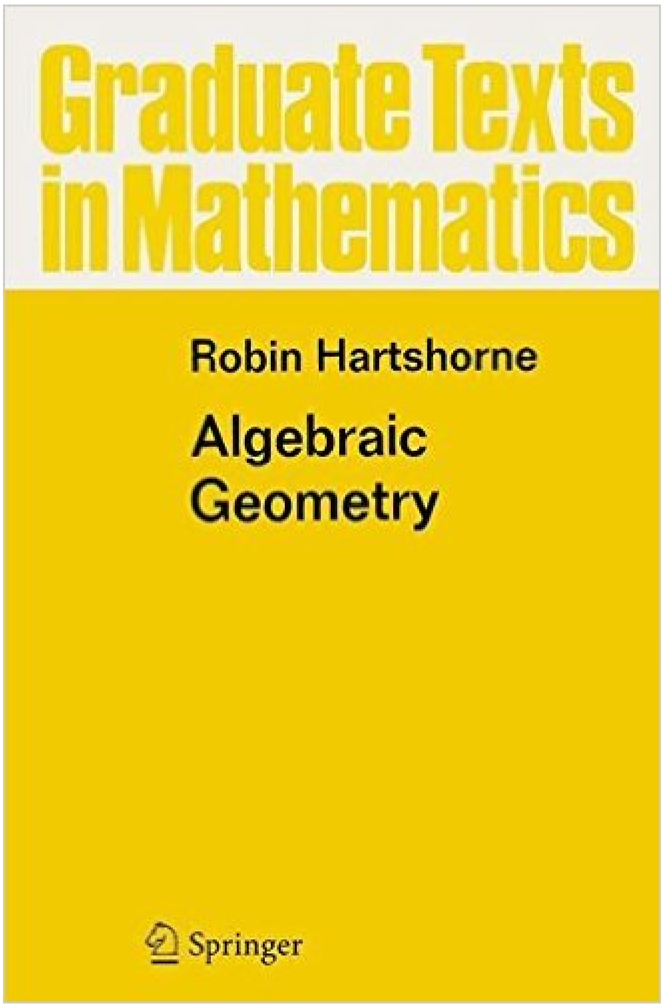
Algebraic Geometry (Graduate Texts In Mathematics)



Synopsis

Note: Item do have Large Margins. An introduction to abstract algebraic geometry, with the only prerequisites being results from commutative algebra, which are stated as needed, and some elementary topology. More than 400 exercises distributed throughout the book offer specific examples as well as more specialised topics not treated in the main text, while three appendices present brief accounts of some areas of current research. This book can thus be used as textbook for an introductory course in algebraic geometry following a basic graduate course in algebra.Robin Hartshorne studied algebraic geometry with Oscar Zariski and David Mumford at Harvard, and with J.-P. Serre and A. Grothendieck in Paris. He is the author of "Residues and Duality", "Foundations of Projective Geometry", "Ample Subvarieties of Algebraic Varieties", and numerous research titles.

Book Information

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Customer Reviews

This book is one of the most used in graduate courses in algebraic geometry and one that causes most beginning students the most trouble. But it is a subject that is now a "must-learn" for those interested in its many applications, such as cryptography, coding theory, physics, computer graphics, and engineering. That algebraic geometry has so many applications is quite amazing, since it was not too long ago that it was thought of as a highly abstract, esoteric topic. That being said, most of the books on the subject, including this one, are written from a very formal point of view. Those interested in applications will have to face up to this when attempting to learn the subject. To read this book productively one should gain a thorough knowledge of commutative algebra, a good start being Eisenbud's book on this subject. Also, it is important to dig into the original literature on algebraic geometry, with the goal of gaining insight into the constructions and problems involved. The author of this book does not make an attempt to motivate the subject with historical examples, and so such a perusal of the literature is mandatory for a deeper appreciation of algebraic geometry. The study of algebraic geometry is well worth the time however, since it is one that is marked by brilliant developments, and one that will no doubt find even more applications in this century. Varieties, both affine and projective, are introduced in chapter 1. The discussion is purely formal, with the examples given unfortunately in the exercises. The Zariski topology is introduced by first defining algebraic sets, which are zero sets of collections of polynomials. The algebraic sets are closed under intersection and under finite unions. Therefore their complements form a topology which is the Zariski topology.

Algebraic Geometry is the first textbook on scheme-theoretic algebraic geometry. Scheme theory was created in the 1960's by Alexander Grothendieck. Grothendieck also co-authored an extremely well-written, 1800-page reference manuscript on scheme theory called "Ã‰lÃ©ments de GÃ©omÃ©trie AlgÃ©brique" (EGA). However, EGA is unsuitable as a textbook because it had no examples or motivation and proved every theorem in great detail and maximal generality.Algebraic Geometry has 5 chapters. The first chapter summarizes algebraic geometry before schemes. The next two chapters compress EGA to 230 pages(!). The last two chapters show how well scheme theory can solve classical problems from algebraic geometry.That should be a hint that Algebraic Geometry is one of the most dense and difficult math textbooks ever written.To achieve that kind of compression, Hartshorne's writing is extremely terse. He assumes a solid understanding of commutative algebra and point-set topology. He often gives one or two-sentence proofs and explanations that, when fleshed out and made complete, would need both many pages and new techniques that are never mentioned in the text. He also gives almost no motivation throughout Chapters II and III, because Chapters IV and V fill this role. When he does give motivation, it is usually relegated to the exercises, many of which, again, require techniques that are never mentioned in the text. Finally, he assigns the proofs of many essential and extremely difficult theorems as exercises.

Robin Hartshorne is a master of Grothendieck's general machinery for generalizing the tools of classical algebraic geometry to apply to families of varieties, and more broadly to number theory. A fundamental difficulty is to grapple with algebro geometric objects such as doubled lines, or surfaces with embedded curves and points in them, that arise as "limits" of simpler varieties. Here the algebra is essential as the naive set of points does not reveal the antecedents of the limiting object. Even more in number theory, when the rings of coefficients used may not admit solutions, the structure of the rings themselves is all you have to go on. For the most basic invariants, when we leave the complex numbers and Riemann's topological and integration techniques are not available, sheaf cohomology is the abstract substitute.These esoteric developments did not arise spontaneously, but out of classical problems that should be approached first in order to motivate and appreciate the power of the tools in chapters 2,3 of this book. Professor Hartshorne says himself that he taught the chapters out of order when he first was writing the book. The average reader should probably read the chapters in the order he taught them in, not the order they appear in this book. Thus first read chapters 4 and 5 on curves and surfaces, or possibly read 1,4,5, to get first a general introduction, then study curves and surfaces. Only then delve into chapters 2 and 3 for the sophisticated stuff.If you really want to start with the classical roots, begin instead with Rick Miranda's book on Algebraic curves and Riemann surfaces.