

Graduate Texts in Mathematics

Dale Husemöller

Elliptic Curves

Second Edition



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P. Camion, P. Charpin, S. Harari



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Elliptic Curves Lawrence C. Washington, 2008-04-03 Like its bestselling predecessor *Elliptic Curves Number Theory and Cryptography* Second Edition develops the theory of elliptic curves to provide a basis for both number theoretic and cryptographic applications With additional exercises this edition offers more comprehensive coverage of the fundamental theory techniques and application

The Arithmetic of Elliptic Curves Joseph H. Silverman, 2009-04-20 The theory of elliptic curves is distinguished by its long history and by the diversity of the methods that have been used in its study This book treats the arithmetic approach in its modern formulation through the use of basic algebraic number theory and algebraic geometry Following a brief discussion of the necessary algebraic geometric results the book proceeds with an exposition of the geometry and the formal group of elliptic curves elliptic curves over finite fields the complex numbers local fields and global fields Final chapters deal with integral and rational points including Siegel's theorem and explicit computations for the curve $y^2 = x^3 + dx$ while three appendices conclude the whole *Elliptic Curves* in Characteristics 2 and 3 Group Cohomology and an overview of more advanced topics

A Classical Introduction to Modern Number Theory Kenneth Ireland, Michael Rosen, 2013-04-17 Bridging the gap between elementary number theory and the systematic study of advanced topics *A Classical Introduction to Modern Number Theory* is a well developed and accessible text that requires only a familiarity with basic abstract algebra Historical development is stressed throughout along with wide ranging coverage of significant results with comparatively elementary proofs some of them new An extensive bibliography and many challenging exercises are also included This second edition has been corrected and contains two new chapters which provide a complete proof of the Mordell Weil theorem for elliptic curves over the rational numbers and an overview of recent progress on the arithmetic of elliptic curves

Elliptic Curves, Modular Forms and Cryptography Ashwani K. Bhandari, D.S. Nagaraj, B. Ramakrishnan, T.N. Venkataramana, 2003-07-15

Mathematics Into the Twenty-first Century American Mathematical Society, 1992 In the summer of 1988 in Providence the AMS celebrated its centennial with a wide range of mathematical activities Among those was a symposium *Mathematics into the Twenty first Century* which brought together a number of the top research mathematicians who will likely have a significant impact on the mathematics of this century This book contains the lectures presented by 16 of the 18 individuals who spoke during the symposium Written by some of the major international figures in mathematical research this group of articles covers a panorama of the vital areas of mathematics at the turn of the 21st century and gives the general mathematical reader a broad perspective on some of the major trends in research

Classical Hypergeometric Functions and Generalizations Howard S. Cohl, Roberto S. Costas-Santos, Robert S. Maier, 2025-04-23 This is the first volume of a two volume collection of recent research results related to hypergeometric functions The second volume *Contemporary Mathematics Volume 819* is titled *Applications and q Extensions of Hypergeometric Functions* This volume contains the proceedings of a minisymposium and two AMS special sessions in three

conferences Minisymposium on All Things Hypergeometric q series and Generalizations at the 16th International Symposium on Orthogonal Polynomials Special Functions and Applications OPSFA 16 June 13 17 2022 Centre de Recherches Mathématiques Montréal Québec Canada AMS Special Session on Hypergeometric Functions and q series at the 2022 AMS Fall Western Sectional Meeting October 22 23 2022 University of Utah Salt Lake City Utah and the AMS Special Session on Hypergeometric Functions q series and Generalizations at the 2023 AMS Spring Eastern Virtual Sectional Meeting April 1 2 2023 This book provides a sampling of current mathematical research related to the Gauss hypergeometric function and as well its immediate generalizations and extensions This includes the generalized hypergeometric functions that originated with Kummer as well as such classical special functions as Lam and Heun functions It also includes certain functions relevant to algebraic geometry such as hypergeometric functions over finite fields All research articles come with extensive bibliographies and can serve as entry points to the current literature

