Syllabus
Math for Political Scientists Workshop

Summer 2024

Instructor:	Yang Yang
Class:	1:00 p.m. – 2:30 p.m. (Except August 19: 1:30 p.m. - 3:00 p.m.)
Location:	369 Willard Building
Office Hours:	3:00 p.m.- 4:00 p.m. (224 Pond Lab)
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1 Course Description

This workshop will provide an introduction to a range of mathematical concepts that are crucial for quantitative political research. Topics covered will include one-variable and multivariate calculus, linear (matrix) algebra, and probability.

The focus of this workshop is on developing your intuitive understanding and reading fluency in mathematics, rather than on solving specific mathematical problems or writing formal proofs. Throughout the five sessions, we will pursue four main objectives. First, to enhance preparation for our methods sequence courses, specifically PLSC 502 and PLSC 503. Second, to improve comfort with comprehending all of the math concepts and techniques commonly used in the study of quantitative methodology in political science. Third, to provide useful resources that you can utilize for self-study in the future as needed. Last but not least, to get familiar with your cohort.

2 Recommended Textbooks

Moore, Will H. and David Siegel. 2013. A Mathematics Course for Political & Social Research. Princeton University Press.

Simon, Carl P. and Lawrence Blume, Mathematics for Economists. New York: W.W. Norton and Company, 1994.

3 Useful Resources

Given our constrained schedule, we won't be able to delve into every mathematical concept in detail, such as the entire section on optimization, despite it being featured in our methods sequence (PLSC 503 and 504). However, you are encouraged, though not required, to deepen your mathematical understanding by self-studying the free online courses provided by Professor David Siegel, one of the textbook authors, as needed. These include video lectures and problem sets (including solutions) that closely align with the textbook topics. All videos are available for free on YouTube.

- David Siegel's Course Webpage.
- Syllabus with Direct Links to All Videos.
- Link to YouTube Channel

You may also find the online materials below very useful when you would like to understand the intuition of basic probability and statistics as well as statistical proofs relevant to our methods sequence in the future. The latter can be used as a handbook along the way:

1. Devlin, Guo, et al. (2018). Seeing Theory: A Visual Introduction to Probability and Statistics (Version 2018).
2. Soch, Joram, et al. (2024). StatProofBook/StatProofBook.github.io: The Book of Statistical Proofs (Version 2023). Zenodo. https://doi.org/10.5281/ZENODO.4305949

4 Schedule

Pre-Class Refresher

- Basic Notations and Expressions.
- *Reading: Moore & Siegel: Chapter 1 (page 18-21); Chapter 4 (page 81-92).*

1. (Monday, August 19) Calculus in One Dimension
   - Intro to Calculus and The Derivative; The Rules of Differentiation; The Integral.
   - *Reading: Moore & Siegel: Chapter 5, 6 (page 117-127), 7 & 8.*
2. (Tuesday, August 20) Exponential and Logarithm Functions & Intro to Probability
   - Intro to Exponential and Logarithm Functions and Their Derivatives; Simple and Compound Events and Their Properties; Conditional, Joint, and Union Probabilities; Combinations and Permutations.
   - *Reading: Simon & Blume: Chapter 5; Moore & Siegel: Chapter 9.*
3. (Wednesday, August 21) Linear Algebra 1
   - Scalars; Vectors; Matrices; Square and Identity Matrix; Matrix Addition (Subtraction); Matrix Multiplication; Matrix Transposition; Matrix Inversion.
   - *Reading: Simon & Blume: Chapter 8 (page 153-159, 165-167)*
4. (Thursday, August 22) Linear Algebra 2
   - Determinants; Eigenvalues and Eigenvectors.
   - *Reading: Simon & Blume: Chapter 9; Moore & Siegel: Chapter 14 (page 327-336)*
5. (Friday, August 23) Multivariate Calculus
   - Partial Derivatives; Gradients and Total Derivatives; Second-order Derivatives and the Hessian Matrix.
   - *Reading: Moore & Siegel: Chapter 15 (page 355-369)*