Mathematics Of The 19th Century Function Theory According To Chebyshev Ordinary Differential Equations Calculus Of Variations Theory Of Finite Differences V 3

In this book I have attempted to trace the development of numerical analysis during the period in which the foundations of the modern theory were being laid. To do this I have had to exercise a certain amount of selectivity in choosing and in rejecting both authors and papers. I have rather arbitrarily chosen, in the main, the most famous mathematicians of the period in question and have concentrated on their major works in numerical analysis at the expense, perhaps, of other lesser known but capable analysts. This selectivity results from the need to choose from a large body of literature, and from my feeling that almost by definition the great masters of mathematics were the ones responsible for the most significant accomplishments. In any event I must accept full responsibility for the choices. I would particularly like to acknowledge my thanks to Professor Otto Neugebauer for his help and inspiration in the preparation of this book. This consisted of many friendly discussions that I will always value. I should also like to express my deep appreciation to the International Business Machines Corporation of which I have the honor of being a Fellow and in particular to Dr. Ralph E. Gomory, its Vice-President for Research, for permitting me to undertake the writing of this book and for helping make it possible by his continuing encouragement and support.
This book addresses the historiography of mathematics as it was practiced during the 19th and 20th centuries by paying special attention to the cultural contexts in which the history of mathematics was written. In the 19th century, the history of mathematics was recorded by a diverse range of people trained in various fields and driven by different motivations and aims. These backgrounds often shaped not only their writing on the history of mathematics, but, in some instances, were also influential in their subsequent reception. During the period from roughly 1880-1940, mathematics modernized in important ways, with regard to its content, its conditions for cultivation, and its identity; and the writing of the history of mathematics played into the last part in particular. Parallel to the modernization of mathematics, the history of mathematics gradually evolved into a field of research with its own journals, societies and academic positions. Reflecting both a new professional identity and changes in its primary audience, various shifts of perspective in the way the history of mathematics was and is written can still be observed to this day. Initially concentrating on major internal, universal developments in certain sub-disciplines of mathematics, the field gradually gravitated towards a focus on contexts of knowledge production involving individuals, local practices, problems, communities, and networks. The goal of this book is to link these disciplinary and methodological changes in the history of mathematics to the broader cultural contexts of its practitioners, namely the historians of mathematics during the period in question.
During the last few decades historians of science have shown a growing interest in science as a cultural activity and have regarded science more and more as part of the gene ral developments that have occurred in society. This trend has been less evident arnong historians of mathematics, who traditionally concentrate primarily on tracing the develop ment of mathematical knowledge itself. To some degree this restriction is connected with the special role of mathematics compared with the other sciences; mathematics typifies the most objective, most coercive type of knowledge, and there fore seems to be least affected by social influences. Nevertheless, biography, institutional history and his tory of national developments have long been elements in the historiography of mathematics. This interest in the social aspects of mathematics has widened recently through the stu dy of other themes, such as the

relation of mathematics to the development of the educational system. Some scholars have begun to apply the methods of historical sociology of knowledge to mathematics; others have attempted to give a ix x Marxist analysis of the connection between mathematics and productive forces, and there have been philosophical studies about the communication processes involved in the production of mathematical knowledge. An interest in causal analyses of historical processes has led to the study of other factors influencing the development of mathematics, such as the f- mation of mathematical schools, the changes in the profes- onal situation of the mathematician and the general cultural milieu of the mathematical scientist.

This multi-authored effort, Mathematics of the nineteenth century (to be fol lowed by Mathematics of the twentieth century), is a sequel to the History of mathematics from antiquity to the early nineteenth century, published in three volumes from 1970 to 1972. 1 For reasons explained below, our discussion of twentieth-century mathematics ends with the 1930s. Our general objectives are identical with those stated in the preface to the three-volume edition, i. e. , we consider the development of mathematics not simply as the process of perfecting concepts and techniques for studying real-world spatial forms and quantitative relationships but as a social process as well. Mathematical structures, once established, are capable of a certain degree of autonomous development. In the final analysis, however, such immanent mathematical evolution is conditioned by practical activity and is either self-directed or, as is most often the case, is determined by the needs of society. Proceeding from this premise, we intend, first, to unravel the forces that shape mathe matical progress. We examine the interaction of mathematics with the social structure, technology, the natural sciences, and philosophy. Through an anal ysis of mathematical history proper, we hope to delineate the relationships among the various mathematical disciplines and to evaluate mathematical achievements in the light of the current state and future prospects of the science. The difficulties confronting us considerably exceeded those encountered in preparing the three-volume edition.