An Experimental Introduction to Number Theory Benjamin Hutz, 2018-04-17 This book presents material suitable for an undergraduate course in elementary number theory from a computational perspective It seeks to not only introduce students to the standard topics in elementary number theory such as prime factorization and modular arithmetic but also to develop their ability to formulate and test precise conjectures from experimental data Each topic is motivated by a question to be answered followed by some experimental data and finally the statement and proof of a theorem There are numerous opportunities throughout the chapters and exercises for the students to engage in guided open ended exploration At the end of a course using this book the students will understand how mathematics is developed from asking questions to gathering data to formulating and proving theorems The mathematical prerequisites for this book are few Early chapters contain topics such as integer divisibility modular arithmetic and applications to cryptography while later chapters contain more specialized topics such as Diophantine approximation number theory of dynamical systems and number theory with polynomials Students of all levels will be drawn in by the patterns and relationships of number theory uncovered through data driven exploration

A Gateway to Number Theory: Applying the Power of Algebraic Curves Keith Kendig, 2021-04-23 Challenge Can you find all the integers a b c satisfying $2a^2 + 3b^2 = 5c^2$ Looks simple and there are in fact a number of easy solutions But most of them turn out to be anything but obvious There are infinitely many possibilities and as any computer will tell you each of a b c will usually be large So the challenge remains Find all integers a b c satisfying $2a^2 + 3b^2 = 5c^2$ A major advance in number theory means this book can give an easy answer to this and countless similar questions The idea behind the approach is transforming a degree two equation in integer variables a b c into a plane curve defined by a polynomial Working with the curve makes obtaining solutions far easier and the geometric solutions then get translated back into integers This method morphs hard problems into routine ones and typically requires no more than high school math The complete solution to $2a^2 + 3b^2 = 5c^2$ is included in the book In addition to equations of degree two the book addresses degree three equations a branch of number theory that is today something of a

cottage industry and these problems translate into elliptic curves This important part of the book includes many pictures along with the exposition making the material meaningful and easy to grasp This book will fit nicely into an introductory course on number theory In addition the many solved examples illustrations and exercises make self studying the book an option for students thus becoming a natural candidate for a capstone course

Rational Points on Elliptic Curves Joseph H. Silverman, John T. Tate, 2015-06-02 The theory of elliptic curves involves a pleasing blend of algebra geometry analysis and number theory This volume stresses this interplay as it develops the basic theory thereby providing an opportunity for advanced undergraduates to appreciate the unity of modern mathematics At the same time every effort has been made to use only methods and results commonly included in the undergraduate curriculum This accessibility the informal writing style and a wealth of exercises make *Rational Points on Elliptic Curves* an ideal introduction for students at all levels who are interested in learning about Diophantine equations and arithmetic geometry Most concretely an elliptic curve is the set of zeroes of a cubic polynomial in two variables If the polynomial has rational coefficients then one can ask for a description of those zeroes whose coordinates are either integers or rational numbers It is this number theoretic question that is the main subject of *Rational Points on Elliptic Curves* Topics covered include the geometry and group structure of elliptic curves the Nagell Lutz theorem describing points of finite order the Mordell Weil theorem on the finite generation of the group of rational points the Thue Siegel theorem on the finiteness of the set of integer points theorems on counting points with coordinates in finite fields Lenstra's elliptic curve factorization algorithm and a discussion of complex multiplication and the Galois representations associated to torsion points Additional topics new to the second edition include an introduction to elliptic curve cryptography and a brief discussion of the stunning proof of Fermat's Last Theorem by Wiles et al via the use of elliptic curves

