# Apostol Analytic Number Theory Solutions | 338049a224d3a12edbe40d34bc2cc970

Number TheoryZeta and Q-Zeta Functions and Associated Series and IntegralsElementary Methods in Number TheoryElliptic Curves, Modular Forms, and Their L-functionsIntegral Transforms and Operational CalculusElementary Number TheoryPrinciples of Mathematical AnalysisSeries Associated With the Zeta and Related FunctionsBeyond the Mechanical UniverseAnalytic Number TheoryAn Introduction to the Theory of NumbersIntroduction to Real AnalysisAn Invitation to Modern Number TheoryA Classical Introduction to Modern Number TheoryIntroduction to Analytic Number TheoryAn Introductory Course in Elementary Number TheoryCalculusNot Always Buried DeepA Course in CombinatoricsModular Functions and Dirichlet Series in Number TheoryIntroduction to Analytic Number TheoryFunctional Equations and How to Solve ThemFunctional Analysis, Sobolev Spaces and Partial Differential EquationsElementary Number Theory: Primes, Congruences, and SecretsAnalytic Number TheoryElementary Number TheoryA Course in Number TheoryUsing the Mathematics LiteratureScientia Magna, Vol. 1, No. 2, 2005Advanced CalculusExercises in Number TheoryA Primer of Analytic Number TheorySpectral Theory of Infinite-Area Hyperbolic SurfacesScientia Magna, Vol. 4, No. 2, 2008On the solvability of an equation involving the Smarandache function and Euler functionMultiplicative Number TheoryMathematical AnalysisA (terse) Introduction to Linear AlgebraA Computational Introduction to Number Theory and AlgebraEnumerative Combinatorics:

This is a book about prime numbers, congruences, secret messages, and elliptic curves that you can read cover to cover. It grew out of undergr- uate courses that the author taught at Harvard, UC San Diego, and the University of Washington. The systematic study of number theory was initiated around 300B. C. when Euclid proved that there are in?nitely many prime numbers, and also cleverly deduced the fundamental theorem of arithmetic, which asserts that every positive integer factors uniquely as a product of primes. Over a thousand years later (around 972A. D. ) Arab mathematicians formulated the congruent number problem that asks for a way to decide whether or not a given positive integer n is the area of a right triangle, all three of whose sides are rational numbers. Then another thousand years later (in 1976), Di?e and Hellman introduced the ?rst ever public-key cryptosystem, which enabled two people to communicate secretely over a public communications channel with no predetermined secret; this invention and the ones that followed it revolutionized the world of digital communication. In the 1980s and 1990s, elliptic curves revolutionized number theory, providing striking new insights into the congruent number problem, primality testing, publ- key cryptography, attacks on public-key systems, and playing a central role in Andrew Wiles' resolution of Fermat's Last Theorem.

For any positive integer n, the famous F.Smarandache function S(n) is de?ned as the smallest positive integer m such that n divides m!.

An undergraduate-level 2003 introduction whose only prerequisite is a standard calculus course.

After an eclipse of some 50 years, Number Theory, that is to say the study of the properties of the integers, has regained in France a vitality worthy of its distinguished past. More 'and more researchers have been attracted by problems which, though it is possible to express in simple statements, whose solutions require all their ingenuity and talent. In so doing, their work enriches the whole of mathematics with new and fertile methods. To be in a position to tackle these problems, it is neces sary to be familiar with many specific aspects of number theory. These are very different from those encountered in analysis or geometry. The necessary know-how can only be acquired by study ing and solving numerous problems. Now it is very easy to form ulate problems whose solutions, while sometimes obvious, more often go beyond current methods. Moreover, there is no doubt that, even more than in other disciplines, in mathematics one must have exercises available whose solutions are accessible. This is the objective realised by this work. It is the collab orative work of several successful young number theorists. They have drawn these exercises from their own work, from the work of their associated research groups as well as from published work.

This introductory book emphasises algorithms and applications, such as cryptography and error correcting codes.

Collection of papers from various scientists dealing with smarandache notions in science.

