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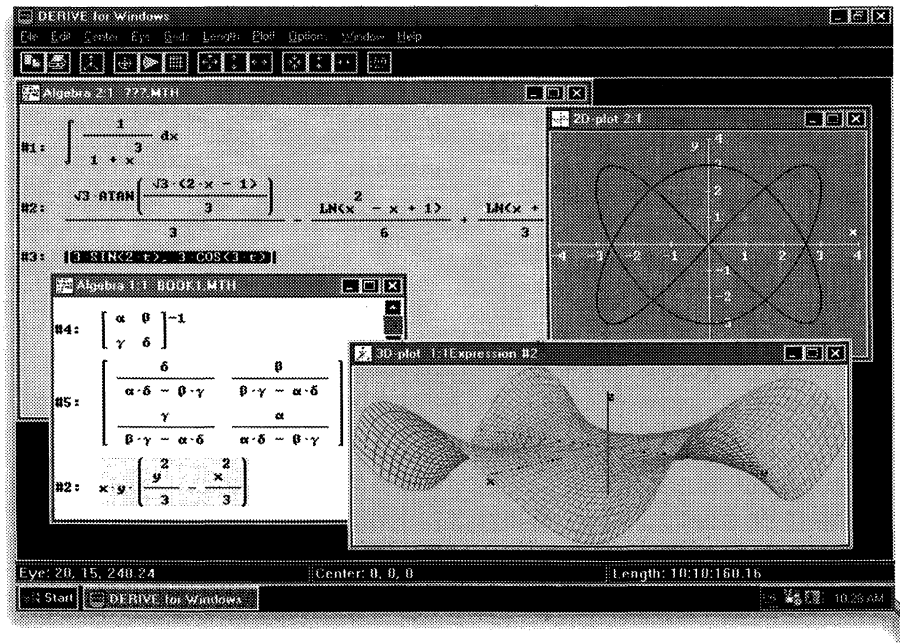

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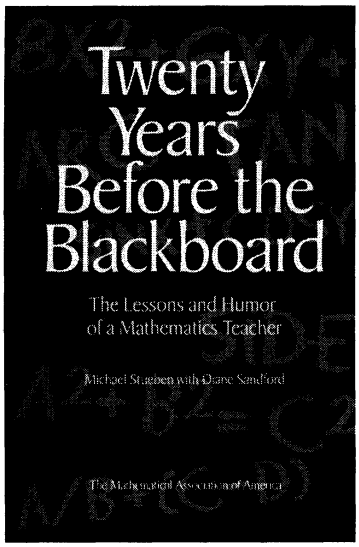

Twenty Years Before the Blackboard

The Lessons and Humor of a Mathematics Teacher

Michael Stueben with Diane Sandford

Series: Spectrum

A perfect gift for the new teacher. . . or for anyone interested in the teaching of mathematics.

This book is the legacy of twenty years of mathematics teaching. During this time, the author searched for motivation techniques, mnemonics, insightful proofs, and serious applications of humor to aid his teaching. The result is this book: part philosophy, part humor, and part biography. Readers will be amused and enlightened on every page.

Mr. Stueben shows how he has used humor and wordplay to motivate his students. The book is filled with wonderful problems and proofs, as well as the author's insights about how to approach teaching problem solving to high school students. Sections of the book also treat the use of calculators and computers in the classroom. A section on mnemonics shows how teachers can use memory aids to help their students learn and retain material.

All in all, *Twenty Years Before the Blackboard* provides a goldmine of ideas for the classroom teacher. Although Mr. Stueben taught at the high school level, his book is an excellent "methods" book for mathematics teachers at all levels.

Read what Martin Gardner has to say about this fascinating book:

It's been decades since I read so entertaining a book about mathematics. The book is a treasure-trove of mathematical jokes, rhymes, anecdotes, word play, mnemonics, and beautiful proofs. For teachers there is an abundance of wise advice based on the author's twenty years in high school teaching. Mathematicians at all levels, from amateurs to college professors will not only chuckle over its gems, but learn much they did not know before. —Martin Gardner

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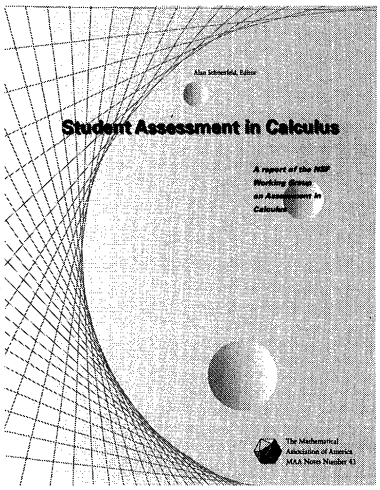

Student Assessment in Calculus

A Report of the NSF Working Group on Assessment in Calculus

ALAN SCHOENFELD, EDITOR

Series: MAA Notes

If you teach calculus, you should read this book. If you want to know what mathematics your students understand, or if you want to know how to find out what they understand, this book contains essential information for you.