Number Theory for the Millennium III M.A. Bennett, Bruce Berndt, N. Boston, A.J. Hildebrand, H.G. Diamond, W. Philipp, 2023-03-17 Building on the tradition of an outstanding series of conferences at the University of Illinois at Urbana Champaign the organizers attracted an international group of scholars to open the new Millennium with a conference that reviewed the current state of number theory research and pointed to future directions in the field The conference was the largest general number theory conference in recent history featuring a total of 159 talks with the plenary lectures given by George Andrews Jean Bourgain Kevin Ford Ron Graham Andrew Granville Roger Heath Brown Christopher Hooley Winnie Li Kumar Murty Mel Nathanson Ken Ono Carl Pomerance Bjorn Poonen Wolfgang Schmidt Chris Skinner K Soundararajan Robert Tijdeman Robert Vaughan and Hugh Williams The Proceedings Volumes of the conference review some of the major number theory achievements of this century and to chart some of the directions in which the subject will be heading during the new century These volumes will serve as a useful reference to researchers in the area and an introduction to topics of current interest in number theory for a general audience in mathematics

Abelian Varieties and Number Theory Moshe Jarden, Tony Shaska, 2021-05-03 This book is a collection of articles on Abelian varieties and number

theory dedicated to Gerhard Frey's 75th birthday. It contains original articles by experts in the area of arithmetic and algebraic geometry. The articles cover topics on Abelian varieties and finitely generated Galois groups, ranks of Abelian varieties and Mordell Lang conjecture, Tate Shafarevich group and isogeny volcanoes, endomorphisms of superelliptic Jacobians, obstructions to local-global principles over semi-global fields, Drinfeld modular varieties, representations of étale fundamental groups and specialization of algebraic cycles, Deuring's theory of constant reductions, etc. The book will be a valuable resource to graduate students and experts working on Abelian varieties and related areas. *Quantum*

Computational Number Theory Song Y. Yan, 2015-12-26. This book provides a comprehensive introduction to advanced topics in the computational and algorithmic aspects of number theory focusing on applications in cryptography. Readers will learn to develop fast algorithms including quantum algorithms to solve various classic and modern number theoretic problems. Key problems include prime number generation, primality testing, integer factorization, discrete logarithms, elliptic curve arithmetic, conjecture and numerical verification. The author discusses quantum algorithms for solving the Integer Factorization Problem (IFP), the Discrete Logarithm Problem (DLP), and the Elliptic Curve Discrete Logarithm Problem (ECDLP) and for attacking IFP, DLP, and ECDLP based cryptographic systems. Chapters also cover various other quantum algorithms for Pell's equation, principal ideal unit group, class group, Gauss sums, prime counting function, Riemann's hypothesis, and the BSD conjecture. *Quantum Computational Number Theory* is self-contained and intended to be used either as a graduate text in computing, communications, and mathematics, or as a basic reference in the related fields. Number theorists, cryptographers, and professionals working in quantum computing, cryptography, and network security will find this book a valuable asset.

A Century of Advancing Mathematics Paul Zorn, 2015-08-23. The MAA was founded in 1915 to serve as a home for *The American Mathematical Monthly*. The mission of the Association to advance mathematics, especially at the collegiate level, has however always been larger than merely publishing world-class mathematical exposition. MAA members have explored more than just mathematics; we have, as this volume tries to make evident, investigated mathematical connections to pedagogy, history, the arts, technology, literature, every field of intellectual endeavor. Essays all commissioned for this volume include exposition by Bob Devaney, Robin Wilson, and Frank Morgan; history from Karen Parshall, Della Dumbaugh, and Bill Dunham; pedagogical discussion from Paul Zorn, Joe Gallian, and Michael Starbird; and cultural commentary from Bonnie Gold, Jon Borwein, and Steve Abbott. This volume contains 35 essays by all-star writers and expositors writing to celebrate an extraordinary century for mathematics: more mathematics has been created and published since 1915 than in all of previous recorded history. We've solved age-old mysteries, created entire new fields of study, and changed our conception of what mathematics is. Many of those stories are told in this volume, as the contributors paint a portrait of the broad cultural sweep of mathematics during the MAA's first century. Mathematics is the most thrilling, the most human area of intellectual inquiry you will find in this volume; compelling proof of that claim.

On the Symplectic Type of Isomorphisms of the

\$p\$-Torsion of Elliptic Curves Nuno Freitas, Alain Kraus, 2022-05-24 View the abstract **The Grothendieck**

Festschrift, Volume III Pierre Cartier, Luc Illusie, Nicholas M. Katz, Gérard Laumon, Yuri I. Manin, Kenneth A.

