BOOK REVIEWS

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Who Gave You the Epsilon? & Other Tales of Mathematical History
Edited by Marlow Anderson, Victor Katz, and Robin Wilson
The Mathematical Association of America, Washington, DC, 2009
ISBN-13: 978-0-88385-569-0, hardcover, 429+x pages, US$65.50
Reviewed by ***Jeff Hooper****, Acadia University, Wolfville, NS*

For more than one hundred years, the Mathematical Association of America (MAA) has been publishing journals geared to a general mathematics readership. This present volume, a sequel to the editors' earlier excellent *Sherlock Holmes in Babylon*, consists of a collection of articles culled from MAA journals and dealing with aspects of the History of Mathematics, in particular considering developments in the nineteenth and twentieth centuries.

The book's articles are arranged by topic into chapters on Analysis; Geometry, Topology, and Foundations; Algebra and Number Theory; and a short final one consisting of Surveys. Throughout each section, the editors' choices of articles focus on those which examine the development of critical concepts. For a number of topics there are multiple articles which examine the same concept from different perspectives. In some cases the articles selected on a topic were written years apart, and reading them provides an interesting glimpse into the way the ideas and approaches have evolved.

The Analysis chapter begins with an article by Judith V. Grabiner which gives the book its title. Many readers will have battled with the $\varepsilon - \delta$ definitions of limit and continuity which underpin calculus, and Grabiner takes us on a fascinating exploration of Cauchy's rigorization of the ideas of Newton and Leibniz. In particular she focuses on why the desire for rigor arose in the first place. Cauchy's predecessors were content to work with the less-rigorous version of calculus.

Further articles explore the evolution of the function concept, of Green's work on electricity and magnetism, and Stokes' Theorem. Also included are excellent biographical sketches on the significant mathematical contributions of two pioneer mathematicians, looking at the lives of Sofya Kovalevsky and David Blackwell and the myriad societal challenges overcome by each.

The nineteenth century was a pivotal one in the development of modern geometry, so it should be no surprise to find included in the Geometry, Topology, and Foundations chapter articles on Euclid's parallel postulate and the development of non-Euclidean Geometry. Among other topics here, the articles also explore the developing notion of connectedness, as well as the far-reaching concepts of homotopy and homology. The nature of infinite sets is also examined, as are the remarkable properties of Cantor sets and functions.

The last two centuries witnessed enormous progress in algebra and number theory as well, and a number of key ideas are highlighted here, including Hamilton's quaternions, Galois' discoveries, the development of the group concept and the hunt for finite simple groups, and the history of the prime number theorem. The lives of Galois, Ramanujan, and Emmy Noether are also examined.

The final closing chapter examines the development of mathematics from a wider point of view, including three survey articles on mathematics (written in 1900, 1951, and 2000), as well as a short account of the 1900 International Congress of Mathematicians in Paris, now famous for Hilbert's address on the major open problems in mathematics, by an American delegate, G.B. Halsted. Each of these surveys gives a panoramic view of areas under active investigation at that time. Since they are describing research frontiers, these surveys necessarily consider more sophisticated mathematics. Nevertheless, they still provide useful general perspectives of how math is seen to be developing at each point in time.

So, if you are intrigued by the historical development of mathematics during the past 200 years, then there is a wealth of material collected for you in these 41 articles. I highly recommend it.

The Princeton Companion to Mathematics
Edited by Timothy Gowers with associate editors
June Barrow-Green and Imre Leader
Published by Princeton University Press, 2008
ISBN 978-0-691-11880-2, hardcover, 1034+xx pages, US$99.00
Reviewed by ***R.W. Richards****, Sir Wilfred Grenfell College, Corner Brook, NL*

This large (more than thousand page) opus aims to provide an overview of mathematics as it is practiced today. It is not intended as a dictionary of mathematics, nor an encyclopedia. The content covers a large spectrum of current areas of interest in pure mathematics, and is aimed at a readership of non-experts. There are more than 130 contributors from many American, European, and other research institutions. The reader with some experience in mathematics will recognize many of the names.

It is an ambitious project to provide a self-contained exposition accessible to those not familiar with a field. In this objective, this volume succeeds remarkably well, although a certain level of mathematical sophistication and some patience is required. As the intention is to provide a look at areas of current interest in mathematics, necessarily some topics are omitted, or are only covered briefly. For example, many elementary topics are not discussed, and calculus is only approached in a historical context. At the other end of the spectrum, many areas of research interest are not mentioned, or are only briefly described. For example, a reader interested in Moufang Loops will have to look somewhere else, and a reader interested in Category

Theory will only find a very basic description of that discipline. But again, this is not intended as a dictionary or an encyclopedia and the topics it does cover it does, for the most part, in an interesting and readable way. The editors have tried to present the material so that it is accessible to as large a (mathematically educated) readership as possible. As they state in the preface, they, as a policy, did not include material that they themselves did not understand.

The book is divided into eight parts. The core is in Part IV, which is a collection of twenty six essays on branches of current pure mathematics, covering major areas such as Number Theory, Topology, Geometry, Algebra, Analysis, etc. These essays do achieve the aim of opening large areas to the interested reader. For each there is suggested further reading once the reader's appetite is whetted.

It is preceded, in Part III, by a section of shorter descriptions of mathematical concepts, many of which are then used in the section that follows. These concepts may or may not be familiar to the reader, so a certain amount of jumping back and forth may be necessary.

Part V is devoted to brief entries of important problems of mathematics, some of which were significant in the development of branches of mathematics (Fermat's Last Theorem and the Insolubility of the Quintic), and some of which are major breakthroughs of recent research (the Poincaré Conjecture).

The book opens with an attempt at a current definition of mathematics and a description of what mathematicians do. This is followed by several essays on the development of the fundamental ideas of mathematics – for example the growth of abstraction and the need for rigor.

Near the end of the book, there is a series of short biographies of mathematicians of historical interest, arranged chronologically from Pythagoras to Abraham Robinson and Nicolas Bourbaki. The concluding sections concern mathematics in a broader intellectual, social, and cultural context

At a list price of CD$118.95 (and I notice online discounts) this book is a wonderful bargain. Anyone with an interest in mathematics will welcome this on their bookshelf. There is such a range of topics and lengths of articles, that it can provide many hours of fascinating reading. Were it not for the size and weight, I would even suggest that it contains some good bedtime reading. Further, it would be a valuable holding for any academic library collection.