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The History of Mathematics: A Source-Based Approach, Volume II (Book Review)

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Abstract

Reviewed Title: *The History of Mathematics: A Source-Based Approach, Volume II* by June Barrow-Green, Jeremy Gray, and Robin Wilson. Providence, Rhode Island: MAA Press, an imprint of the American Mathematical Society, 2022. 687 pp. ISBN: 978-1-4704-4382-5

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Comments

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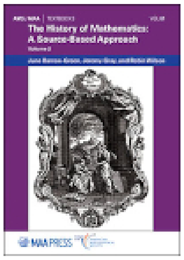
The History of Mathematics: A Source-Based Approach, Volume 2



June Barrow-Green, Jeremy Gray, and Robin Wilson

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The History of Mathematics: A Source-Based Approach, Volume 2 is the final volume arising out of materials compiled for Britain's Open University's year-long undergraduate history of mathematics correspondence course (see our review of Volume 1), which was offered from 1987 to 2007. This volume continues where Volume 1 left off, covering topics from 1650 to around 1900.

Part 1 treats 17th- and 18th-century mathematics:

- The development of calculus by Newton, Leibniz, and their followers: chapters 1 – 6, 9
- Algebra, number theory, and geometry: chapters 7, 8
- Applied mathematics (vibrating string, mechanics, celestial mechanics): chapters 10, 11

Part 2 is devoted to 19th-century (and a few early 20th-century) developments:

- Professionalization and national contexts: chapters 13, 22
- Geometry (non-Euclidean, projective, axiomatic): chapters 14, 15
- Rigorization of analysis and other foundational developments: chapters 16, 17
- Number theory and number systems: chapter 18
- Group theory (solving equations, Galois theory): chapter 19
- Applied mathematics (Fourier series, potential theory, celestial mechanics): chapters 20, 21

The intentional focus throughout is on "questions about the history of mathematics, not mathematical questions with a historical flavour" (2). Thoughtful exercises provided at the end of the book for each chapter and for the book as a whole call for historical essays involving explanation, interpretation, and evaluation, as in the case of Volume 1; no mathematical exercises culled from the various periods are proposed for students to work using either contemporaneous methods or modern mathematical techniques. The authors note that "some familiarity with mathematics is advisable" but they optimistically say that "rich answers … can be obtained without one having to master the accompanying mathematics." (2) Based on my experience teaching history of mathematics to undergraduate mathematics secondary education majors over the years, however, I'd say that a fair amount of mathematical maturity and familiarity with the mathematics and scientific applications might be needed to read the text and answer its questions, even though the authors provide helpful story-telling to frame and summarize the primary source material presented.

Like the first volume, this work grew out of *The History of Mathematics: A Reader* by Fauvel and Gray. Additional source works are also drawn from, such as Struik's *A Source Book in Mathematics: 1200 – 1800* and van Heijenoort's *From Frege to Gödel: A Source Book in Mathematical Logic*, and numerous quotes are taken both from other primary sources and from significant secondary sources. For all this, the book flows well: quotes are incorporated to illustrate mathematical developments that are masterfully narrated and contextualized. The authors at times highlight controversial issues (such as the role of calculus in Newton's writing *Principia Mathematics*, or the reasons for the slow acceptance of non-Euclidean geometry), and they are not bashful about occasionally assessing developments and excerpts as being less than perspicuous or not completely rigorous or as exhibiting biases not shared by all at the time.

As the contents listed above make clear, this text has much in common with other history of mathematics textbooks (e.g., by Katz, Boyer, Eves, Burton). What sets this volume somewhat apart from the others is the attention given to applied topics, to the use of differential equations in various fields of physics and astronomy during these time periods. A topic that is conspicuously absent along these lines, though, is any treatment of probability and statistics, and there are no applications to the social sciences. Developments in complex analysis (Cauchy, Riemann) and 19th- and early 20th-century approaches to integration (Riemann, Darboux, Lebesgue) are also not discussed. And, while this volume arises out of Britain's Open University course in the history of mathematics, it is surprisingly silent on early-to-mid 19th-century British developments in analysis, algebra, and logic. One might have expected to see some discussion of the influence of Cambridge's short-lived Analytical Society on the rise of a more abstract viewpoint on algebra (Peacock) and the attendant creation of mathematical logic in England and the United States (De Morgan, Boole, Jevons, Peirce). Logic and foundations are treated, but almost exclusively within a Continental setting, a bias that also characterizes van Heijenoort's *Source Book in Mathematical Logic*. Largely terminating the discussion of topics around 1900 means some significant further developments go unmentioned or are truncated—for example, there is no discussion of Zermelo's axiomatization of set theory to prove the Well Ordering Theorem and address the paradoxes; Cantor's efforts on the Continuum Hypothesis are discussed, but Hilbert's elevating this to the first problem in his famous 1900 list is not identified, and while Cohen's 1963 independence result is cited, Gödel's 1940 consistency result is not.

Despite these sorts of shortcomings, which are unavoidable in any survey work, this volume (and the series as a whole) is an outstanding addition to the body of history of mathematics texts now available to instructors and students, providing a wonderfully rich treasure trove of primary source material. While few may choose this book as a text for a one-semester survey course on the history of mathematics, it is certainly an excellent option for those who wish to focus solely on the modern era from a professional historical perspective—though I personally would want to begin with Volume 1's algebraic-turn-in-mathematics (Cardano, Viète, Fermat, Descartes). Nevertheless, this text belongs in college and university libraries and in the personal library of anyone teaching the modern history of mathematics.

Regarding publication logistics, the work seems to have been carefully edited, though precise references for some quotations are lacking—not a good model for student essays. And although this is an American publication, British spelling is used throughout (which won't confuse readers), but using a period as a multiplication sign and for dot products in formulas might be perplexing at first. What I find regrettable, however, is the lack of a subject index (in both volumes, as also in the earlier Reader); this makes the book less useful for anyone who wishes to dip into it as an auxiliary resource for teaching or studying the history of a particular topic in mathematics.

Calvin Jongsma (Calvin.Jongsma@dordt.edu) is Professor of Mathematics Emeritus at Dordt University. His joint Ph.D. in Mathematics and History of Mathematics from the University of Toronto prepared him to teach a wide range of undergraduate mathematics courses, including an upper-level alternate-year history of mathematics course.

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