Winner of the the Susan Elizabeth Abrams Prize in History of Science. When Isaac Newton published the Principia three centuries ago, only a few scholars were capable of understanding his conceptually demanding work. Yet this esoteric knowledge quickly became accessible in the nineteenth and early twentieth centuries when Britain produced many leading mathematical physicists. In this book, Andrew Warwick shows how the education of these "masters of theory" led them to transform our understanding of everything from the flight of a boomerang to the structure of the universe. Warwick focuses on Cambridge University, where many of the best physicists trained. He begins by tracing the dramatic changes in undergraduate education there since the eighteenth century, especially the gradual emergence of the private tutor as the most important teacher of mathematics. Next he explores the material culture of mathematics instruction, showing how the humble pen and paper so crucial to this study transformed everything from classroom teaching to final examinations. Balancing their intense intellectual work with strenuous physical exercise, the students themselves—known as the "Wranglers"—helped foster the competitive spirit that drove them in the classroom and informed the Victorian ideal of a manly student. Finally, by investigating several historical "cases," such as the reception of Albert Einstein's special and general theories of relativity, Warwick shows how the production, transmission, and reception of new knowledge was profoundly shaped by the skills taught to Cambridge undergraduates. Drawing on a wealth of new archival evidence and illustrations, Masters of Theory examines the origins of a cultural tradition within which the complex world of theoretical physics was made commonplace.

Refuting the accepted belief that mathematics is exact and infallible, the author examines the development of conflicting concepts of mathematics and their implications for the physical, applied, social, and computer sciences

This book presents a fascinating story of the long life and great accomplishments of Jacques Hadamard (1865-1963), who was once called 'the living legend of mathematics'. As one of the last universal mathematicians, Hadamard's contributions to mathematics are landmarks in various fields. His life is linked with world history of the 20th century in a dramatic way. This work provides an inspiring view of the development of various branches of mathematics during the 19th and 20th centuries.Part I of the book portrays Hadamard's family, childhood and student years, scientific triumphs, and his personal life and trials during the first two world wars. The story is told of his involvement in the Dreyfus affair and his subsequent fight for justice and human rights. Also recounted are Hadamard's worldwide travels, his famous seminar, his passion for botany, his home orchestra, where he played the violin with Einstein, and his interest in the psychology of mathematical creativity. Hadamard's life is described in a readable and inviting way.The authors humorously weave throughout the text his jokes and the myths about him. They also movingly recount the tragic side of his life. Stories about his relatives and friends, and old letters and documents create an authentic and colorful picture. The book contains over 300 photographs and illustrations. Part II of the book includes a lucid overview of Hadamard's enormous work, spanning over six decades. The authors do an excellent job of connecting his results to current concerns.While the book is accessible to beginners, it also provides rich information of interest to experts. Vladimir Mazya and Tatyana Shaposhnikova were the 2003 laureates of the Insitut de France's Prix Alfred Verdaguer. One or more prizes are awarded each year, based on suggestions from the Academie francaise, the Academie de sciences, and the Academie de beaux-arts, for the most remarkable work in the arts, literature, and the sciences. In 2003, the award for excellence was granted in recognition of Mazya and Shaposhnikova's book, ""Jacques Hadamard, A Universal Mathematician"", which is both an historical book about a great citizen and a scientific book about a great mathematician.
Plato's Ghost is the first book to examine the development of mathematics from 1880 to 1920 as a modernist transformation similar to those in art, literature, and music. Jeremy Gray traces the growth of mathematical modernism from its roots in problem solving and theory to its interactions with physics, philosophy, theology, psychology, and ideas about real and artificial languages. He shows how mathematics was popularized, and explains how mathematical modernism not only gave expression to the work of mathematicians and the professional image they sought to create for themselves, but how modernism also introduced deeper and ultimately unanswerable questions. Plato's Ghost evokes Yeats's lament that any claim to worldly perfection inevitably is proven wrong by the philosopher's ghost; Gray demonstrates how modernist mathematicians believed they had advanced further than anyone before them, only to make more profound mistakes. He tells for the first time the story of these ambitious and brilliant mathematicians, including Richard Dedekind, Henri Lebesgue, Henri Poincaré,