Zeta and q-Zeta Functions and Associated Series and Integrals is a thoroughly revised, enlarged and updated version of Series Associated with the Zeta and Related Functions. Many of the chapters and sections of the book have been significantly modified or rewritten, and a new chapter on the theory and applications of the basic (or q-) extensions of various special functions is included. This book will be invaluable because it covers not only detailed and systematic presentations of the theory and applications of the various methods and techniques used in dealing with many different classes of series and integrals associated with the Zeta and related functions, but stimulating historical accounts of a large number of problems and well-classified tables of series and integrals. Detailed and systematic presentations of the theory and applications of the various methods and techniques used in dealing with many different classes of series and integrals associated with the Zeta and related functions

These notes serve as course notes for an undergraduate course in number theory. Most if not all universities worldwide offer introductory courses in number theory for math majors and in many cases as an elective course. The notes contain a useful introduction to important topics that need to be addressed in a course in number theory. Proofs of basic theorems are presented in an interesting and comprehensive way that can be read and understood even by non-majors with the exception in the last three chapters where a background in analysis, measure theory and abstract algebra is required. The exercises are carefully chosen to broaden the understanding of the concepts. Moreover, these notes shed light on analytic number theory, a subject that is rarely seen or approached by undergraduate students. One of the unique characteristics of these notes is the careful choice of topics and its importance in the theory of numbers. The freedom is given in the last two chapters because of the advanced nature of the topics that are presented.

An authorised reissue of the long out of print classic textbook, Advanced Calculus by the late Dr Lynn Loomis and Dr Shlomo Sternberg both of Harvard University has been a revered but hard to find textbook for the advanced calculus course for decades. This book is based on an honors course in advanced calculus that the authors gave in the 1960's. The foundational material, presented in the unstarred sections of Chapters 1 through 11, was normally covered, but different applications of this basic material were stressed from year to year, and the book therefore contains more material than was covered in any one year. It can accordingly be used (with omissions) as a text for a year's course in advanced calculus, or as a text for a three-semester introduction to analysis. The prerequisites are a good grounding in the calculus of one variable from a mathematically rigorous point of view, together with some acquaintance with linear algebra. The reader should be familiar with limit and continuity type arguments and have a certain amount of mathematical sophistication. As possible introductory texts, we mention Differential and Integral Calculus by R Courant, Calculus by T Apostol, Calculus by M Spivak, and Pure Mathematics by G Hardy. The reader should also have some experience with partial derivatives. In overall plan the book divides roughly into a first half which develops the calculus (principally the differential calculus) in the setting of normed vector spaces, and a second half which deals with the calculus of differentiable manifolds.

An introduction to the Calculus, with an excellent balance between theory and technique. Integration is treated before differentiation--this is a departure from most modern texts, but it is historically correct, and it is the best way to establish the true connection between the integral and the derivative. Proofs of all the important theorems are given, generally preceded by geometric or intuitive discussion. This Second Edition introduces the mean-value theorems and their applications earlier in the text, incorporates a treatment of linear algebra, and contains many new and easier exercises. As in the first edition, an interesting historical introduction precedes each important new concept.

This textbook is a completely revised, updated, and expanded English edition of the important Analyse fonctionnelle (1983). In addition, it contains a wealth of problems and exercises (with solutions) to guide the reader. Uniquely, this book presents in a coherent, concise and unified way the main results from functional analysis together with the main results from the theory of partial differential equations (PDEs). Although there are many books on functional analysis and many on PDEs, this is the first to cover both of these closely connected topics. Since the French book was first published, it has been translated into Spanish, Italian, Japanese, Korean, Romanian, Greek and Chinese. The English edition makes a welcome addition to this list.

A new edition of a classical treatment of elliptic and modular functions with some of their number-theoretic applications, this text offers an updated bibliography and an alternative treatment of the transformation formula for the Dedekind eta function. It covers many topics, such as Hecke’s theory of entire forms with multiplicative Fourier coefficients, and the last chapter recounts Bohr’s theory of equivalence of general Dirichlet series.

This basic introduction to number theory is ideal for those with no previous knowledge of the subject. The main topics of divisibility, congruences, and the distribution of prime numbers are covered. Of particular interest is the inclusion of a proof for one of the most famous results in mathematics, the prime number theorem. With many examples and exercises, and only requiring knowledge of a little calculus and algebra, this book will suit individuals with imagination and interest in following a mathematical argument to its conclusion.

