Pioneers Of Representation Theory Frobenius Burnside Schur And Brauer History Of Mathematics

This is the English translation of a volume originally published only in Russian and now out of print. The book was written by Jacques Hadamard on the work of Poincare. Poincare's creation of a theory of automorphic functions in the early 1880s was one of the most significant mathematical achievements of the nineteenth century. It directly inspired the uniformization theorem, led to a class of functions adequate to solve all linear ordinary differential equations, and focused attention on a large new class of discrete groups. It was the first significant application of non-Euclidean geometry. This unique exposition by Hadamard offers a fascinating and intuitive introduction to the subject of automorphic functions and illuminates its connection to differential equations, a connection not often found in other texts.

The editorial board for the History of Mathematics series has selected for this volume a series of translations from two Russian publications, Kolmogorov in Remembrance and Mathematics and its Historical Development. This book, Kolmogorov in Perspective, includes articles written by Kolmogorov's students and colleagues and his personal accounts of shared experiences and lifelong mathematical friendships. The articles combine to give an excellent personal and scientific biography of this important mathematician. There is also an extensive bibliography with the complete list of Kolmogorov's works--including the articles written for encyclopedias and newspapers. The book is illustrated with photographs and includes quotations from Kolmogorov's letters and conversations, uniquely reflecting his mathematical tastes and opinions.

"With a Foreword written for the English edition, this volume will appeal to a broad mathematical audience, including mathematical historians and mathematicians working in number theory."--BOOK JACKET.

This book is an introduction to analytic number theory suitable for beginning graduate students. It covers everything one expects in a first course in this field, such as growth of arithmetic functions, existence of primes in arithmetic progressions, and the Prime Number Theorem. But it also covers more challenging topics that might be used in a second course, such as the Siegel-Walfisz theorem, functional equations of L-functions, and the explicit formula of von Mangoldt. For students with an interest in Diophantine analysis, there is a chapter on the Circle Method and Waring's Problem. Those with an interest in algebraic number theory may find the chapter on the analytic theory of number fields of interest, with proofs of the Dirichlet unit theorem, the analytic class number formula, the functional equation of the Dedekind zeta function, and the Prime Ideal Theorem. The exposition is both clear and precise, reflecting careful attention to the needs of the reader. The text includes extensive historical notes, which occur at the ends of the chapters. The exercises range from introductory problems and standard problems in analytic number theory to interesting original problems that will challenge the reader. The author has made an effort to provide clear explanations for the techniques of analysis used. No background in analysis beyond rigorous calculus and a first course in complex function theory is assumed.

The Ausdehnungslehre of 1862 is Grassmann's most mature presentation of his "extension theory". The work was unique in capturing the full sweep of his mathematical achievements. Compared with Grassmann's first book, Lineale Ausdehnungslehre, this book contains an enormous amount of new material, including a detailed development of the inner product and its relation to the concept of angle, the "theory of functions" from the point of view of extension theory, and Grassmann's contribution to the Pfaff problem. In many ways, this book is the version of Grassmann's system most accessible to contemporary readers. This translation is based on the material in Grassmann's "Gesammelte Werke", published by B. G. Teubner (Stuttgart and Leipzig, Germany). It includes nearly all the Editorial Notes from that edition, but the "improved" proofs are relocated, and Grassmann's original proofs are restored to their proper places. The original Editorial Notes are augmented by Supplementary Notes, elucidating Grassmann's achievement in modern terms. This is the third in an informal sequence of works to be included within the History of Mathematics series, co-published by the AMS and the London Mathematical Society. Volumes in this subset are classical mathematical works that served as cornerstones for modern mathematical thought.

Presents a complete description of homogenous and isotropic tensor-valued random fields, including the problems of continuum physics, mathematical tools and applications.

This book examines the fundamental results of modern combinatorial representation theory. The exercises are interspersed with text to reinforce readers' understanding of the subject. In addition, each exercise is assigned a difficulty level to test readers' learning. Solutions and hints to most of the exercises are provided at the end.

This book is intended for a one-year graduate course on Lie groups and Lie algebras. The book goes beyond the representation theory of compact Lie groups, which is the basis of many texts, and provides a carefully chosen range of material to give the student the bigger picture. The book is organized to allow different paths through the material depending on one's interests. This second edition has substantial new material, including improved discussions of underlying principles, streamlining of some proofs, and many results and topics that were not in the first edition. For compact Lie groups, the book covers the Peter–Weyl theorem, Lie algebra, conjugacy of maximal tori, the Weyl group, roots and weights, Weyl character formula, the fundamental group and more. The book continues with the study of complex analytic groups and general noncompact Lie groups, covering the Bruhat decomposition, Coxeter groups, flag varieties, symmetric spaces, Satake diagrams, embeddings of Lie groups and spin. Other topics that are treated are symmetric function theory, the representation theory of the symmetric group, Frobenius–Schur duality and $GL(n) \times GL(m)$ duality with many applications including some in random matrix theory, branching rules, Toeplitz determinants, combinatorics of tableaux, Gelfand pairs, Hecke algebras, the "philosophy of cusp forms" and the cohomology of Grassmannians. An appendix introduces the reader to the use of Sage mathematical software for Lie group computations.