and many others. He describes the lively debates surrounding novel objects, definitions, and proofs in mathematics arising from the use of naïve set theory and the revived axiomatic method--debates that spilled over into contemporary arguments in philosophy and the sciences and drove an upsurge of popular writing on mathematics. And he looks at mathematics after World War I, including the foundational crisis and mathematical Platonism. Plato's Ghost is essential reading for mathematicians and historians, and will appeal to anyone interested in the development of modern mathematics.
The editors of the present series had originally intended to publish an integrated work on the history of mathematics in the nineteenth century, passing systemati cally from one discipline to another in some natural order. Circumstances beyond their control, mainly difficulties in choosing authors, led to the abandonment of this plan by the time the second volume appeared. Instead of a unified mono graph we now present to the reader a series of books intended to encompass all the mathematics of the nineteenth century, but not in the order of the accepted classification of the component disciplines. In contrast to the first two books of The Mathematics of the Nineteenth Century, which were divided into chapters, this third volume consists of four parts, more in keeping with the nature of the publication. 1 We recall that the first book contained essays on the history of mathemati 2 cal logic, algebra, number theory, and probability, while the second covered the history of geometry and analytic function theory. In the present third volume the reader will find: 1. An essay on the development of Chebyshev's theory of approximation of functions, later called "constructive function theory" by S. N. Bernshtein. This highly original essay is due to the late N. I. Akhiezer (1901-1980), the author of fundamental discoveries in this area. Akhiezer's text will no doubt attract attention not only from historians of mathematics, but also from many specialists in constructive function theory.
Historians of philosophy, science, and mathematics explore the influence of Kant'sphilosophy on the evolution of modern scientific thought.
This textbook provides an accessible account of the history of abstract algebra, tracing a range of topics in modern algebra and number theory back to their modest presence in the seventeenth and eighteenth centuries, and exploring the impact of ideas on the development of the subject. Beginning with Gauss’s theory of numbers and Galois’s ideas, the book progresses to Dedekind and Kronecker, Jordan and Klein, Steinitz, Hilbert, and Emmy Noether. Approaching mathematical topics from a historical perspective, the author explores quadratic forms, quadratic reciprocity, Fermat’s Last Theorem, cyclotomy, quintic equations, Galois theory, commutative rings, abstract fields, ideal theory, invariant theory, and group theory. Readers will learn what Galois accomplished, how difficult the proofs of his theorems were, and how important Camille Jordan and Felix Klein were in the eventual acceptance of Galois’s approach to the solution of equations. The book also describes the relationship between Kummer’s ideal numbers and Dedekind’s ideals, and discusses why Dedekind

felt his solution to the divisor problem was better than Kummer's. Designed for a course in the history of modern algebra, this book is aimed at undergraduate students with an introductory background in algebra but will also appeal to researchers with a general interest in the topic. With exercises at the end of each chapter and appendices providing material difficult to find elsewhere, this book is self-contained and therefore suitable for self-study.

The calculus of variations is a subject whose beginning can be precisely dated. It might be said to begin at the moment that Euler coined the name calculus of variations but this is, of course, not the true moment of inception of the subject. It would not have been unreasonable if I had gone back to the set of isoperimetric problems considered by Greek mathemati cians such as Zenodorus (c. 200 B. C.) and preserved by Pappus (c. 300 A. D.). I have not done this since these problems were solved by geometric means. Instead I have arbitrarily chosen to begin with Fermat's elegant principle of least time. He used this principle in 1662 to show how a light ray was refracted at the interface between two optical media of different densities. This analysis of Fermat seems to me especially appropriate as a starting point: He used the methods of the calculus to minimize the time of passage cif a light ray through the two media, and his method was adapted by John Bernoulli to solve the brachystochrone problem. There have been several other histories of the subject, but they are now hopelessly archaic. One by Robert Woodhouse appeared in 1810 and another by Isaac Todhunter in 1861.

