BOOK REVIEWS

ALAN LAW

Calculus, The Dynamics of Change edited by A. Wayne Roberts,
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This volume is number 39 in the outstanding Mathematical Association of America series on mathematics education, with the emphasis on calculus and calculus reform. There are four main sections: I. Visions; II. Planning; III. Assessment; IV. Connections, each of which has a number of articles by various authors. In addition, there is a prefatory section on how to think about and plan a modern calculus course and three final sections on, respectively, resources, calculus on the Internet, and a historical and philosophical section "Calculus for a New Century". A total of 17 different authors were involved in the various articles.

The prefatory section is a good "how to" guide to effective organization of a course in calculus—every beginning instructor (and all old fogeys) should read it. There are ideas you may not accept, but overall any instructor will get a refreshingly succinct and useful guide to preparing an interesting and useful course.

There are six articles in the Visions section. Sharon Cutler Ross in "Visions of Calculus" gives a historical discussion of the development of reform, with a very balanced discussion of the most important issues. This is a good way to bring yourself to an understanding of what are the issues, what has worked, and which ideas are still in question. A short article by Thomas Tucker shows, with one simple example, how one can solve calculus problems using numerical or verbal techniques. Mai Gehrke and David Pengelley report on their programs at New Mexico State University, and give practical advice for conducting reform courses, and for getting colleagues on side. Deborah Hughes Hallett contributes a very personal essay on her experiences with calculus teaching and calculus reform. David A. Smith contributes an essay which emphasizes 10 active verbs which characterize his ideas about teaching.

There are four articles in the Planning section. Martin Flashman's article reports on the full history of the introduction of reform at six institutions. Morton Brown reports on the Michigan program. The last two articles are in fact an outline for change followed by a checklist.

Part III, Assessment, has an introductory article by David Bressoud, followed by a large set of final examinations for each of Calculus I, II and III. Each examination had at least one pleasant surprise for me. Bressoud's article has lots of good thoughts, and begins with an apocryphal quote of

Richard Feynman, *The biggest problem with being a student is that you're always too busy getting an education to learn anything*, and the rest of the article is just as interesting in its insights. Assessment is probably the weakest area of most mathematics courses, and this section will help most of us learn to think more deeply about the problem.

Part IV, Connections, is concerned with what in many ways is the most overlooked area in Mathematics departments. The degree to which we think of our individual courses in isolation, rather than as an integrated whole, is almost criminal. I am not thinking of the "analysis sequence" or the "algebra sequence", but of how all of our courses fit (or rather, do not) into some kind of integrated system. John Dossey's article on secondary school mathematics reform is not terribly relevant to Canada—this nation is quite far ahead of the U.S. in designing effective high school mathematics programs—whether students take them and are attracted to the subject by them is another matter! Robert Borrelli and Courtney Coleman of Harvey Mudd report on their experiments with modifying the introductory differential equations course. The article gives four examples to emphasize how modern ideas can be brought into a first course. David Carlson and Wayne Roberts give a very brief report on their experiences with post-calculus linear algebra and analysis. Sheldon Gordon recorded a round-table discussion between mathematicians, electrical engineers, ecologists, physicists, biologists, chemists and chemical engineers.

Martin Flashman's article on the Internet gives a couple of key, central, sites. Since this book appeared in 1996, there are by now hordes of other first class sites.

Recent reports from colleagues indicate that at many schools the mathematics department is more or less completely isolated from its clients, in particular from the faculty of engineering and the department of physics. At many schools these faculties and departments keep their students away from the mathematics department as much as possible. The reports indicate an arrogance and lack of respect for other disciplines which is truly amazing. These mathematics departments are recognized as leaders in our profession, yet they have no research in teaching, learning, or assessment, nor would they be valued if they did. This book and others like it show that in our profession there is a large group of committed professionals trying to get us all to think about the teaching and learning side of our work. Thank goodness. And thank the MAA.