# Math 380: Computational Algebraic Geometry – Spring 2026

**Lecture:** MWF 1:30pm - 2:20pm in IEB 205
**Instructor:** Cynthia Vinzant (vinzant@uw.edu, PDL C-439)
**Instructor Office Hours (tentative):** MW 2:30 - 3:20pm in PDL C-439

**Teaching Assistants:** Bryan Lu (blu17@uw.edu, PDL C-8G)

**Textbook:** David A. Cox, Donal O'Shea, and John B. Little. Ideals, Varieties, and Algorithms: An Introduction to Computational Algebraic Geometry and Commutative Algebra. The fourth edition is freely available through the UW libraries, which you are welcome to use. The fifth edition was published in 2025.

**Course website:** https://sites.math.washington.edu/~vinzant/teaching/380/

**Course Description:** Polynomial equations and their solutions are fundamental objects in mathematics and appear across a wide range of applications. As in linear algebra, solutions to equations can be understood geometrically using tools from algebra. The solution sets of nonlinear equations in multiple variables have more interesting geometry and require us to develop new tools. In this class, we will learn how to understand and work with polynomial systems of equations using a mix of algebra, geometry, and algorithms and explore some real-world applications, such as to robotics and computer vision. Topics will include an introduction to polynomial rings and ideals, affine varieties, monomial orderings, Groebner bases, elimination theory, Hilbert's Nullstellensatz, and applications. This class is open to everyone who knows linear algebra and is familiar with mathematical proofs.

**Prerequisite:** A minimum grade of 2.0 in either MATH 334, or both MATH 208 and MATH 300.

**Emails:** I will not respond to math questions via email. Please post questions (privately or publicly) on the Ed Discussion board.

**Homework:** There will be homework assignments due weekly on (most) Thursdays via Gradescope. You may discuss the problems with other students, but should write up solutions completely on your own. At the end of the quarter, the lowest homework grade will be dropped.

**Late homework submission:** GradeScope will accept submissions until the end of Sunday. Every student is allowed 5 late days (120 hours) in total without any prior approval. Submissions turned in late after this total has been reached will not receive credit. Except in extraordinary circumstances, no other late homework will be accepted.

**Exams:** There will be a midterm exam in class on **Friday, May 1**. There will not be a final exam, but there will be a poster presentation during the final exam period, **Monday, June 8, 2:30 - 4:20pm**.

**Final Project:** Part of the course grade will be based on a final project. You may work in groups of 1-3 students and will be expected to write a report and give a poster presentation. More details and some suggested topics will be posted on the course website. Some project ideas are also listed at the end of the textbook. The written report will be due **Monday, June 8**.

**Grading:** Your grade for this class will be based on your scores on homeworks (30%), midterm (30%), and the final project (40%). If you get a total score of 50% or more in the course, you are guaranteed at least a 2.0.

**Academic Integrity:** The University takes academic integrity very seriously. Behaving with integrity is part of our responsibility to our shared learning community. If you are uncertain about if something is academic misconduct, ask me. Acts of academic misconduct may include but are not limited to cheating (working collaboratively on assignments/exams and discussion submissions, sharing answers and previewing exams) plagiarism (representing the work of others as your own without giving appropriate credit) and unauthorized collaboration (working with each other on assignments). Concerns about these or other behaviors prohibited by the Student Conduct Code will be referred for investigation and adjudication by (include information for specific campus office). Students found to have engaged in academic misconduct may receive a zero on the assignment (or other possible outcome).

**Access and Accommodations:** Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or `uwdrs@uw.edu` or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

**Religious Accommodations:** Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy. Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form.