Gerhard Gentzen (1909–1945) is the founder of modern structural proof theory. His lasting methods, rules, and structures resulted not only in the technical mathematical discipline called “proof theory” but also in verification programs that are essential in computer science. The appearance, clarity, and elegance of Gentzen's work on natural deduction, the sequent calculus, and ordinal proof theory continue to be impressive even today. The present book gives the first comprehensive, detailed, accurate scientific biography expounding the life and work of Gerhard Gentzen, one of our greatest logicians, until his arrest and death in Prague in 1945. Particular emphasis in the book is put on the conditions of scientific research, in this case mathematical logic, in National Socialist Germany, the ideological fight for “German logic”, and their mutual protagonists. Numerous hitherto unpublished sources, family documents, archival material, interviews, and letters, as well as Gentzen's lectures for the mathematical public,

make this book an indispensable source of information on this important mathematician, his work, and his time. The volume is completed by two deep substantial essays by Jan von Plato and Craig Smory?ski on Gentzen's proof theory; its relation to the ideas of Hilbert, Brouwer, Weyl, and Gödel; and its development up to the present day. Smory?ski explains the Hilbert program in more than the usual slogan form and shows why consistency is important. Von Plato shows in detail the benefits of Gentzen's program. This important book is a self-contained starting point for any work on Gentzen and his logic. The book is accessible to a wide audience with different backgrounds and is suitable for general readers, researchers, students, and teachers.
In this book, the author presents the theory of quasifree quantum fields and argues that they could provide non-zero scattering for some particles. The free-field representation of the quantised transverse electromagnetic field is not closed in the weak*-topology. Its closure contains soliton–anti-soliton pairs as limits of two-photon states as time goes to infinity, and the overlap probability can be computed using Uhlmann's prescription. There are no free parameters: the probability is determined with no requirement to specify any coupling constant. All cases of the Shale transforms of the free field ? of the form ???+?, where ? is not in the one-particle space, are treated in the book. There remain the cases of the Shale transforms of the form ? ? T?, where T is a symplectic map on the one-particle space, not near the identity. Contents: IntroductionHaag–Kastler FieldsRepresentations of the Poincaré GroupThe Maxwell Field Some Theory of RepresentationsEuclidean ElectrodynamicsModelsConclusion Readership: Graduate students and professional in particle and mathematical physics. Key Features:There are no competing titles for this bookKeywords:Relativistic Quasifree Representation of Transverse Electromagnetic Field;Quasi-Free Scattering;Quantum Scattering;Relativistic Quantum Field Theory;Quasi-Free Quantum Field Theory;C*-Algebra;Euclidean Electrodynamics;Haag-Ruelle Theory;Haag-Kastler Axioms;Segal-Bargmann Transform;Shale Transformation
Frobenius made many important contributions to mathematics in the latter part of the 19th century. Hawkins here focuses on his work in linear algebra and its relationship with the work of Burnside, Cartan, and Molien, and its extension by Schur and Brauer. He also discusses the Berlin school of mathematics and the guiding force of Weierstrass in that school, as well as the fundamental work of d'Alembert, Lagrange, and Laplace, and of Gauss, Eisenstein and Cayley that laid the groundwork for Frobenius's work in linear algebra. The book concludes with a discussion of Frobenius's contribution to the theory of stochastic matrices.
This is a one-of-a-kind reference for anyone with a serious interest in mathematics. Edited by Timothy Gowers, a recipient of the Fields Medal, it presents nearly two hundred entries, written especially for this book by some of the world's leading mathematicians, that introduce basic mathematical tools and vocabulary; trace the development of modern mathematics; explain essential terms and concepts; examine core ideas in major areas of mathematics; describe the achievements of scores of famous mathematicians; explore the impact of mathematics on other disciplines such as biology, finance, and music--and much, much more. Unparalleled in its depth of coverage, The Princeton Companion to Mathematics surveys the most active and exciting branches of pure