It doesn't matter whether you teach a reform or traditional course, whether you have large or small sections, or whether you use lectures or laboratories. The bottom line is the same: When all is said and done, what counts is what our students understand. And that's what *Student Assessment in Calculus* is about.

Over the last ten years calculus instruction has changed in numerous ways. Whether they were trying on new ideas or following the more traditional routes towards conceptual understanding, both individual faculty and departments needed to know if their instruction was effective. To help deal with that issue, the National Science Foundation brought together a Working Group of experts in students' mathematical thinking, in assessment, and in calculus reform. The goals of their work were to:

- develop a framework to tailor calculus instruction to the students' needs;
- establish an agenda for further research on student understanding;
- describe how to make use of a range of techniques to test what students know, such as multiple-choice tests or short essay questions, student portfolios and "clinical" interviews;
- summarize major goals of the reform movement and describe the challenges faced by those who are taking a closer look at how students learn;
- illustrate the ways in which calculus projects attempt (via exams, papers, projects, etc.) to find out what their students have learned.

This book is the result of those efforts. If you teach calculus, if you want to see examples of useful assessment techniques, or if you are interested in issues of how to measure student learning in mathematics, then there is a lot for you here.

Catalog Code: NTE-43/JR97
122 pp., Paperbound, 1997
ISBN 0-88385-152-0
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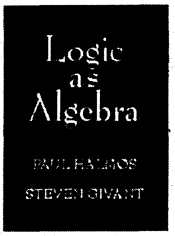

Logic as Algebra

Dolciani Mathematical Expositions–No. 21
The Mathematical Association of America

Paul Halmos and Steven Givant

Series: Dolciani Mathematical Expositions

This book is based on the notes of a course in logic given by Paul Halmos. This book retains the spirit and purpose of those notes, which was to show that logic can (and perhaps should) be viewed from an algebraic perspective. When so viewed, many of its principal notions are seen to be old friends, familiar algebraic notions that were "disguised" in logical clothing. Moreover, the connection between the principal theorems of the subject and well-known theorems in algebra becomes clearer. Even the proofs often gain in simplicity.

Propositional logic and monadic predicate calculus—predicate logic with a single quantifier— are the principal topics treated. The connections between logic and algebra are carefully explained. The key notions and the fundamental theorems are elucidated from both a logical and algebraic perspective. The final section gives a unique and illuminating algebraic treatment of the theory of syllogisms—perhaps the oldest branch of logic, and a subject that is neglected in most modern logic texts.

The presentation is aimed at a broad audience—mathematics amateurs, students, teachers, philosophers, linguists, computer scientists, engineers, and professional mathematicians. Whether the reader's goal is a quick glimpse of modern logic or a more serious study of the subject, the book's fresh approach will bring novel and illuminating insights to beginners and professionals alike. All that is required of the reader is an acquaintance with some of the basic notions encountered in a first course in modern algebra. In particular, no prior knowledge of logic is assumed. The book could serve equally well as a fireside companion and as a course text.

Contents: **What is Logic?:** To count or to think; A small alphabet; A small grammar; A small logic; What is truth?; Motivation of the small language; All mathematics. **Propositional Calculus:** Propositional symbols; Propositional abbreviations; Polish notation; Language as an algebra; Concatenation; Theorem schemata; Formal proofs; Entailment; Logical equivalence; Conjunction; Algebraic identities. **Boolean Algebra:** Equivalence classes; Interpretations; Consistency and Boolean algebra; Duality and commutativity; Properties of Boolean algebras; Subtraction; Examples of Boolean algebras. **Boolean Universal Algebra:** Subalgebras; Homomorphisms; Examples of homomorphisms; Free algebras; Kernels and ideals; Maximal ideals; Homomorphism theorem; Consequences; The representation theorem. **Logic via Algebra:** Pre-Boolean algebras; Substitution rule; Boolean logics; Algebra of the propositional calculus; Algebra of proof and consequence. **Lattices and Infinite Operations:** Lattices; Non-distributive lattices; Infinite operations. **Monadic Predicate Calculus:** Propositional functions; Finite functions; Functional monadic algebras; Functional quantifiers; Properties of quantifiers; Monadic algebras; Free monadic algebras; Modal logics; Monadic logics; Syllogisms.