This book contains a series of articles summarizing the technical, institutional and intellectual history of mathematical tables from earliest times until the late 20th century when the electronic spreadsheet changed the way information is processed.

This precis, comprised of three volumes, of which this book is the first, exposes the mathematical elements which make up the foundations of a number of contemporary scientific methods: modern theory on systems, physics and engineering. This first volume focuses primarily on algebraic questions: categories and functors, groups, rings, modules and algebra. Notions are introduced in a general framework and then studied in the context of commutative and homological algebra; their application in algebraic topology and geometry is therefore developed. These notions play an essential role in algebraic analysis (analytico-algebraic systems theory of ordinary or partial linear differential equations). The book concludes with a study of modules over the main types of rings, the rational canonical form of matrices, the (commutative) theory of elemental divisors and their application in systems of linear differential equations with constant coefficients. Part of the New Mathematical Methods, Systems, and Applications series Presents the notions, results, and proofs necessary to understand and master the various topics Provides a unified notation, making the task easier for the reader. Includes several summaries of mathematics for engineers

The book describes the conceptual development of analysis from antiquity up to the end of the nineteenth century. Intra-theoretical processes are considered as well as the influence of applied problems and biographical and philosophical backgrounds. The book has thirteen chapters, each written by a leading specialist in the history of mathematics. The first ten chapters tell the story in its temporal succession (narrative order) whereas the last three chapters give surveys on the history of differential equations, the calculus of variations, and functional analysis. Special features of the book are a separate chapter on the development of the theory of complex functions in the nineteenth century and two chapters on the influence of physics on analysis. One is about the origins of analytical mechanics and one treats boundary value problems of mathematical physics (especially potential theory) in the nineteenth century. The authors present the history of analysis as near to the historical sources as is possible from the point of view of readability. The book includes comprehensive bibliographies, providing useful listings of the original literature. Mathematical examples are carefully chosen so that readers with a very modest background in mathematics may follow them.

August Möbius was one of the nineteenth century's most influential mathematicians and astronomers. Written by six distinguished contributors, this book explores the work of Möbius and his fellow-German scholars, in particular the achievements which act as a mirror for the work being undertaken by his contemporaries around the world.

Based on the latest historical research, Worlds Out of Nothing is the first book to provide a course on the history of geometry in the 19th century. Topics covered in the first part of the book are projective geometry, especially the concept of duality, and non-Euclidean geometry. The book then moves on to the study of the singular points of algebraic curves (Plücker’s equations) and their role in resolving a paradox in the theory of duality; to Riemann’s work on differential geometry; and to Beltrami’s role in successfully establishing non-Euclidean geometry as a rigorous mathematical subject. The final part of the book considers how projective geometry rose to prominence, and looks at Poincaré’s ideas about non-Euclidean geometry and their physical and philosophical significance. Three chapters are devoted to writing and assessing work in the history of mathematics, with examples of sample questions in the subject, advice on how to write essays, and comments on what instructors should be looking for.

This volume is, as may be readily apparent, the fruit of many years’ labor in archives and libraries, unearthing rare books, researching Nachlässe, and above all, systematic comparative analysis of fecund sources. The work not only demanded much time in preparation, but was also interrupted by other duties, such as time spent as a guest professor at universities abroad, which of course provided welcome opportunities to present and discuss the work, and in particular, the organizing of the 1994 International Graßmann Conference and the subsequent editing of its proceedings. If it is not possible to be precise about the amount of time spent on this work, it is possible to be precise about the date of its inception. In 1984, during research in the archive of the École polytechnique, my attention was drawn to the way in which the massive rupture that took place in 1811—precipitating the change back to the synthetic method and replacing the limit method by the method of the quantités infiniment petites—significantly altered the teaching of analysis at this first modern institution of higher education, an institution originally founded as a citadel of the analytic method.