mathematics. Accessible in style, this is an indispensable resource for undergraduate and graduate students in mathematics as well as for researchers and scholars seeking to understand areas outside their specialties. Features nearly 200 entries, organized thematically and written by an international team of distinguished contributors Presents major ideas and branches of pure mathematics in a clear, accessible style Defines and explains important mathematical concepts, methods, theorems, and open problems Introduces the language of mathematics and the goals of mathematical research Covers number theory, algebra, analysis, geometry, logic, probability, and more Traces the history and development of modern mathematics Profiles more than ninety-five mathematicians who influenced those working today Explores the influence of mathematics on other disciplines Includes bibliographies, cross-references, and a comprehensive index Contributors incude: Graham Allan, Noga Alon, George Andrews, Tom Archibald, Sir Michael Atiyah, David Aubin, Joan Bagaria, Keith Ball, June Barrow-Green, Alan Beardon, David D. Ben-Zvi, Vitaly Bergelson, Nicholas Bingham, Béla Bollobás, Henk Bos, Bodil Branner, Martin R. Bridson, John P. Burgess, Kevin Buzzard, Peter J. Cameron, Jean-Luc Chabert, Eugenia Cheng, Clifford C. Cocks, Alain Connes, Leo Corry, Wolfgang Coy, Tony Crilly, Serafina Cuomo, Mihalis Dafermos, Partha Dasgupta, Ingrid Daubechies, Joseph W. Dauben, John W. Dawson Jr., Francois de Gandt, Persi Diaconis, Jordan S. Ellenberg, Lawrence C. Evans, Florence Fasanelli, Anita Burdman Feferman, Solomon Feferman, Charles Fefferman, Della Fenster, José Ferreirós, David Fisher, Terry Gannon, A. Gardiner, Charles C. Gillispie, Oded Goldreich, Catherine Goldstein, Fernando Q. Gouvêa, Timothy Gowers, Andrew Granville, Ivor Grattan-Guinness, Jeremy Gray, Ben Green, Ian Grojnowski, Niccolò Guicciardini, Michael Harris, Ulf Hashagen, Nigel Higson, Andrew Hodges, F. E. A. Johnson, Mark Joshi, Kiran S. Kedlaya, Frank Kelly, Sergiu Klainerman, Jon Kleinberg, Israel Kleiner, Jacek Klinowski, Eberhard Knobloch, János Kollár, T. W. Körner, Michael Krivelevich, Peter D. Lax, Imre Leader, Jean-François Le Gall, W. B. R. Lickorish, Martin W. Liebeck, Jesper Lützen, Des MacHale, Alan L. Mackay, Shahn Majid, Lech Maligranda, David Marker, Jean Mawhin, Barry Mazur, Dusa McDuff, Colin McLarty, Bojan Mohar, Peter M. Neumann, Catherine Nolan, James Norris, Brian Osserman, Richard S. Palais, Marco Panza, Karen Hunger Parshall, Gabriel P. Paternain, Jeanne Peiffer, Carl Pomerance, Helmut Pulte, Bruce Reed, Michael C. Reed, Adrian Rice, Eleanor Robson, Igor Rodnianski, John Roe, Mark Ronan, Edward Sandifer, Tilman Sauer, Norbert Schappacher, Andrzej Schinzel, Erhard Scholz, Reinhard Siegmund-Schultze, Gordon Slade, David J. Spiegelhalter, Jacqueline Stedall, Arild Stubhaug, Madhu Sudan, Terence Tao, Jamie Tappenden, C. H. Taubes, Rüdiger Thiele, Burt Totaro, Lloyd N. Trefethen, Dirk van Dalen, Richard Weber, Dominic Welsh, Avi Wigderson, Herbert Wilf, David Wilkins, B. Yandell, Eric Zaslow, Doron Zeilberger
A meticulously researched history on the development of American mathematics in the three decades following World War I As the Roaring Twenties lurched into the Great Depression, to be followed by the scourge of Nazi Germany and World War II, American mathematicians pursued their research, positioned themselves collectively within American science, and rose to global mathematical hegemony. How did they do it? The New Era in American Mathematics, 1920–1950 explores the institutional, financial, social, and political forces that shaped and supported this community in the first half of the twentieth century. In doing so, Karen Hunger Parshall debunks the widely held view that American mathematics only thrived after European émigrés fled to the shores of the United States. Drawing from extensive archival and primary-source research, Parshall uncovers the key players in American mathematics who worked together to effect change and she looks at their research output over the course of three decades. She highlights the educational, professional, philanthropic, and governmental entities that bolstered progress. And she uncovers the strategies implemented by American mathematicians in their quest for the advancement of knowledge. Throughout, she considers how geopolitical circumstances shifted the course of the discipline. Examining how the American mathematical community asserted itself on the international stage, The New Era in American Mathematics, 1920–1950 shows the way one nation became the focal point for the field.

