# Math Workshop for Political Science
## University of Florida
### Syllabus: Autumn 2025


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| Instructor: | Dr. Andrew Rosenberg | Class location: | 0101 Anderson Hall |
| Office: | 210 Anderson Hall | Class time: | Various |
| Email: | *andrewrosenberg@ufl.edu* | Office hours: | By Appointment |


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## Description

The purpose of this workshop is to provide incoming first year Ph.D. students with some fundamental skills in various mathematical techniques that are used in political science, regardless of sub-specialty, and generally to prepare students for the first-year methods sequence. The workshop is also open to continuing students who feel that they would gain from participating in the course.

It's important to keep a few things in mind. First, I am not a mathematician. I took one semester of community college calculus that I immediately forgot. The bar here is very low. Second, we will focus on covering the things necessary for you to understand quantitative methods in political science. Some of this stuff might seem escoteric, but I promise it directly ties to something we will cover during the first two methods courses. Third, this course is not graded and your performance is not a reflection of your self-worth.

NB: This course is typically 10 days. We only have 5, so we will have to move fast and cut out some topics. We maybe have to adjust the schedule somewhat.

#### Textbook

Moore, W.H. and Siegel, D.A., 2013. *A Mathematics Course for Political and Social Research*. Princeton University Press. (SM)

This is a good textbook for getting started with R programming, a topic we won't have time to cover: Wickham, H. and Grolemund, G., 2017. *R for Data Science*. O'Reilly. (WG)

#### General resources

- Another popular, but more technical, textbook is: Simon, Carl P. and Lawrence Blume., 1994, *Mathematics for Economists*. Vol. 7. New York: Norton.
- MIT Open Courseware (Mathematics): http://ocw.mit.edu/courses/#mathematics
- Khan Academy: http://www.khanacademy.org/

- Brightstorm: http://www.brightstorm.com/math/
- MathTV: http://www.mathtv.com/videos_by_topic

## Class Format

The class will meet in-person for an extensive lecture, followed by students completing problem sets after class on their own. For each module, students will be expected to do the textbook readings, consult online videos, and complete a problem set. During each class, we will review the problem set from the previous day's material and then I will answer questions about the current day's material. For example, on day 2 we will review day 1's problem set and answer clarifying questions about day 2's topics.

## R Introduction

The compressed nature of this class makes it impossible to give students a comprehensive introduction to all of the tools they will need in the first year methods sequence. However, I am available to provide a brief R and computational social science introduction to interested students.

## Class schedule

**Day 1 (Monday, August 11): Introduction, Pre-test, Notation and Definitions, and Some Basic Mathematics**

- **Reading** (don't panic): SM (3–21, Ch.2, 44–73)
- Definition of a variable and real number systems
- Set notation and relationships
- Definition of independent and dependent variables
- Discussion of interval notation
- Definitions of types of functions
- Commutative, associative, and distributive laws
- Concepts of inequality and absolute value
- Exponent rules
- Summation and product operators
- Factorials, permutations, and combinations
- Solving equations, inequalities, and for roots
    - Single and multiple variables
    - Quadratic formula
    - Factoring

- Logarithms and rules

## Linear Algebra: SM Ch. 12–13

**Day 2 (Tuesday, August 12): Linear Algebra I**

- **Reading**: SM (275–288, 297–298, 304–315)
- Linear equations and linear systems
- Method of elimination
- Definition of matrices and vectors
- Matrix operators
- Transposes
- Dot product and matrix multiplication
- Matrix representation of systems of equations

**Day 3 (Wednesday, August 13): Linear Algebra II**

- **Reading**: SM (289-297, 315-324)
- Linear dependence/independence
- Definition of matrix rank
- Properties of matrix operators
- Definition of identity, zero, and idempotent matrices
- Reduced row/row echelon form and solving linear systems of equations Gauss-Jordan Reduction/Elimination
- Inverses
- Conditions for nonsingularity of matrix
- Determinants
- Matrix inversion
- Trace of a matrix

## Calculus: SM Ch. 5–8

**Day 4 (Monday, August 18): Calculus I**

- **Reading**: SM (81-92, Ch.5, 8)
- Limits
- The difference quotient
- The derivative
- Rules of differentiation for a function of one variable
- Rules of differentiation involving two or more functions of the same variable

- Derivative of exponential and log functions
- Partial differentiation
- Second and higher derivatives
- Definition of optimum and extreme values
- Relative maximum and minimum
- Second-derivative test

**Day 5 (Wednesday, August 19): Calculus II**

- **Reading**: SM (Ch. 7)
- Constrained optimization and Lagrange Multipliers (maybe)
- Antidifferentiation
- Areas and Riemann sums
- Indefinite and definite integrals
- Fundamental Theorem of Calculus