The third edition of this well known text continues to provide a solid foundation in mathematical analysis for undergraduate and first-year graduate students. The text begins with a discussion of the real number system as a complete ordered field. (Dedekind's construction is now treated in an appendix to Chapter I.) The topological background needed for the development of convergence, continuity, differentiation and integration is provided in Chapter 2. There is a new section on the gamma function, and many new and interesting exercises are included. This text is part of the Walter Rudin Student Series in Advanced Mathematics.

This text introduces geometric spectral theory in the context of infinite-area Riemann surfaces, providing a comprehensive account of the most recent developments in the field. For the second edition the context has been extended to general surfaces with hyperbolic ends, which provides a natural setting for development of the spectral theory while still keeping technical difficulties to a minimum. All of the material from the first edition is included and updated, and new sections have been added. Topics covered include an introduction to the geometry of hyperbolic surfaces, analysis of the resolvent of the Laplacian, scattering theory, resonances and scattering poles, the Selberg zeta function, the Poisson formula, distribution of resonances, the inverse scattering problem, Patterson-Sullivan theory, and the dynamical approach to the zeta function. The new sections cover the latest developments in the field, including the spectral gap, resonance asymptotics near the critical line, and sharp geometric constants for resonance bounds. A new chapter introduces recently developed techniques for resonance calculation that illuminate the existing results and conjectures on resonance distribution. The spectral theory of hyperbolic surfaces is a point of intersection for a great variety of areas, including quantum physics, discrete groups, differential geometry, number theory, complex analysis, and ergodic theory. This book will serve as a valuable resource for graduate students and researchers from these and other related fields. Review of the first edition: "The exposition is very clear and thorough, and essentially self-contained; the proofs are detailedThe book gathers together some material which is not always easily available in the literatureTo conclude, the book is certainly at a level accessible to graduate students and researchers from a rather large range of fields. Clearly, the readerwould certainly benefit greatly from it." (Colin Guillarmou, Mathematical Reviews, Issue 2008 h)

Many books have been written on the theory of functional equations, but very few help readers solve functional equations in mathematics competitions and mathematical problem solving. This book fills that gap. Each chapter includes a list of problems associated with the covered material. These vary in difficulty, with the easiest being accessible to any high school student who has read the chapter carefully. The most difficult will challenge students studying for the International Mathematical Olympiad or the Putnam Competition. An appendix provides a springboard for further investigation of the concepts of limits, infinite series and continuity.

Many problems in number theory have simple statements, but their solutions require a deep understanding of algebra, algebraic geometry, complex analysis, group representations, or a combination of all four. The original simply stated problem can be obscured in the depth of the theory developed to understand it. This book is an introduction to some of these problems, and an overview of the theories used nowadays to attack them, presented so that the number theory is always at the forefront of the discussion. Lozano-Robledo gives an introductory survey of elliptic curves, modular forms, and $L$-functions. His main goal is to provide the reader with the big picture of the surprising connections among these three families of mathematical objects and their meaning for number theory. As a case in point, Lozano-Robledo explains the modularity theorem and its famous consequence, Fermat's Last Theorem. He also discusses the Birch and Swinnerton-Dyer Conjecture and other modern conjectures. The book begins with some motivating problems and includes numerous concrete examples throughout the text, often involving actual numbers, such as 3, 4, 5, $\frac{3344161}{747348}$, and $\frac{2244035177043369699245575130906674863160948472041}{8912332268928859588025535178967163570016480830}$. The theories of elliptic curves, modular forms, and $L$-functions are too vast to be covered in a single volume, and their proofs are outside the scope of the undergraduate curriculum. However, the primary objects of study, the statements of the main theorems, and their corollaries are within the grasp of advanced undergraduates. This book concentrates on motivating the definitions, explaining the statements of the theorems and conjectures, making connections, and providing lots of examples, rather than dwelling on the hard proofs. The book succeeds if, after reading the text, students feel compelled to study elliptic curves and modular forms in all their glory.

Richard Stanley's two-volume basic introduction to enumerative combinatorics has become the standard guide to the topic for students and experts alike. This thoroughly revised second edition of Volume 1 includes ten new sections and more than 300 new exercises, most with solutions, reflecting numerous new developments since the publication of the first edition in 1986. The author brings the coverage up to date and includes a wide variety of additional applications and examples, as well as updated and expanded chapter bibliographies. Many of the less difficult new exercises have no solutions so that they can more easily be assigned to students. The material on P-partitions has been rearranged and generalized; the treatment of permutation statistics has been greatly enlarged; and there are also new sections on q-analogues of permutations, hyperplane arrangements, the cd-index, promotion and evacuation and differential posets.