This updated edition of this classic book is devoted to ordinary representation theory and is addressed to finite group theorists intending to study and apply character theory. It contains many exercises and examples, and the list of problems contains a number of open questions.
Social reformer, banker, and mathematician, Olinde Rodrigues is a fascinating figure of nineteenth-century Paris. Information about him is obscure--scattered in publications on history, mathematics, and the social sciences--and often inaccurate. Rodrigues left no papers or archives. Here, for the first time, is an authoritative account of his family history, education, and important mathematical works. Written by a team of prominent mathematicians and historians, the book comprises the interests and associations that make Rodrigues such a remarkable character in the history of mathematics. This is a superb panorama of nineteenth-century France, portrayed through the life and work of Olinde Rodrigues. The beginning chapters attempt to recreate the scientific and social background of nineteenth-century Paris and Rodrigues's place in it. The following chapters discuss his contributions to a variety of mathematical fields (e.g., orthogonal polynomials, combinatorics, and rotations). The final chapters discuss contemporary reactions to his mathematical work. Sufficient background is given to make it accessible to readers familiar with basic college mathematics. The book is suitable for specialists in the history of mathematics and/or science, graduate students, and mathematicians. Co-published with the London Mathematical Society beginning with Volume 4.
Number Theory is more than a comprehensive treatment of the subject. It is an introduction to topics in higher level mathematics, and unique in its scope; topics from analysis, modern algebra, and discrete mathematics are all included. The book is divided into two parts. Part A covers key concepts of number theory and could serve as a first course on the subject. Part B delves into more advanced topics and an exploration of related mathematics. The prerequisites for this self-contained text are elements from linear algebra. Valuable references for the reader are collected at the end of each chapter. It is suitable as an introduction to higher level mathematics for undergraduates, or for self-study.
The theory of semigroups is a relatively young branch of mathematics, with most of the major results having appeared after the Second World War. This book describes the evolution of (algebraic) semigroup theory from its earliest origins to the establishment of a full-fledged theory. Semigroup theory might be termed `Cold War mathematics' because of the time during which it developed. There were thriving schools on both sides of the Iron Curtain, although the two sides were not always able to communicate with each other, or even gain access to the other's publications. A major theme of this book is the comparison of the approaches to the subject of mathematicians in East and West, and the study of the extent to which contact between the two sides was possible.
Very roughly speaking, representation theory studies symmetry in linear spaces. It is a beautiful mathematical subject which has many applications, ranging from number theory and combinatorics to geometry, probability theory, quantum mechanics, and quantum field theory. The goal of this book is to give a ``holistic'' introduction to representation theory, presenting it as a unified subject which studies representations of associative algebras and treating the representation theories of groups, Lie algebras, and quivers as special cases. Using this approach, the book covers a number of standard topics in the representation theories of these structures. Theoretical material in the book is supplemented by many problems and exercises which touch upon a lot of additional topics; the more difficult exercises are provided with hints. The book is designed as a textbook for advanced undergraduate and beginning graduate students. It should be accessible to students with a strong background in linear algebra and a basic knowledge of abstract algebra.
This volume is a translation of Dirichlet's Vorlesungen uber Zahlentheorie which includes nine supplements by Dedekind and an introduction by John Stillwell, who translated the volume. Lectures on Number Theory is the first of its kind on the subject matter. It covers most of the topics that are standard in a modern first course on number theory, but also includes Dirichlet's famous results on class numbers and primes in arithmetic progressions. The book is suitable as a textbook, yet it also offers a fascinating historical perspective that links Gauss with modern number theory.
For a long time, World War I has been shortchanged by the historiography of science. Until recently, World War II was usually considered as the defining event for the formation of the modern relationship between science and society. In this context, the effects of the First World War, by contrast, were often limited to the massive deaths of promising young scientists. By focusing on a few key places (Paris, Cambridge, Rome, Chicago, and others), the present book gathers studies representing a broad spectrum of positions adopted by mathematicians about the conflict, from militant pacifism to military, scientific, or ideological mobilization. The use of mathematics for war is thoroughly examined. This book suggests a new vision of the long-term influence of World War I on mathematics and mathematicians. Continuities and discontinuities in the structure and organization of the mathematical sciences are discussed, as well as their images in various milieux. Topics of research and the values with which they were defended are scrutinized. This book, in particular, proposes a more in-depth evaluation of the issue of modernity and modernization in mathematics. The issue of scientific international relations after the war is revisited by a close look at the situation in a few Allied countries (France, Britain, Italy, and the USA). The historiography has emphasized the place of Germany as the leading mathematical country before WWI and the absurdity of its postwar ostracism by the Allies. The studies presented here help explain how dramatically different prewar situations, prolonged interaction during the war, and new international postwar organizations led to attempts at redrafting models for mathematical developments.
About the First Edition: The study of any topic becomes more meaningful if one also studies the historical development that resulted in the final theorem. ... This is an excellent book on mathematics in the making. --Philip Peak, The Mathematics Teacher, May, 1975 I find the book very interesting. It contains valuable information and useful references. It can be recommended not only to historians of science and mathematics but also to students of probability and statistics. --Wei-Ching Chang, Historica Mathematica, August, 1976 In the months since I wrote ... I have read it from cover to cover at least once and perused it here and there a number of times. I still find it a very interesting and worthwhile contribution to the history of probability and statistics. --Churchill Eisenhart, past president of the American Statistical Association, in a letter to the author, February 3, 1975 The name Central Limit Theorem covers a wide variety of results involving the determination of necessary and sufficient conditions under which sums of independent random variables, suitably standardized, have cumulative distribution functions close to the Gaussian distribution. As the name Central Limit Theorem suggests, it is a centerpiece of probability theory which also carries over to statistics. Part One of The Life and Times of the Central Limit Theorem, Second Edition traces its fascinating history from seeds sown by Jacob Bernoulli to use of integrals of $\exp (x^2)$ as an approximation tool, the development of the theory of errors of observation, problems in mathematical astronomy, the emergence of the hypothesis of elementary errors, the fundamental work of Laplace, and the emergence of an abstract Central Limit Theorem through the work of Chebyshev, Markov and Lyapunov. This

