# Math Camp Summer 2014

August 26 – September 9
Morning Session: 10:00am – 11:50pm
Afternoon Session: 1:30pm – 3:20pm
Corwin 127 (Robertson 029 on September 8)


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| **Instructors:** | Gabriel López-Moctezuma and Yuki Shiraito |
| Office: | Corwin 031 |
| Office Hours: | 4:00pm – 6:00pm, or stop by anytime |
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| **Faculty advisers:** | Kristopher Ramsay, Kosuke Imai, and Adam Meirowitz |


**Course Description:** The math camp reviews basic calculus and linear algebra, as well as it introduces the fundamental ideas of real analysis necessary for graduate courses in formal and quantitative methods[1].

The goal of the camp is twofold. The first is to provide an opportunity to review the basic tools in calculus and linear algebra by solving a number of practice problems. To achieve this goal, the math camp is NOT designed to teach these materials to students for the first time. Rather, it will focus on applying basic calculus and linear algebra tools to solve mathematical problems. We will start providing preview materials in late June. All students are strongly encouraged to go over these materials PRIOR to the camp.

The second goal is to facilitate a smooth transition to the mathematical foundation course (POL502). For this goal, we will cover the basic concepts of real analysis. Specifically, the camp will ensure that students can use these basic concepts to prove mathematical propositions. POL502 will be built on the materials covered in this part of the camp.

**Course Structure:**

1. Pre-camp assessment test (June): The purpose of this exercise is to assess your mathematical background in order to make the math camp as useful to everyone as possible. We will plan the preview materials and the camp syllabus taking your answers into consideration.

2. Preview materials (July-August): A set of video lectures and pre-camp exercises will be distributed after the assessment test, so that you are prepared for the course. Pre-camp exercises will be sent out weekly throughout July and August and students must hand them in every week.

3. Sessions (August-September): The course will meet for 10 days with a morning session (2 hours) and an afternoon session (2 hours) each day. There will be daily problem sets to be completed outside of class. The topics for each day's session can be found below.

[1]The details of these courses are available at `http://www.princeton.edu/politics/about/file-repository/public/FQcourses-2014.pdf`

**Course Requirements:** There will be pre-camp exercises, problem sets, and an in-class final exam. Each pre-camp exercise will contain a few elementary problems to check if you understand the assigned materials. The details on the pre-camp materials including the pre-camp exercises will be announced later. Each problem set will be distributed at the end of each morning session, and will be due by **10 am** on the following day. The problem sets and the final exam will be graded and solution sets will be distributed. Students are allowed to work together on problems, but you will learn much better if you try them on your own first before consulting with others: solving problems on your own is the only way to learn mathematics! Please remember that you are required to write up your solutions individually.

**Course Textbooks:**

- Preview Materials
  - Gilbert Strang, *Introduction to Linear Algebra*, Wellesley-Cambridge Press. Various useful materials are available at `http://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010`
  - Adrian Banner, *The Calculus Lifesaver*, Princeton University Press. Videos of lectures are available at `http://press.princeton.edu/video/banner/`
- Sessions: We do not use any particular textbooks for the sessions. In addition to the two books above, you can refer to the following books.
  - Michael Spivak, *Calculus*, Publish or Perish, Inc.
  - David C. Lay, *Linear Algebra and Its Applications*, Addsion-Wesley.
  - Carl P. Simon and Lawrence E. Blume, *Mathematics for Economists*, W. W. Norton & Company.
  - Michael Reed, *Fundamental Ideal of Analysis*, Wiley.
  - Serge Lang, *Undergraduate Analysis*, Springer.

## Session Schedule

| Day | AM/PM | Topics | Details |
|---|---|---|---|
| Aug 26 | AM | Axioms/Proofs | Operations and relations on $\mathbb{R}$ |
| Aug 26 | PM | Calculus | Limits of functions |
| Aug 27 | AM | Calculus | Continuity |
| Aug 27 | PM | Calculus | Differentiation |
| Aug 28 | AM | Calculus | Optimization |
| Aug 28 | PM | Calculus | Integration |
| Aug 29 | AM | Calculus | Multivariate calculus |
| Aug 29 | PM | Review Session (1) | |
| Sep 2 | AM | Linear Algebra | Vector spaces |
| Sep 2 | PM | Linear Algebra | Linear transformations |
| Sep 3 | AM | Linear Algebra | Projection |
| Sep 3 | PM | Linear Algebra | Determinants and inverse |
| Sep 4 | AM | Linear Algebra | Eigenvalues and eigenvectors |
| Sep 4 | PM | Linear Algebra | Diagonalization and SVD |
| Sep 5 | AM | Review Session (2) | |
| Sep 5 | PM | Real Analysis | Sets and functions |
| Sep 8 | AM | Real Analysis | Real numbers |
| Sep 8 | PM | Real Analysis | Sequences and series |
| Sep 9 | AM | Real Analysis | Convergence |
| Sep 9 | PM | Final Exam | |