The authors assemble a fascinating collection of topics from analytic number theory that provides an introduction to the subject with a very clear and unique focus on the anatomy of integers, that is, on the study of the multiplicative structure of the integers. Some of the most important topics presented are the global and local behavior of arithmetic functions, an extensive study of smooth numbers, the Hardy-Ramanujan and Landau theorems, characters and the Dirichlet theorem, the $abc$ conjecture along with some of its applications, and sieve methods. The book concludes with a whole chapter on the index of composition of an integer. One of this book's best features is the collection of problems at the end of each chapter that have been chosen carefully to reinforce the material. The authors include solutions to the even-numbered problems, making this volume very appropriate for readers who want to test their understanding of the theory presented in the book.

This book is a revised and greatly expanded version of our book Elements of Number Theory published in 1972. As with the first book the primary audience we envisage consists of upper level undergraduate mathematics majors and graduate students. We have assumed some familiarity with the material in a standard undergraduate course in abstract algebra. A large portion of Chapters 1-11 can be read even without such background with the aid of a small amount of supplementary reading. The later chapters assume some knowledge of Galois theory, and in Chapters 16 and 18 an acquaintance with the theory of complex variables is necessary. Number theory is an ancient subject and its content is vast. Any intro ductory book must, of necessity, make a very limited selection from the fascinat ing array of possible topics. Our focus is on topics which point in the direction of algebraic number theory and arithmetic algebraic geometry. By a careful selection of subject matter we have found it possible to exposit some rather advanced material without requiring very much in the way oftechnical background. Most of this material is classical in the sense that is was dis covered during the nineteenth century and earlier, but it is also modern because it is intimately related to important research going on at the present time.

An undergraduate-level introduction to number theory, with the emphasis on fully explained proofs and examples. Exercises, together with their solutions are integrated into the text, and the first few chapters assume only basic school algebra. Elementary ideas about groups and rings are then used to study groups of units, quadratic residues and arithmetic functions with applications to enumeration and cryptography. The final part, suitable for third-year students, uses ideas from algebra, analysis, calculus and geometry to study Dirichlet series and sums of squares. In particular, the last chapter gives a concise account of Fermat's Last Theorem, from its origin in the ancient Babylonian and Greek study of Pythagorean triples to its recent proof by Andrew Wiles.

Papers on two problems related to the Smarandache function, the additive k-power complements, the generalization of sequence of numbers with alternate common differences, an equation related to the Smarandache function and its positive integer solutions, the pseudo Smarandache square-free function, and other similar topics. Contributors: W. Zhang, Y. Guo, W. Xiong, S. Yilmaz, M. Turgut, A. A. Majumdar, B. Ahmad, J. Zhang, P. Zhang, N. Dung, and many others.

Using an extremely clear and informal approach, this book introduces readers to a rigorous understanding of mathematical analysis and presents challenging math concepts as clearly as possible. The real number system. Differential calculus of functions of one variable. Riemann integral functions of one variable. Integral calculus of real-valued functions. Metric Spaces. For those who want to gain an understanding of mathematical analysis and challenging mathematical concepts.

This valuable book focuses on a collection of powerful methods of analysis that yield deep number-theoretical estimates. Particular attention is given to counting functions of prime numbers and multiplicative arithmetic functions. Both real variable (?elementary?) and complex variable (?analytic?) methods are employed. The reader is assumed to have knowledge of elementary number theory (abstract algebra will also do) and real and complex analysis. Specialized analytic techniques, including transform and Tauberian methods, are developed as needed.Comments and corrigenda for the book are found at http: //www.math.uiuc.edu/ diamond/

Linear algebra is the study of vector spaces and the linear maps between them. It underlies much of modern mathematics and is widely used in applications. A (Terse) Introduction to Linear Algebra is a concise presentation of the core material of the subject--those elements of linear algebra that every mathematician, and everyone who uses mathematics, should know. It goes from the notion of a finite-dimensional vector space to the canonical forms of linear operators and their matrices, and covers along the way such key topics as: systems of linear equations, linear operators and matrices, determinants, duality, and the spectral theory of operators on inner-product spaces. The last chapter offers a selection of additional topics indicating directions in which the core material can be applied. The Appendix provides all the relevant background material. Written for students with some mathematical maturity and an interest in abstraction and formal reasoning, the book is self-contained and is appropriate for an advanced undergraduate course in linear algebra.