closes the classical period of the life of the Central Limit Theorem, 1713-1901. The second part of the book includes papers by Feller and Le Cam, as well as comments by Doob, Trotter, and Pollard, describing the modern history of the Central Limit Theorem (1920-1937), in particular through contributions of Lindeberg, Cramer, Levy, and Feller. The Appendix to the book contains four fundamental papers by Lyapunov on the Central Limit Theorem, made available in English for the first time.

This graduate textbook presents the basics of representation theory for finite groups from the point of view of semisimple algebras and modules over them. The presentation interweaves insights from specific examples with development of general and powerful tools based on the notion of semisimplicity. The elegant ideas of commutant duality are introduced, along with an introduction to representations of unitary groups. The text progresses systematically and the presentation is friendly and inviting. Central concepts are revisited and explored from multiple viewpoints. Exercises at the end of the chapter help reinforce the material. Representing Finite Groups: A Semisimple Introduction would serve as a textbook for graduate and some advanced undergraduate courses in mathematics. Prerequisites include acquaintance with elementary group theory and some familiarity with rings and modules. A final chapter presents a self-contained account of notions and results in algebra that are used. Researchers in mathematics and mathematical physics will also find this book useful. A separate solutions manual is available for instructors.

The fame of the Polish school at Lvov rests with the diverse and fundamental contributions of Polish mathematicians working there during the interwar years. In particular, despite material hardship and without a notable mathematical tradition, the school made major contributions to what is now called functional analysis. The results and names of Banach, Kac, Kuratowski, Mazur, Nikodym, Orlicz, Schauder, Sierpi?ski, Steinhaus, and Ulam, among others, now appear in all the standard textbooks. The vibrant joie de vivre and singular ambience of Lvov's once scintillating social scene are evocatively recaptured in personal recollections. The heyday of the famous Scottish Café--unquestionably the most mathematically productive cafeteria of all time--and its precious Scottish Book of highly influential problems are described in detail, revealing the special synergy of scholarship and camaraderie that permanently elevated Polish mathematics from utter obscurity to global prominence. This chronicle of the Lvov school--its legacy and the tumultuous historical events which defined its lifespan--will appeal equally to mathematicians, historians, or general readers seeking a cultural and institutional overview of key aspects of twentieth-century Polish mathematics not described anywhere else in the extant English-language literature.

This book contains essays on Ramanujan and his work that were written especially for this volume. It also includes important survey articles in areas influenced by Ramanujan's mathematics. Most of the articles in the book are nontechnical, but even those that are more technical contain substantial sections that will engage the general reader.

The theory of Frobenius splittings has made a significant impact in the study of the geometry of flag varieties and representation theory. This work, unique in book literature, systematically develops the theory and covers all its major developments. Key features: * Concise, efficient exposition unfolds from basic introductory material on Frobenius splittings—definitions, properties and examples—to cutting edge research * Studies in detail the geometry of Schubert varieties, their syzygies, equivariant embeddings of reductive groups, Hilbert Schemes, canonical splittings, good filtrations, among other topics * Applies Frobenius splitting methods to algebraic geometry and various problems in representation theory * Many examples, exercises, and open problems suggested throughout * Comprehensive bibliography and index This book will be an excellent resource for mathematicians and graduate students in algebraic geometry and representation theory of algebraic groups.