Ribet, 2007-10-23 This three volume work contains articles collected on the occasion of Alexander Grothendieck's sixtieth birthday and originally published in 1990 The articles were offered as a tribute to one of the world's greatest living mathematicians Many of the groundbreaking contributions in these volumes contain material that is now considered foundational to the subject Topics addressed by these top notch contributors match the breadth of Grothendieck's own interests including functional analysis algebraic geometry algebraic topology number theory representation theory K theory category theory and homological algebra Algebraic Geometry Thomas A. Garrity, 2013-02-01 Algebraic Geometry has

been at the center of much of mathematics for hundreds of years It is not an easy field to break into despite its humble beginnings in the study of circles ellipses hyperbolas and parabolas This text consists of a series of ex **Supersymmetric**

Field Theories Sergio Cecotti, 2015-01-08 Adopting an elegant geometrical approach this advanced pedagogical text describes deep and intuitive methods for understanding the subtle logic of supersymmetry while avoiding lengthy computations The book describes how complex results and formulae obtained using other approaches can be significantly simplified when translated to a geometric setting Introductory chapters describe geometric structures in field theory in the general case while detailed later chapters address specific structures such as parallel tensor fields G structures and isometry groups The relationship between structures in supergravity and periodic maps of algebraic manifolds Kodaira Spencer theory modularity and the arithmetic properties of supergravity are also addressed Relevant geometric concepts are introduced and described in detail providing a self contained toolkit of useful techniques formulae and constructions Covering all the material necessary for the application of supersymmetric field theories to fundamental physical questions this is an outstanding resource for graduate students and researchers in theoretical physics **Transcendental Numbers** M. Ram

Murty, Purusottam Rath, 2014-06-24 This book provides an introduction to the topic of transcendental numbers for upper level undergraduate and graduate students The text is constructed to support a full course on the subject including descriptions of both relevant theorems and their applications While the first part of the book focuses on introducing key concepts the second part presents more complex material including applications of Baker's theorem Schanuel's conjecture and Schneider's theorem These later chapters may be of interest to researchers interested in examining the relationship between transcendence and L functions Readers of this text should possess basic knowledge of complex analysis and elementary algebraic number theory **Quantum Attacks on Public-Key Cryptosystems** Song Y. Yan, 2014-07-08 The cryptosystems

based on the Integer Factorization Problem IFP the Discrete Logarithm Problem DLP and the Elliptic Curve Discrete Logarithm Problem ECDLP are essentially the only three types of practical public key cryptosystems in use The security of these cryptosystems relies heavily on these three infeasible problems as no polynomial time algorithms exist for them so far

However polynomial time quantum algorithms for IFP DLP and ECDLP do exist provided that a practical quantum computer exists Quantum Attacks on Public Key Cryptosystems presents almost all known quantum computing based attacks on public key cryptosystems with an emphasis on quantum algorithms for IFP DLP and ECDLP It also discusses some quantum resistant cryptosystems to replace the IFP DLP and ECDLP based cryptosystems This book is intended to be used either as a graduate text in computing communications and mathematics or as a basic reference in the field *Eurocode '92* P. Camion, P. Charpin, S. Harari, 2014-05-04 This book is made of the proceedings of EUROCODE 1992 which was held in Udine Italy at the CISM October 27 30 1992 EUROCODE 92 is a continuation as well as an extension of the previous colloquia *Trois Journ es sur le codage* and EUROCODE 90 whose proceedings appeared as Lecture Notes in Computer Science Volumes 388 and 514 The aim of EUROCODE 92 was to attract high level research papers and to encourage interchange of ideas among the areas of coding theory and related fields which share the same tools for applications in the science of communications theoretical computer science software engineering and mathematics Then the book is characterized by a very broad spectrum ranging from combinatorics or algebraic geometry to implementation of coding algorithms There were about 90 participants to the conference from the academic and industrial worlds 53 conferences were selected The submitted full papers were separately refereed for publication by at least two international referees

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