"This book is the first volume of a two-volume textbook for undergraduates and is indeed the crystallization of a course offered by the author at the California Institute of Technology to undergraduates without any previous knowledge of number theory. For this reason, the book starts with the most elementary properties of the natural integers. Nevertheless, the text succeeds in presenting an enormous amount of material in little more than 300 pages."-—MATHEMATICAL REVIEWS

Number theory is one of the few areas of mathematics where problems of substantial interest can be fully described to someone with minimal mathematical background. Solving such problems sometimes requires difficult and deep methods. But this is not a universal phenomenon; many engaging problems can be successfully attacked with little more than one's mathematical bare hands. In this case one says that the problem can be solved in an elementary way. Such elementary methods and the problems to which they apply are the subject of this book. Not Always Buried Deep is designed to be read and enjoyed by those who wish to explore elementary methods in modern number theory. The heart of the book is a thorough introduction to elementary prime number theory, including Dirichlet's theorem on primes in arithmetic progressions, the Brun sieve, and the Erdos-Selberg proof of the prime number theorem. Rather than trying to present a comprehensive treatise, Pollack focuses on topics that are particularly attractive and accessible. Other topics covered include Gauss's theory of cyclotomy and its applications to rational reciprocity laws, Hilbert's solution to Waring's problem, and modern work on perfect numbers. The nature of the material means that little is required in terms of prerequisites: The reader is expected to have prior familiarity with number theory at the level of an undergraduate course and a first course in modern algebra (covering groups, rings, and fields). The exposition is complemented by over 200 exercises and 400 references.

Although it was in print for a short time only, the original edition of Multiplicative Number Theory had a major impact on research and on young mathematicians. By giving a connected account of the large sieve and Bombieri's theorem, Professor Davenport made accessible an important body of new discoveries. With this stimula tion, such great progress was made that our current understanding of these topics extends well beyond what was known in 1966. As the main results can now be proved much more easily. I made the radical decision to rewrite §§23-29 completely for the second edition. In making these alterations I have tried to preserve the tone and spirit of the original. Rather than derive Bombieri's theorem from a zero density estimate tor L timctions, as Davenport did, I have chosen to present Vaughan'S elementary proof of Bombieri's theorem. This approach depends on Vaughan's simplified version of Vinogradov's method for estimating sums over prime numbers (see §24). Vinogradov devised his method in order to estimate the sum LPH e(prx); to maintain the historical perspective I have inserted (in §§25, 26) a discussion of this exponential sum and its application to sums of primes, before turning to the large sieve and Bombieri's theorem. Before Professor Davenport's untimely death in 1969, several mathematicians had suggested small improvements which might be made in Multiplicative Number Theory, should it ever be reprinted.

The Indian National Science Academy on the occasion ofthe Golden Jubilee Celebration (Fifty years of India's Independence) decided to publish a number of monographs on the selected fields. The editorial board of INS A invited us to prepare a special monograph in Number Theory. In reponse to this assignment, we invited several eminent Number Theorists to contribute expository/research articles for this monograph on Number Theory. Al though some ofthose invited, due to other preoccupations-could not respond positively to our invitation, we did receive fairly encouraging response from many eminent and creative number theorists throughout the world. These articles are presented herewith in a logical order. We are grateful to all those mathematicians who have sent us their articles. We hope that this monograph will have a significant impact on further development in this subject. R. P. Bambah v. C. Dumir R. J. Hans-Gill A Centennial History of the Prime Number Theorem Tom M. Apostol The Prime Number Theorem Among the thousands of discoveries made by mathematicians over the centuries, some stand out as significant landmarks. One of these is the prime number theorem, which describes the asymptotic distribution of prime numbers. It can be stated in various equivalent forms, two of which are: x (I) K(X) '" -I - as x --+ 00, ogx and Pn '" n log n as n --+ 00. (2) In (1), K(X) denotes the number of primes P ::s x for any x > O.

