



Learning Modern Algebra: From Early Attempts to Prove Fermat's Last Theorem (Maa Textbooks) (Mathematical Association of America Textbooks)

Al Cuoco, Joseph J. Rotman

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Learning Modern Algebra aligns with the CBMS Mathematical Education of Teachers II recommendations, in both content and practice. It emphasizes rings and fields over groups, and it makes explicit connections between the ideas of abstract algebra and the mathematics used by high school teachers. It provides opportunities for prospective and practicing teachers to experience mathematics for themselves, before the formalities are developed, and it is explicit about the mathematical habits of mind that lie beneath the definitions and theorems.

This book is designed for prospective and practicing high school mathematics teachers, but it can serve as a text for standard abstract algebra courses as well. The presentation is organized historically: the Babylonians introduced Pythagorean triples to teach the Pythagorean theorem; these were classified by Diophantus, and eventually this led Fermat to conjecture his Last Theorem. The text shows how much of modern algebra arose in attempts to prove this; it also shows how other important themes in algebra arose from questions related to teaching. Indeed, modern algebra is a very useful tool for teachers, with deep connections to the actual content of high school mathematics, as well as to the mathematics teachers use in their profession that doesn't necessarily "end up on the blackboard."

The focus is on number theory, polynomials, and commutative rings. Group theory is introduced near the end of the text to explain why generalizations of the quadratic formula do not exist for polynomials of high degree, allowing the reader to appreciate the more general work of Galois and Abel on roots of polynomials. Results and proofs are motivated with specific examples whenever possible, so that abstractions emerge from concrete experience. Applications range from the theory of repeating decimals to the use of imaginary quadratic fields to construct problems with rational solutions. While such applications are integrated throughout, each chapter also contains a section giving explicit connections between the content of the chapter and high school teaching.

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