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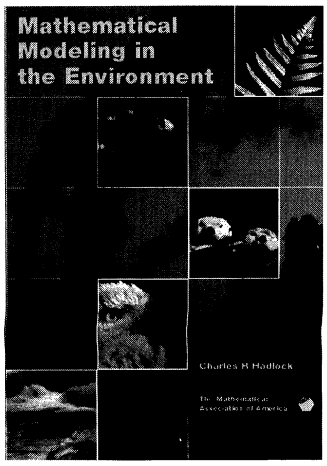

Mathematical Modeling in the Environment

Charles Hadlock

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This book has a dual objective: first, to introduce the reader to some of the most important and widespread environmental issues of the day; and second, to illustrate the vital role played by mathematical models in investigating these issues. The environmental issues addressed include: ground-water contamination, air pollution, and hazardous material emergencies. These issues are presented in their full real-world context, not as scientific or mathematical abstractions; and for background, readers are invited to investigate their status in their own communities.

The first part of the book leads the reader through relatively elementary modeling of these phenomena, including simple algebraic equations for ground water, slightly more complex algebraic equations (preferably implemented on a spreadsheet or other computerized framework) for air pollution, and a fully computerized modeling package for hazardous materials incident analysis. The interplay between physical intuition and mathematical analysis is emphasized.

For more advanced readers, the second part of the book returns to the same three subjects but with a higher level of mathematical sophistication (adjustable to the preparation of the reader by selection of subsections.) Many important classical mathematical themes are developed through this context, examples coming from single and multivariable calculus, differential equations, numerical analysis, linear algebra and probability. The material is presented in such a way as to minimize the required background and to encourage the subsequent study of some of these fields.

An elementary course for a general audience could be based entirely on Part I, and a higher level mathematics, science, or engineering course could move quickly to Part 2.

A PC compatible diskette packaged with the text contains a spreadsheet program that facilitates the numerical experimentation with the Gaussian plume equation introduced in Chapter 3, as well as public domain DOS program (ARCHIE) for evaluating the consequences from various hazardous materials scenarios (e.g., the physical extent of flammable and toxic vapor clouds). Text is not tied to the use of this software, but it is included as an aid to meet the pedagogical objectives of the text.

Catalog Code: ENV/SA
312 pp., Paperbound, 1998, ISBN 0-88385-709-X
List: $55.00 MAA Member: $43.95

Instructor's and Solutions Manual for *Mathematical Modeling in the Environment*

Charles Hadlock

Contains the complete solutions and further discussion of nearly every exercise presented in the textbook. This includes both the mathematical/computational exercises as well as the research questions and investigations. Readers will benefit greatly from perusing solutions to the problems whether they have worked them out themselves or not. Students using this volume will still need to work out solutions of research questions using their own sources and adapting them to their own geographic locations, or using their own computational schemes, so this volume could well be useful for students in many course contexts. Enrichment material is included on the topics of some of the exercises. Advice for teachers who lack previous environmental experience, but who want to teach this material is also provided and makes it practical for such persons to offer a course based on these volumes.

Catalog Code: EVS/SA
150 pp., Paperbound, 1998, ISBN 0-88385-713-8
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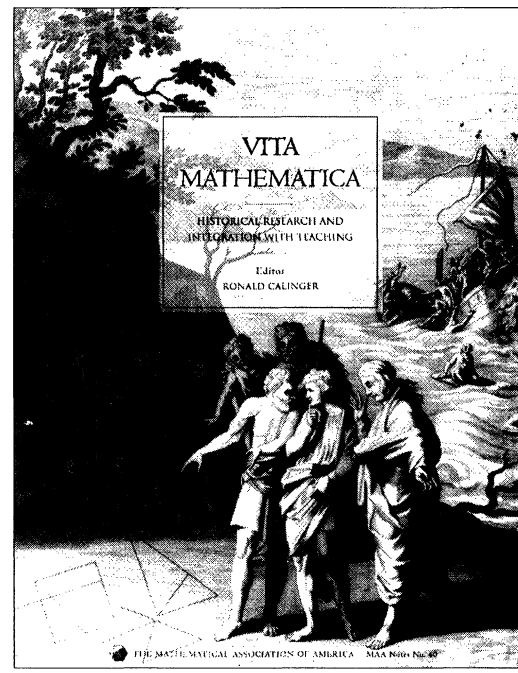
Vita Mathematica

Historical Research and Integration with Teaching

Ronald Calinger, Editor



The use of the history of mathematics in the teaching of mathematics at all levels is an idea whose time has come. To use history in the teaching of undergraduate mathematics, the instructor must be familiar with the history as well as the mathematics. *Vita Mathematica* will enable college teachers to learn the relevant history of various topics in the undergraduate curriculum and help them incorporate this history in their teaching.

