

COURSE SYLLABUS

Course Title: Introduction to Algebraic Geometry

Abbreviated Title Intro Algebraic Geometry
As Appears on Transcript

Course Number: DMAT 362

Credit Hours: 4 credits [semester credit hours]

Course Description: An introduction to the study of Algebraic Geometry from elementary formulations, historical perspectives, and modern visualizations of algebraic curves and surfaces, providing tangible examples to give first presentations of groups, rings, and fields. Topics include classical real and complex conics, projective geometry, links to number theory, cubic and elliptic curves, an introduction to groups, higher degree curves and surfaces, and the Riemann-Roch Theorem.

Prerequisite: Successful completion with grade B or higher in Linear Algebra and Multivariable Calculus or equivalent, or consent of instructor.

Course Workload: 4 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 168 hours student course workload average

Examination Requirements: Proctored written and oral final examination must be passed at 70% or higher to earn passing grade in course. “B” and “A” grade paths have additional examinations and assignments. See <https://www.distancecalculus.com/grades/> for more information.

Course Professor: Robert R. Curtis, Ph.D. <rcurtis@rwu.edu>, <robert@distancecalculus.com>

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Accredited by New England Commission of Higher Education (NECHE).

See <https://www.rwu.edu/academics/accreditation/> for more information.

E-Textbook:

Algebraic Geometry - A Problem Solving Approach by Garrity et al.

Mathematical Software: LiveMath and Mathematica Computer Algebra & Graphing Systems

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Students with disabilities who need accommodations in order to fully

participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore the arrangements needed to be made to assure access. Student Accessibility Services is open Monday through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit

<https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas>

COURSE RULES

Academic Honesty

Academic Dishonesty in a Distance course includes copying or relying upon another person's work. Working with other students is good and encouraged, but the work you submit for this course must be genuinely your own work. Private tutors are allowed, but you must notify the instructor that you have obtained a private tutor to aid in your studies. Any documented instance of Academic Dishonesty will be grounds for immediate failure in this course.

Final (and Other) Examinations

A written and oral proctored final exam will occur at the student's location over video with the course professor; The student must score 70% or higher on this final exam to be eligible to earn a passing grade in the course.

Communication

Communication is the key to success in a Distance course. It is the student's responsibility to keep good communication channels with the instructors during the course; failure to participate in the course does not constitute "dropping" the course (Withdrawal from the course must be requested in writing to the instructors before the completion date deadline)

Roger Williams University Policies & Procedures

Roger Williams University has Policies & Procedures that all students must follow, including the Roger Williams University Student Handbook. Student must agree to follow all stated rules governing student conduct listed on the Roger Williams University website, and at the [Roger Williams University Course Catalog](#)

Course Completion 1 Year Rule

All Distance Calculus students are afforded 1 Year to finish their course from the Date of Enrollment. Students will be placed in the Academic Semester based upon their Date of Enrollment for academic records purposes. If a student does not finish the course, and does not request a Course Withdrawal for a W, then an "F" grade will be issued.

No Chatbots / AI

Students must pledge to **not** use any Chatbot/AI at all - **period**. Student must pledge to **limit** use of search engines (Google, Bing, etc) to a minimal level. Student must pledge to not engage in dishonest disguise of any Chatbot/AI/Search Engine source of information as student's own honest academic work. Verified chatbot usage will result in an "F" course grade, and will be referred to the Roger Williams University Academic Integrity Committee.

Learning Outcomes for DMAT 362 - Introduction to Algebraic Geometry

1. To understand the general topic of Algebraic Geometry from first principles and examples.
2. To understand the historical aspect of Algebra Geometry leading to its modernization in the 1970s.
3. To understand affine and projective geometry
4. To understand polynomial equations, their algebra and methods of analysis
5. To understand singular points.
6. To understand the geometric notion of duality
7. To understand cubic curves and their natural group structure
8. To understand introductory group, ring, and field theory.
9. To understand the initial connections between curves and surfaces and group and quotient group structures.
10. To understand and utilize visualization tools such a computer algebra systems

Syllabus Topics Outline for DMAT 362 - Introduction to Algebraic Geometry

1. Getting Started
 - 1.1 Email and Chat
 - 1.2 Learning About the Course
 - 1.3 Required Hardware
 - 1.4 Software Fundamentals
2. Conics
 - 2.1 Conics over the Reals
 - 2.2 Changes of Coordinates
 - 2.3 Conics over the Complex Numbers
 - 2.4 The Complex Projective Plane
 - 2.5 Projective Change of Coordinates
 - 2.6 The Complex Projective Line
 - 2.7 Ellipses, Hyperbolas, and Parabolas as Spheres
 - 2.8 Links to Number Theory
 - 2.9 Degenerate Conics
 - 2.10 Tangents and Singular Points
 - 2.11 Conics via Linear Algebra
 - 2.12 Duality
 - 2.13 Visualization of Real and Complex Curves
3. Cubic Curves and Elliptic Curves
 - 3.1 Cubics in Complex Plane
 - 3.2 Inflection Points
 - 3.3 Group Law
 - 3.4 Normal Forms of Cubics
 - 3.5 Group Law for Smooth Cubic in Canonical Form
 - 3.6 Cross-Ratios and the j -Invariant
 - 3.7 Torus as a Quotient Group of Complex Line

- 3.8 Mapping Torus Quotient Group to a Cubic
- 3.9 Cubics as Tori
- 3.10 Visualization of Real and Complex Curves

- 4. Higher Degree Curves
 - 4.1 Higher Degree Polynomials and Curves
 - 4.2 Higher Degree Curves as Surfaces
 - 4.3 Bézout's Theorem
 - 4.4 The Ring of Regular Functions and Function Fields
 - 4.5 Divisors
 - 4.6 The Riemann-Roch Theorem
 - 4.7 Blowing Up
 - 4.8 27 Lines on a Cubic Surface
 - 4.9 Visualization of Real and Complex Surfaces