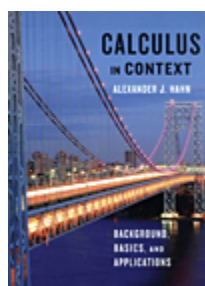




Calculus in Context



Alexander J. Hahn

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Category: Textbook
BLL Rating: [BLL](#)

The Basic Library List Committee suggests that undergraduate mathematics libraries consider this book for acquisition.

MAA REVIEW

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[Reviewed by Megan Sawyer, on 08/4/2017]

Calculus in Context has the admirable aim of introducing students to geometry, trigonometry, and calculus through a framework of historical applications. Covering material as early as the geometry of the ancient Greek culture to differential equations, series and sequences, this text has been clearly thought out to highlight the connection between physical applications and the mathematics that one traditionally associates with a first semester calculus course.

Chapters 1–4 are essentially a review of geometry and trigonometry, but framed by historical applications. Significant terminology not typically seen in a calculus book is introduced to the student in context of each problem. This method, although appreciated by the reviewer, can be distracting for the student seeking to determine the important focal points. As an example, the solar system is used to frame studies of ellipses and other geometric objects. A student could easily be discouraged about or distracted from the main point of the chapter — the mathematics — because they get lost in the historical context. On the flip side, other students may appreciate the context as a framework for their understanding. An instructor using this book must strike a delicate balance between the two types of students.

Calculus, as we traditionally know it, begins in Chapter 5 with a study of lines in the plane. The chapter has an almost exponential development of material: the first thirteen pages revolve around concepts of functions and lines in the plane, and then derivatives, continuity, and the First Derivative Test are given a mere three pages before a historical tangent is taken. This is not unique to this chapter, or to this content. The topic of integrals, including the development using Riemann Sums and volumes of revolution, is contained within ten pages.

Although the back-and-forth connection between derivatives and integrals may make it easier for students to intuitively grasp the connection between the two, it takes almost one hundred pages to move from the introduction of the derivative to proofs and methods to actually compute the derivative. This can pose significant trouble to a three-credit calculus course, for example, where time is of the essence.

A strong component of this book is the almost overwhelming number of applications of calculus, and the well-researched details for each application. The author has clearly spent time developing the framework for where to place each application in the text, and how to build concepts contained within the example and the end of chapter problems to support these applications. This reviewer has found the applications fascinating, ranging from the mathematics of the solar system to the support of domes in recent and not-so-recent structures.

Overall, this reviewer would not choose to use this text as the main text for a calculus course, but would (and has) utilized the myriad of applications as starting points for student projects. The depth of detail in each application provides an excellent structure for guiding students through the “why should we care” moments that every calculus class experiences.

Megan Sawyer is an assistant professor of mathematics at Southern New Hampshire University in Manchester, NH.

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Comments

A Comment from William J. Frascella

Submitted by fggouvea on Thu, 2017-12-14 12:24

Last August (08/04/2017) Megan Sawyer reviewed in these pages the calculus textbook *Calculus in Context*, by Alexander Hahn. Though extolling the book’s “admirable aim of introducing students to geometry, trigonometry, and calculus through a framework of historical applications”, Sawyer clearly states in her final paragraph that she would not choose to use *Calculus in Context* as the main text for a calculus course. It is this issue — the suitability of adopting Hahn’s book as a textbook for a standard college calculus course — I explore below.

Sawyer’s main problem with the book seems to be that the way *Calculus in Context* weaves together its historical/contextual material with its mathematical content would make it very difficult to cover the mathematical content objectives of a standard calculus course. For Sawyer, an instructor using *Calculus in Context* as the textbook for such a course would begin with Chapter 5 (The Calculus of Leibniz) and Chapter 6 (The Calculus of Newton).

Sawyer then goes on to identify the problematic nature of this weaving issue. For example, she observes that in Chapter 5, “the first thirteen pages revolve around the concepts of functions and lines in the plane, and then derivatives, continuity and the First Derivative Test are given a mere three pages ... “. She states that this kind of difficulty is found in Chapter 6 as well. The suggestion is that mathematical content would become overwhelmed by the historical material.

It's hard to argue with Sawyer's argument that adopting *Calculus in Context* as the main text would significantly challenge an instructor trying to cover the mathematics in a standard calculus course, *if that instructor had to begin the coverage of the course material with Chapters 5 and 6*. But surely one does not have to begin with these chapters!

In fact, an instructor of a standard calculus course, who chooses to use *Calculus in Context* as its main textbook, could very naturally begin the course, not with Chapters 5 and 6, but with Chapter 7 (Differential Calculus) and Chapter 9 (The Basics of Integral Calculus). These chapters, essentially representing the book's mathematical core of calculus, fit within a compass of 140 pages. Such an instructor could chart a path through these 140 pages (as the course's "mathematical spine") and enhance this spine with (to quote Sawyer) "the almost overwhelming number of applications of calculus, and the well-researched details for each application".

This strategy for using *Calculus in Context* in the college classroom puts certain demands on the instructor: namely, taking the time and effort needed to (i) customize the mathematical spine (i.e., chapters 7 and 9) consistent with the course's mathematical syllabus, and (ii) select those historical/contextual applications, examples, and problems best suited to his or her students' abilities and backgrounds. This path through the book could offer the instructor a safeguard, insuring the mathematical material (in terms of both scope and depth) will not be overwhelmed as he or she decides exactly what historical/contextual material to incorporate.

I taught mathematics courses to both majors and non-majors alike at all undergraduate levels at Indiana University South Bend since 1970. Among my teaching assignments, calculus courses of all varieties were a big part. I was also Chair of IUSB's Department of Mathematical Sciences for several terms. In addition, I have taught courses in the history and philosophy of science and mathematics in IUSB's Master of Liberal Studies Program. Since my retirement I have continued offering this kind of course for the master's program on an occasional basis. I also directed the division of elementary, secondary, and informal education of the NSF for two years before I retired from fulltime work at IUSB.

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Mathematical Association of America

P: (800) 331-1622

F: (240) 396-5647

E: maaservice@maa.org

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