With a foreword by Adam Hart-Davis, this book constitutes perhaps the first general survey of the mathematics of the Victorian period. It charts the institutional development of mathematics as a profession, as well as exploring the numerous innovations made during this time, many of which are still familiar today.

This book contains a history of real and complex analysis in the nineteenth century,

from the work of Lagrange and Fourier to the origins of set theory and the modern foundations of analysis. It studies the works of many contributors including Gauss, Cauchy, Riemann, and Weierstrass. This book is unique owing to the treatment of real and complex analysis as overlapping, inter-related subjects, in keeping with how they were seen at the time. It is suitable as a course in the history of mathematics for students who have studied an introductory course in analysis, and will enrich any course in undergraduate real or complex analysis.
This multi-authored effort, Mathematics of the nineteenth century (to be fol lowed by Mathematics of the twentieth century), is a sequel to the History of mathematics fram antiquity to the early nineteenth century, published in three 1 volumes from 1970 to 1972. For reasons explained below, our discussion of twentieth-century mathematics ends with the 1930s. Our general objectives are identical with those stated in the preface to the three-volume edition, i. e. , we consider the development of mathematics not simply as the process of perfecting concepts and techniques for studying real-world spatial forms and quantitative relationships but as a social process as well. Mathematical structures, once established, are capable of a certain degree of autonomous development. In the final analysis, however, such immanent mathematical evolution is conditioned by practical activity and is either self-directed or, as is most often the case, is determined by the needs of society. Proceeding from this premise, we intend, first, to unravel the forces that shape mathe matical progress. We examine the interaction of mathematics with the social structure, technology, the natural sciences, and philosophy. Throughan anal ysis of mathematical history proper, we hope to delineate the relationships among the various mathematical disciplines and to evaluate mathematical achievements in the light of the current state and future prospects of the science. The difficulties confronting us considerably exceeded those encountered in preparing the three-volume edition.
This biography traces the life and work of Mary Fairfax Somerville, whose extraordinary mathematical talent only came to light through fortuitous circumstances. Barely taught to read and write as a child, all the science she learned and mastered was self taught. In this delightful narrative the author takes up the challenge of discovering how Somerville came to be one of the most outstanding British women scientists and, furthermore, a popular writer. Particular attention is paid to the gender aspects of Somerville's success in what was, to put it mildly, a predominantly male domain.
Carl Friedrich Gauss’s textbook, Disquisitiones arithmeticae, published in 1801 (Latin), remains to this day a true masterpiece of mathematical examination. .
A few years ago, in the Wren Library of Trinity College, Cambridge, I came across a remarkable but then little-known album of pencil and watercolour portraits. The artist of most (perhaps all) was Thomas Charles Wageman. Created during 1829–1852, these portraits are of pupils of the famous mat- matical tutor William Hopkins. Though I knew much about several of the subjects, the names of others were then unknown to me. I was prompted to discover more about them all, and gradually this interest evolved into the present book. The project has expanded naturally to describe the Cambridge educational milieu of the time, the work of William Hopkins, and the later achievements of his pupils and their contemporaries. As I have taught applied mathematics in a British university for forty years, during a time of rapid change, the struggles to implement and to resist reform in mid-nineteenth-century Cambridge struck a chord of recognition. So,

too, did debates about academic standards of honours degrees. And my own experiences, as a graduate of a Scottish university who proceeded to C- bridge for postgraduate work, gave me a particular interest in those Scots and Irish students who did much the same more than a hundred years earlier. As a mathematician, I sometimes felt frustrated at having to suppress virtually all of the ? ne mathematics associated with this period: but to have included such technical material would have made this a very different book.