Algebra, as a subdiscipline of mathematics, arguably has a history going back some 4000 years to ancient Mesopotamia. The history, however, of what is recognized today as high school algebra is much shorter, extending back to the sixteenth century, while the history of what practicing mathematicians call "modern algebra" is even shorter still. The present volume provides a glimpse into the complicated and often convoluted history of this latter conception of algebra by juxtaposing twelve episodes in the evolution of modern algebra from the early nineteenth-century work of Charles Babbage on functional equations to Alexandre Grothendieck's mid-twentieth-century metaphor of a ``rising sea'' in his categorical approach to algebraic geometry. In addition to considering the technical development of various aspects of algebraic thought, the historians of modern algebra whose work is united in this volume explore such themes as the changing aims and organization of the subject as well as the often complex lines of mathematical communication within and across national boundaries. Among the specific algebraic ideas considered are the concept of divisibility and the introduction of non-commutative algebras into the study of number theory and the emergence of algebraic geometry in the twentieth century. The resulting volume is essential reading for anyone interested in the history of modern mathematics in general and modern algebra in particular. It will be of particular interest to mathematicians and historians of mathematics.

This book describes two stages in the historical development of the notion of mathematical structures: first, it traces its rise in the context of algebra from the mid-1800s to 1930, and then considers attempts to formulate elaborate theories after 1930 aimed at elucidating, from a purely mathematical perspective, the precise meaning of this idea.

The AMS History of Mathematics series is one of the most popular items for bookstore sales. These books feature colorful, attractive covers that are perfect for face out displays. The topics will appeal to a broad audience in the mathematical and scientific communities.

What is algebra? For some, it is an abstract language of x's and y's. For mathematics majors and professional mathematicians, it is a world of axiomatically defined constructs like groups, rings, and fields. Taming the Unknown considers how these two seemingly different types of algebra evolved and how they relate. Victor Katz and Karen Parshall explore the history of algebra, from its roots in the ancient civilizations of Egypt, Mesopotamia, Greece, China, and India, through its development in the medieval Islamic world and medieval and early modern Europe, to its modern form in the early twentieth century. Defining algebra originally as a collection of techniques for determining unknowns, the authors trace the development of these techniques from geometric beginnings in ancient Egypt and Mesopotamia and classical Greece. They show how similar problems were tackled in Alexandrian Greece, in China, and in India, then look at how medieval Islamic scholars shifted to an algorithmic stage, which was further developed by medieval and early modern European mathematicians. With the introduction of a flexible and operative symbolism in the sixteenth and seventeenth centuries, algebra entered into a dynamic period characterized by the analytic geometry that could evaluate curves represented by equations in two variables, thereby solving problems in the physics of motion. This new symbolism freed mathematicians to study equations of degrees higher than two and three, ultimately leading to the present abstract era. Taming the Unknown follows algebra's remarkable growth through different epochs around the globe.

The Soviet school, one of the glories of twentieth-century mathematics, faced a serious crisis in the summer of 1936. It was

