testing	(CA) Methods in Applied Microeconometrics I	(CA and SO) Methods in Applied Microeconometrics II
	PM		(SO) Integral Techniques	(SO) Optimization	(SO) ODE	(CA and SO) R Programming

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