

Syllabus for Math 480b: Sage – Open Source Mathematical Software

William Stein

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- **Goal:** Teach you to *solve problems* in linear algebra, abstract algebra, combinatorics, probability, calculus, and number theory using the open source mathematical software Sage.
- **Course webpage:** <http://wiki.wstein.org/09/480b>
- **Office Hours:** Tuesdays 9–11am.
- **Grading:**
 - There will be no exams at all.
 - Your grade will be based entirely on homework.
 - There will be 9 homework assignments, and your lowest homework grade will be dropped.
 - Your course grade will be at least a 3.5 if you get at least 90%, at least a 2.8 if you get at least 80% on homework, at least a 1.8 if you get at least 70%, and at least 0.8 if you get at least 60%. I may adjust grades up.
- **Prerequisites:** Calculus, linear algebra, and experience with some computer programming language.
- **Topics:** We will cover many of the following, depending on how much time we have.
 1. *Linear algebra:* row reduction of matrices, solving systems of linear equations, computing determinants and characteristic polynomials, finding eigenvalues and eigenvectors, subspaces of vector spaces
 2. *Algebra:* factoring polynomials, symbolically finding roots of polynomials, solving systems of polynomial equations, drawing cayley graphs of groups
 3. *Combinatorics, Probability, and Statistics:* plotting graphs (vertices and edges), computing invariants of graphs (automorphism group, shortest path, etc.), solving sudoku puzzles and rubik's cube, counting and enumerating permutations, combinations, etc., generating random numbers and random walks, computing the mean, variance, standard deviation, and plotting frequency histograms, predicting missing data (interpolation)
 4. *Calculus:* plotting functions, computing limits and derivatives, finding min and max points of functions, computing symbolic integrals, computing definite integrals numerically, numerically finding roots of polynomials, summing infinite series, solving differential equations, parametric curves (plotting, arc length)
 5. *Number theory and cryptography:* enumerating and counting prime numbers, exchanging secret messages (Diffie-Hellman and RSA), attacking RSA and Diffie-Hellman, elliptic curve cryptosystems, determining whether an integer is the area of a rational right triangle