suffering from internal strains due to generational conflicts between the young talents and the old establishment. At the same time, Soviet leaders (including Stalin himself) were bent on “Sovietizing” all of science in the USSR by requiring scholars to publish their works in Russian in the Soviet Union, ending the nearly universal practice of publishing in the West. A campaign to “Sovietize” mathematics in the USSR was launched with an attack on Nikolai Nikolaevich Luzin, the leader of the Soviet school of mathematics, in Pravda. Luzin was fortunate in that only a few of the most ardent ideologues wanted to destroy him utterly. As a result, Luzin, though humiliated and frightened, was allowed to make a statement of public repentance and then let off with a relatively mild reprimand. A major factor in his narrow escape was the very abstractness of his research area (descriptive set theory), which was difficult to incorporate into a propaganda campaign aimed at the broader public. The present book contains the transcripts of five meetings of the Academy of Sciences commission charged with investigating the accusations against Luzin, meetings held in July of 1936. Ancillary material from the Soviet press of the time is included to place these meetings in context.
Although today's mathematical research community takes its international character very much for granted, this "global nature" is relatively recent, having evolved over a period of roughly 150 years-from the beginning of the nineteenth century to the middle of the twentieth century. During this time, the practice of mathematics changed from being centered on a collection of disparate national communities to being characterized by an international group of scholars for whom thegoal of mathematical research and cooperation transcended national boundaries. Yet, the development of an international community was far from smooth and involved obstacles such as war, political upheaval, and national rivalries. Until now, this evolution has been largely overlooked by historians andmathematicians alike. This book addresses the issue by bringing together essays by twenty experts in the history of mathematics who have investigated the genesis of today's international mathematical community. This includes not only developments within component national mathematical communities, such as the growth of societies and journals, but also more wide-ranging political, philosophical, linguistic, and pedagogical issues. The resulting volume is essential reading for anyone interestedin the history of modern mathematics. It will be of interest to mathematicians, historians of mathematics, and historians of science in general.
Representation theory investigates the different ways in which a given algebraic object--such as a group or a Lie algebra--can act on a vector space. Besides being a subject of great intrinsic beauty, the theory enjoys the additional benefit of having applications in myriad contexts outside pure mathematics, including quantum field theory and the study of molecules in chemistry. Adopting a panoramic viewpoint, this book offers an introduction to four different flavors of representation theory: representations of algebras, groups, Lie algebras, and Hopf algebras. A separate part of the book is devoted to each of these areas and they are all treated in sufficient depth to enable and hopefully entice the reader to pursue research in representation theory. The book is intended as a textbook for a course on representation theory, which could immediately follow the standard graduate abstract algebra course, and for subsequent more advanced reading courses. Therefore, more than 350 exercises at various levels of difficulty are included. The broad range of topics covered will also make the text a valuable reference for researchers in algebra and related areas and a source for graduate and postgraduate students wishing to learn more about representation theory by self-study.
Henri Poincare (1854-1912) was one of the greatest scientists of his time, perhaps the last one to have mastered and expanded almost all areas in mathematics and theoretical physics. He created new mathematical branches, such as algebraic topology, dynamical systems, and automorphic functions, and he opened the way to complex analysis with several variables and to the modern approach to asymptotic expansions. He revolutionized celestial mechanics, discovering deterministic chaos. In physics, he is one of the fathers of special relativity, and his work in the philosophy of sciences is illuminating. For this book, about twenty world experts were asked to present one part of Poincare's extraordinary work. Each chapter treats one theme, presenting Poincare's approach, and achievements, along with examples of recent applications and some current prospects. Their contributions emphasize the power and modernity of the work of Poincare, an inexhaustible source of inspiration for researchers, as illustrated by the Fields Medal awarded in 2006 to Grigori Perelman for his proof of the Poincare conjecture stated a century before. This book can be read by anyone with a master's (even a bachelor's) degree in mathematics, or physics, or more generally by anyone who likes mathematical and physical ideas. Rather than presenting detailed proofs, the main ideas are explained, and a bibliography is provided for those who wish to understand the technical details.
Doing Mathematics discusses some ways mathematicians and mathematical physicists do their work and the subject matters they uncover and fashion. The conventions they adopt, the subject areas they delimit, what they can prove and calculate about the physical world, and the analogies they discover and employ, all depend on the mathematics — what will work out and what won't. The cases studied include the central limit theorem of statistics, the sound of the shape of a drum, the connections between algebra and topology, and the series of rigorous proofs of the stability of matter. The many and varied solutions to the two-dimensional Ising model of ferromagnetism make sense as a whole when they are seen in an analogy developed by Richard Dedekind in the 1880s to algebraicize Riemann's function theory; by Robert Langlands' program in number theory and representation theory; and, by the analogy between one-dimensional quantum mechanics and two-dimensional classical statistical mechanics. In effect, we begin to see "an identity in a manifold presentation of profiles," as the phenomenologists would say. This second edition deepens the particular examples; it describe the practical role of mathematical rigor; it suggests what might be a mathematician's philosophy of mathematics; and, it shows how an "ugly" first proof or derivation embodies essential features, only to be appreciated after many subsequent proofs. Natural scientists and mathematicians trade physical models and abstract objects, remaking them to suit their needs, discovering new roles for them as in the recent case of the Painlevé transcendents, the Tracy-Widom distribution, and Toeplitz determinants. And mathematics has provided the models and analogies, the ordinary language, for describing the everyday world, the structure of cities, or God's infinitude. Contents:IntroductionConvention: How Means and Variances are Entrenched as StatisticsSubject: The Fields of TopologyAppendix: The Two-Dimensional Ising Model of a FerromagnetCalculation: Strategy, Structure, and Tactics in Applying Classical AnalysisAnalogy: A Syzygy Between a Research Program in Mathematics and a Research Program in PhysicsIn Concreto: The City of MathematicsAppendices:The Spontaneous Magnetization of a Two-Dimensional Ising Model (C N Yang)On the Dirac and Schwinger Corrections to the Ground-State Energy of an Atom (C Fefferman and L A Seco)Sur la Forme des Espaces Topologiques et sur les Points Fixes des Représentations (J Leray)Une Lettre à Simone Weil (A Weil) Readership: Mathematicians, physicists, philosophers and historians of science. Keywords:Means and Variances;Topology;SyzygyReviews: Reviews of the First Edition: "The book Doing Mathematics, by Martin Krieger is truly a masterpiece. He has not only explained ways of doing mathematical work to aspiring mathematicians and the intelligent laymen, but has also shown how various pieces of research work are related to each other. Even experts may not have

