

Hahn, Alexander J.

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Calculus in context. Background, basics, and applications.

Baltimore, MD: Johns Hopkins University Press (ISBN 978-1-4214-2230-5/hbk; 978-1-4214-2231-2/ebook). xii, 692 p. (2017).

Calculus in context is the newest book of Alexander J. Hahn who has already published [Basic calculus. From Archimedes to Newton to its role in science. New York, NY: Springer (1998; Zbl 913.00007)]. This work being out of print, the new book can be understood as an expanded reissue which profits from nearly 20 years of additional teaching experience.

The first part of the book comprises four pre-analytical chapters on topics such as geometry, trigonometry and astronomy in Ancient Greece, the astronomy of the Renaissance and Descartes' coordinate geometry, as well as two historical chapters on the differential calculus of Leibniz and Newton. The second part of the book gives a condensed but robust introduction to contemporary differential and integral calculus, differential equations and polar calculus, devoting as much space to applications as is devoted to theory. In the course of this, Hahn excels in linking the mathematical knowledge and skills needed for further studies in analysis to typical applications, whose presentation is catching and demanding. The 692-pages book also includes over 100 pages of problems and projects which provide a rich source for practice and further study.

I completely support Hahn's position that the book can be used both as a traditional introduction into the mathematical aspects of calculus with occasional references to its history and applications, and as a genetic approach towards calculus which begins with its history and applications. Given the range of mathematical topics which Hahn addresses in the first chapters, I would even argue that Hahn's book can be used as a more general introduction to academic mathematics, including, e.g., elementary geometry. One thing that I missed, however, was explicit information on how to understand and establish a mathematical proof. Given that proving is one of the most difficult aspects for novice students of academical mathematics, a more careful introduction to the art of proving would have been beneficial. For that purpose, Hahn's discussion of Euclid's elements and basic proofs in the first chapter might have marked just the perfect spot.

Hahn's book is the perfect choice for college and university teachers who want to teach calculus with reference to its origins and applications. The book can easily be used to prepare lessons. The problems provided in the book are wonderful to facilitate practice and discussion. However, the text is also understandable to the interested student, making the book a good choice for seminar work as well. Hahn himself reports to have used the resources for flipped-classroom teaching by having teams of students work on the understanding and presentation of an applied topic of calculus on the basis of the book. Whatever style of teaching is preferred, Hahn's book should definitely have its place on the bookshelf.

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