Researches and investigations involving the theory and applications of integral transforms and operational calculus are remarkably wide-spread in many diverse areas of the mathematical, physical, chemical, engineering and statistical sciences. This Special Issue contains a total of 36 carefully-selected and peer-reviewed articles which are authored by established researchers from many countries. Included in this Special Issue are review, expository and original research articles dealing with the recent advances on the topics of integral transforms and operational calculus as well as their multidisciplinary applications

This textbook covers the main topics in number theory as taught in universities throughout the world. Number theory deals mainly with properties of integers and rational numbers; it is not an organized theory in the usual sense but a vast collection of individual topics and results, with some coherent sub-theories and a long list of unsolved problems. This book excludes topics relying heavily on complex analysis and advanced algebraic number theory. The increased use of computers in number theory is reflected in many sections (with much greater emphasis in this edition). Some results of a more advanced nature are also given, including the Gelfond-Schneider theorem, the prime number theorem, and the Mordell-Weil theorem. The latest work on Fermat's last theorem is also briefly discussed. Each chapter ends with a collection of problems; hints or sketch solutions are given at the end of the book, together with various useful tables.

This reference serves as a reader-friendly guide to every basic tool and skill required in the mathematical library and helps mathematicians find resources in any format in the mathematics literature. It lists a wide range of standard texts, journals, review articles, newsgroups, and Internet and database tools for every major subfield in mathematics and details methods of access to primary literature sources of new research, applications, results, and techniques. Using the Mathematics Literature is the most comprehensive and up-to-date resource on mathematics literature in both print and electronic formats, presenting time-saving strategies for retrieval of the latest information.

"This book is the first volume of a two-volume textbook for undergraduates and is indeed the crystallization of a course offered by the author at the California Institute of Technology to undergraduates without any previous knowledge of number theory. For this reason, the book starts with the most elementary properties of the natural integers. Nevertheless, the text succeeds in presenting an enormous amount of material in little more than 300 pages."-—MATHEMATICAL REVIEWS

In a manner accessible to beginning undergraduates, An Invitation to Modern Number Theory introduces many of the central problems, conjectures, results, and techniques of the field, such as the Riemann Hypothesis, Roth's Theorem, the Circle Method, and Random Matrix Theory. Showing how experiments are used to test conjectures and prove theorems, the book allows students to do original work on such problems, often using little more than calculus (though there are numerous remarks for those with deeper backgrounds). It shows students what number theory theorems are used for and what led to them and suggests problems for further research. Steven Miller and Ramin Takloo-Bighash introduce the problems and the computational skills required to numerically investigate them, providing background material (from probability to statistics to Fourier analysis) whenever necessary. They guide students through a variety of problems, ranging from basic number theory, cryptography, and Goldbach's Problem, to the algebraic structures of numbers and continued fractions, showing connections between these subjects and encouraging students to study them further. In addition, this is the first undergraduate book to explore Random Matrix Theory, which has recently become a powerful tool for predicting answers in number theory. Providing exercises, references to the background literature, and Web links to previous student research projects, An Invitation to Modern Number Theory can be used to teach a research seminar or a lecture class.

This 1987 book studies electricity and magnetism, light, the special theory of relativity and modern physics.

Designed as a reference work and also as a graduate-level textbook, this volume presents an up-to-date and comprehensive account of the theories and applications of the various methods and techniques used in dealing with problems involving closed-form evaluations of (and representations of the Riemann Zeta function at positive integer arguments as) numerous families of series associated with the Riemann Zeta function, the Hurwitz Zeta function, and their extensions and generalizations such as Lerch's transcendent (or the Hurwitz-Lerch Zeta function). Audience: This book is intended for professional mathematicians and graduate students in mathematical sciences (both pure and applied).

This is the second edition of a popular book on combinatorics, a subject dealing with ways of arranging and distributing objects, and which involves ideas from geometry, algebra and analysis. The breadth of the theory is matched by that of its applications, which include topics as diverse as codes, circuit design and algorithm complexity. It has thus become essential for workers in many scientific fields to have some familiarity with the subject. The authors have tried to be as comprehensive as possible, dealing in a unified manner with, for example, graph theory, extremal problems, designs, colorings and codes. The depth and breadth of the coverage make the book a unique guide to the whole of the subject. The book is ideal for courses on combinatorical mathematics at the advanced undergraduate or beginning graduate level. Working mathematicians and scientists will also find it a valuable introduction and reference.