realized such inter-relations. The cases studied include, especially, the stability of matter and the Ising model, two topics of great depth. Such clear explanations cannot be found anywhere else. Furthermore, his style of writing makes the book exceptionally enjoyable to read." T T Wu Gordon McKay Professor of Applied Physics Professor of Physics, Harvard University, USA "This is the first time I have seen a mathematician deal substantively with the issue of mathematics as culturally based, and he does it superbly and mathematically … Although this book is no easy read, it is well worth the effort, and I am sure it will stimulate and inform, perhaps even surprise, the most sophisticated of mathematical readers. It is refreshing to find such a book being published." Mathematical Reviews "Both challenging and provocative reading, Doing Mathematics sheds bright light on some of the main characteristics of the mathematical quest." Library of Science "Krieger has made some effort to accommodate different levels of readers; for example, structuring his text so that lay readers are alerted to sections that can be safely skipped and paragraphs that provide nontechnical summaries." Mathematical Association of America

William Burnside was one of the three most important algebraists who were involved in the transformation of group theory from its nineteenth-century origins to a deep twentieth-century subject. Building on work of earlier mathematicians, they were able to develop sophisticated tools for solving difficult problems. All of Burnside's papers are reproduced here, organized chronologically and with a detailed bibliography. Walter Feit has contributed a foreword, and a collection of introductory essays are included to provide a commentary on Burnside's work and set it in perspective along with a modern biography that draws on archive material.

Although she was famous as the "mother of modern algebra," Emmy Noether’s life and work have never been the subject of an authoritative scientific biography. Emmy Noether – Mathematician Extraordinaire represents the most comprehensive study of this singularly important mathematician to date. Focusing on key turning points, it aims to provide an overall interpretation of Noether’s intellectual development while offering a new assessment of her role in transforming the mathematics of the twentieth century. Hermann Weyl, her colleague before both fled to the United States in 1933, fully recognized that Noether’s dynamic school was the very heart and soul of the famous Göttingen community. Beyond her immediate circle of students, Emmy Noether’s lectures and seminars drew talented mathematicians from all over the world. Four of the most important were B.L. van der Waerden, Pavel Alexandrov, Helmut Hasse, and Olga Taussky. Noether’s classic papers on ideal theory inspired van der Waerden to recast his research in algebraic geometry. Her lectures on group theory motivated Alexandrov to develop links between point set topology and combinatorial methods. Noether’s vision for a new approach to algebraic number theory gave Hasse the impetus to pursue a line of research that led to the Brauer–Hasse–Noether Theorem, whereas her abstract style clashed with Taussky’s approach to classical class field theory during a difficult time when both were trying to find their footing in a foreign country. Although similar to Proving It Her Way: Emmy Noether, a Life in Mathematics, this lengthier study addresses mathematically minded readers. Thus, it presents a detailed analysis of Emmy Noether’s work with Hilbert and Klein on mathematical problems connected with Einstein’s theory of relativity. These efforts culminated with her famous paper "Invariant Variational Problems," published one year before she joined the Göttingen faculty in 1919.

Publisher description: This book is a reference for librarians, mathematicians, and statisticians involved in college and research level mathematics and statistics in the 21st century. Part I is a historical survey of the past 15 years tracking this huge transition in scholarly communications in mathematics. Part II of the book is the bibliography of resources recommended to support the disciplines of mathematics and statistics. These resources are grouped by material type. Publication dates range from the 1800's onwards. Hundreds of electronic resources-some online, both dynamic and static, some in fixed media, are listed among the paper resources. A majority of listed electronic resources are free.

More than 14 percent of the PhD's awarded in the United States during the first four decades of the twentieth century went to women, a proportion not achieved again until the 1980s. This book is the result of a study in which the authors identified all of the American women who earned PhD's in mathematics before 1940, and collected extensive biographical and bibliographical information about each of them. By reconstructing as complete a picture as possible of this group of women, Green and LaDuke reveal insights into the larger scientific and cultural communities in which they lived and worked. The book contains an extended introductory essay, as well as biographical entries for each of the 228 women in the study. The authors examine family backgrounds, education, careers, and other professional activities. They show that there were many more women earning PhD's in mathematics before 1940 than is commonly thought. Extended biographies and bibliographical information are available from the companion website for the book: www.ams.org/bookpages/hmath-34. The material will be of interest to researchers, teachers, and students in mathematics, history of mathematics, history of science, women's studies, and sociology. The data presented about each of the 228 individual members of the group will support additional study and analysis by scholars in a large number of disciplines.