## General Information

|  | Class A | Class B |
|---|---|---|
| **Instructor** | Sarah Robinson | Woongchan Jeon |
| **Contact** | sarahrobinson@ucsb.edu | wjeon@ucsb.edu |
| **Website** | [s-robinson.com](s-robinson.com) | [woongchanjeon.com](woongchanjeon.com) |
| **Office Hours** | By Appointment | |
| **Classroom** | [Zoom Link](Zoom Link) (Meeting ID: 948 1445 2482 / PW: 623848) | |
| **Dates** | August $24^{th}$ - September $11^{th}$, M - F (**PT**) | |
| **Time** | 5:30 PM - 6:45 PM (**PT**) | 7:15 PM - 8:30 PM (**PT**) |

† **PT: Pacific Time (US and Canada)**

## 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 and tools 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 are familiar 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:

- Class A : Logic, Real Analysis, and Optimization

- Class B : Linear Algebra, Probability, and Statistics

*(We will not spend time in class on programming, but will provide resources to help you get you started in LaTeX and MATLAB.)*

## 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 LaTeX and submitted by Wednesday the following week.

You are strongly encouraged to work in groups in your first-year coursework, either with your (virtual for now) 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. Answers to problem set questions are often easy to get from classmates, answer keys (many are available for free online), or TA office hour hints – **use these resources after you've struggled a bit first, and use them to learn the underlying tool so that you can apply it again later.**

## 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!** You might find them useful to have on hand, however, and some will be used in future classes. (Many can be found for free online, and answer keys often can be as well.)

- Casella, George, and Roger L. Berger. *Statistical Inference* ($2^{nd}$ edition). Brooks/Cole, 2002. **(used in Econ 241A – we found having a hard copy very useful)**

- Chiang, Alpha C., and Kevin Wainwright. *Fundamental Methods of Mathematical Economics* ($4^{th}$ edition). McGraw Hill, 2005.

- Hansen, Bruce E. *Introduction to Econometrics*. 2020.

- Hansen, Bruce E. *Econometrics*. 2020.

- Mas-Colell, Andreu, Michael D. Whinston, and Jerry R. Green. *Microeconomic Theory*. Oxford University Press, 1995. **(used in Econ 210A – we found having a hard copy very useful)**

- Simon, Carl P., and Lawrence Blume. *Mathematics for Economists* ($7^{th}$ edition). New York: Norton, 1994.

- Smith, Douglas, Maurice Eggen, and Richard St. Andre. *A Transition to Advanced Mathematics* ($7^{th}$ edition). Cengage Learning, 2011.

## Other Resources

- Google and Stack Exchange (can range from not to extremely helpful, especially for coding)

- Jonathan Levin notes "Useful Math for Economists" (here, his other first quarter micro notes may be useful for 210A)

- Peter Troyan notes "Constrained Optimization" (here)

- University of Arizona Math Camp Videos (UAMathCamp on YouTube)

## Topic List and Schedule

|  | Class A | Class B |
|---|---|---|
| **Week 1**<br>(5 Classes) | <u>Logic</u><br>*Connectives, Quantifiers, Proof Strategies*<br><br><u>Set Theory</u><br>*Notation, Operations*<br><br><u>Relations</u><br>*Functions, Correspondences, Sequences* | <u>Linear Algebra</u><br>*Systems of Linear Equations, Vector and Matrix, Quadratic Form, Eigenvalue and Eigenvector, Vector Space, Orthogonality and Projection, Matrix Differentiation* |
| **Week 2**<br>(5 Classes) | <u>Real Analysis</u><br>*Closure, Boundedness, Convexity & Concavity*<br><br><u>Unconstrained Optimization</u><br>*Maxima & Minima, Critical Points, Inflection Points* | <u>Probability Theory</u><br>*Sets, Probability, Combinatorics, Independence, Randomvariable and Distribution Function, Transformation and Moment, Multivariate Distributions* |
| **Week 3**<br>(4 Classes)<br>No class 9/7 | <u>Constrained Optimization</u><br>*Equality & Inequality Constraints, Lagrangians, Kuhn-Tucker Theorem, Shadow Values* | <u>Statistics</u><br>*Random Sample, Statistics, Convergence, Hypothesis Testing* |

## 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 to you. Use it as the first step towards preparing for prelims.

## Zoom Class Recordings

This live Zoom session will be recorded for students who may not be able to attend at this time. Recordings will be made available upon request. By default, your microphone and camera will be muted when you join the session. If you do not want to be included in the recording, simply keep your camera and microphone off. You may ask questions in the chat window. NOTE: Student participants are **_prohibited_** from recording of any kind. **_Only the instructor_** is permitted to record.