THE CALCULUS TUTORING BOOK

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PREFACE

This is a text in calculus, written for students in mathematics and applied areas such as engineering, physics, chemistry, computer science, economics, biology, and psychology. The style is unlike that of the usual text that the student encounters when enrolling in a standard calculus sequence. We'll try to explain the reasoning behind our approach, which is based on more than 20 years of teaching experience.

Mathematicians and consumers of mathematics (such as engineers) seem to disagree as to what mathematics actually is. To a mathematician, it is important to distinguish between rigor and intuition. To an engineer, intuitive thinking, geometric reasoning, and physical deductions are all valid if they illuminate a problem, and a formal proof is often unnecessary or counterproductive.

Most calculus texts claim to be intuitive, informal, and even friendly, and in fact one can find many worked-out examples, as well as some geometric and physical reasoning. However, the dominant feature of these books is *formalism*. Definitions and theorems are stated precisely, and many results are proved at a level of rigor that is acceptable to a working mathematician. We admit to a twinge of embarrassment in arguing that this is bad. However, our calculus students have ranged from close to the best to be found anywhere, to far from the worst, and it seems entirely clear to us that most students are not ready for an abstract presentation, and they simply will not learn the formalism. The better students will succeed in reading around the abstractions, so that the textbook at least becomes useful as a source of examples.

Our approach uses informal language and emphasizes geometric and physical reasoning. The style is similar to that used in applied courses and, for this reason, students find the presentation very congenial. They do not regard calculus as a strange subject outside their normal experience. Invariably, a number of students are motivated toward further study of mathematics, and there is no better preparation than to learn to think intuitively, geometrically, and physically.

We expect that this text will be used for independent study, or as a supplement or reference for those who are having difficulty in a standard calculus course; for maximum benefit to the student, detailed solutions to all problems are supplied. (We have used the book as a classroom text, and have found the inclusion of detailed solutions to be a useful feature here as well.) The problems are limited in number so that it is feasible to work through all of them. They have been carefully chosen so that a student who does most of them will be well prepared for applications of calculus in later courses. The text and problems concentrate on basic material rather than fringe topics; as a result the book is of manageable size.

We believe that for a student encountering calculus for the first time, our approach is most appropriate. We hope that faculty who teach

courses in which calculus is applied will, after seeing how well the approach works, try to influence departments of mathematics to change their style of teaching.

The close cooperation and teamwork of the staff at IEEE PRESS were invaluable. In particular, we would like to express our gratitude to David Boulanger, Associate Editor; W. Reed Crone, Managing Editor; and David L. Staiger, Staff Director.

We wanted the diagrams in the book to be freehand line drawings, similar to those sketched by an instructor at a blackboard or a student working at home. We thank our artist, Evan Polenghi, for carrying out our conception with skill and grace.

Above all, we thank Professor M. E. Van Valkenburg, Dean of the School of Engineering at the University of Illinois at Urbana-Champaign and Editor in Chief of IEEE PRESS, for making the publication of this text possible.

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