For example, should calculus be approached from a geometric or an algebraic point of view? The book shows us how two important eighteenth century mathematicians, Colin Maclaurin and Joseph-Louis Lagrange, understood the calculus from these different standpoints and how their legacy is still important in teaching calculus today. We also learn why Lagrange's algebraic approach dominated teaching in Germany in the nineteenth century. Some of the reasons for this are related to the appropriate foundations of the calculus, and so the book traces the ancient history of one of the possible foundations, the concept of indivisibles. Even though we generally do not use this concept formally today, many ideas for a heuristic approach to the calculus can be developed out of his study.

Vita Mathematica contains numerous other articles dealing with calculus, with algebra, combinatorics, graph theory, and geometry, as well as more general articles on teaching courses for prospective teachers.

This volume, then, demonstrates that the history of mathematics is no longer tangential to the mathematics curriculum, but in fact deserves a central role.

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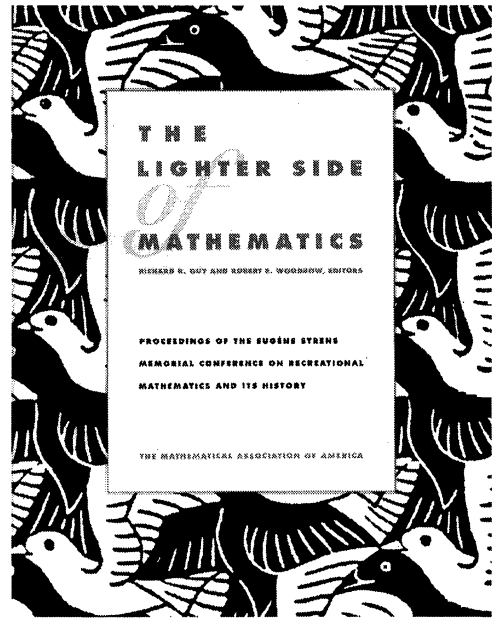
The Lighter Side of Mathematics

Proceedings of the Eugène Strens Memorial Conference on Recreational Mathematics and its History

Richard K. Guy and
Robert E. Woodrow, Editors



The level of exposition is high, and the fun infectious. The reader can find routes to serious mathematics, such as hyperbolic geometry, fractals, group theory, and number theory, all beginning with a delightful puzzle. A sparkling addition for any library where the lover of mathematics at any level comes for support.
—Choice

The book is a fantastic feast of far-from-trivial topics. Entertaining mathematics not only can lead to unexpected applications...but it is one of the best ways to stimulate interest in mathematics among both students and the general public.
—Martin Gardner, American Scientist

In August of 1986 a special conference on recreational mathematics was held at the University of Calgary to celebrate the founding of the Strens Collection. Leading practitioners of recreational mathematics from around the world gathered in Calgary to share with each other the joy and spirit of play that is to be found in recreational mathematics.

The papers in this volume represent a treasure trove of recreational mathematics by a star-studded cast: Leon Bankoff, Elwyn Berlekamp, H.S.M. Coxeter, Ken Falconer, Branko Grünbaum, Richard Guy, Doris Schattschneider, David Singmaster, Athelstan Spilhaus, Stan Wagon and many others.

If you are interested in tessellations, Escher, tiling, Rubik's cube, pentominoes, games, puzzles, the arbelos, Henry Dudeney, or change ringing, then this book is a must for you.

376 pp., Paperbound, 1994
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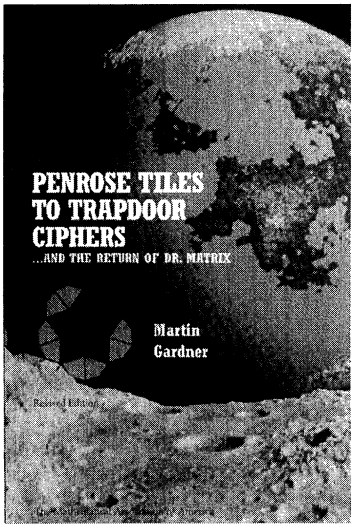

Penrose Tiles to Trapdoor Ciphers

... and the Return of Dr. Matrix

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The MAA is proud to reissue Martin Gardner's *Penrose Tiles to Trapdoor Ciphers*, printed with a new bibliography, corrections to the text, and a postscript from the author. *Penrose Tiles* assembles a collection of Gardner's "Mathematical Games" columns from *Scientific American* that include many of the problems, puzzles and paradoxes that have earned him a reputation as a master mathematical magician.

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The scope is extraordinary ... Those fortunate enough to have encountered Gardner's columns in their original appearance can look for personal bonuses of reminiscence as they read this book ... Gardner is one of history's great figures of recreational mathematics. —New Scientist

Penrose Tiles to Trapdoor Ciphers is invaluable to those interested in recreational mathematics and should enlighten those who consider such activity to be difficult or boring.
—The Mathematics Teacher.

No popular mathematical writer has ever matched Gardner's breadth and richness of knowledge and clarity of style, and this book is up to his usual unsurpassable standard.
—American Scientist

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