In How Economics Became a Mathematical Science E. Roy Weintraub traces the history of economics through the prism of the history of mathematics in the twentieth century. As mathematics has evolved, so has the image of mathematics, explains Weintraub, such as ideas about the standards for accepting proof, the meaning of rigor, and the nature of the mathematical enterprise itself. He also shows how economics itself has been shaped by economists' changing images of mathematics. Whereas others have viewed economics as autonomous, Weintraub presents a different picture, one in which changes in mathematics—both within the body of knowledge that constitutes mathematics and in how it is thought of as a discipline and as a type of knowledge—have been intertwined with the evolution of economic thought. Weintraub begins his account with Cambridge University, the intellectual birthplace of modern economics, and examines specifically Alfred Marshall and the Mathematical Tripos examinations—tests in mathematics that were required of all who wished to study economics at Cambridge. He proceeds to interrogate the idea of a rigorous mathematical economics through the connections between particular mathematical economists and mathematicians in each of the decades of the first half of the twentieth century, and thus describes how the mathematical issues of formalism and axiomatization have shaped economics. Finally, How Economics Became a Mathematical Science reconstructs the career of the economist Sidney Weintraub, whose relationship to mathematics is viewed through his relationships with his mathematician brother, Hal, and his mathematician-economist son, the book's author.

This book presents first-year calculus roughly in the order in which it was first discovered. The first two chapters show how the ancient calculations of practical problems led to infinite series, differential and integral calculus and to differential equations. The establishment of mathematical rigour for these subjects in the 19th century for one and several variables is treated in chapters III and IV. Many quotations are included to give the flavor of the history. The text is complemented by a large number of examples, calculations and mathematical pictures and will provide stimulating and enjoyable reading for students, teachers, as well as researchers.

The general principles by which the editors and authors of the present edition have been guided were explained in the preface to the first volume of Mathemat ics of the 19th Century, which contains chapters on the history of mathematical logic, algebra, number theory, and probability theory (Nauka, Moscow 1978; En glish translation by Birkhiiuser Verlag, Basel-Boston-Berlin 1992). Circumstances beyond the control of the editors necessitated certain changes in the sequence of historical exposition of individual disciplines. The second volume contains two chapters: history of geometry and history of analytic function theory (including elliptic and Abelian functions); the size of the two chapters naturally entailed di viding them into sections. The history of differential and integral calculus, as well as computational mathematics, which we had planned to include in the second volume, will form part of the third volume. We remind our readers that the appendix of each volume contains a list of the most important literature and an index of names. The names of journals are given in abbreviated form and the volume and year of publication are indicated; if the actual year of publication differs from the nominal year, the latter is given in parentheses. The book History of Mathematics from Ancient Times to the Early Nineteenth Century [in Russian], which was published in the years 1970-1972, is cited in abbreviated form as HM (with volume and page number indicated). The first volume of the present series is cited as Bk. 1 (with page numbers).

This textbook provides a unified and concise exploration of undergraduate mathematics by approaching the subject through its history. Readers will discover the rich tapestry of ideas behind familiar topics from the undergraduate curriculum, such as calculus, algebra, topology, and more. Featuring historical episodes ranging from the Ancient Greeks to Fermat and Descartes, this volume offers a glimpse into the broader context in which these ideas developed, revealing unexpected connections that make this ideal for a senior capstone course. The presentation of previous versions has been refined by omitting the less mainstream topics and inserting new connecting material, allowing instructors to cover the book in a one-semester course. This condensed edition prioritizes succinctness and cohesiveness, and there is a greater emphasis on visual clarity, featuring full color images and high quality 3D models. As in previous editions, a wide array of mathematical topics are covered, from geometry to computation; however, biographical sketches have been omitted. Mathematics and Its History: A Concise Edition is an essential resource for courses or reading programs on the history of mathematics. Knowledge of basic calculus, algebra, geometry, topology, and set theory is assumed. From reviews of previous editions: “Mathematics and Its History is a joy to read. The writing is clear, concise and inviting. The style is very different from a traditional text. I found myself picking it up to read at the expense of my usual late evening thriller or detective novel.... The author has done a wonderful job of tying together the dominant themes of undergraduate mathematics.” Richard J. Wilders, MAA, on the Third Edition "The book...is presented in a lively style without unnecessary detail. It is very stimulating and will be appreciated not only by students. Much attention is paid to problems and to the development of mathematics before the end of the nineteenth century.... This book brings to the non-specialist interested in mathematics many interesting results. It can be recommended for seminars and will be enjoyed by the broad mathematical community." European Mathematical Society, on the Second Edition