Publications

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The Assessment Challenge in Statistics Education, I. Gal and J. B. Garfield, eds., 1997. xii + 284 pp., $65 cloth. ISBN 90-5199-333-1. Published by IOS Press, Netherlands. Distributed by IOS Press, P.O. Box 10558, Burke, VA 22009-0058, (703) 323-5554.

The editors furnished a good, succinct summary of this book when they wrote that the chapters supply "solid rationales and a wealth of suggestions for assessing students' achievements and progress regarding knowledge, skills, reasoning, and dispositions" (p. xii). The thirty-five authors—twenty-one from the United States and fourteen from other countries—contributed nineteen chapters related to assessment in statistics. The first chapter not only gives an overview of the book but also includes eight "instructional goals," which should inspire any teacher of statistics. I plan to put a copy of them on my wall and read them regularly to remind myself of how I should teach statistics.

The breadth of this book is considerable and multidimensional: from cognition studies to practical suggestions, from kindergarten-level statistics to graduate school–level statistics, from sample test questions to detailed rubrics for evaluating students' projects. Nearly anyone teaching statistics should find at least a few items of particular interest, and researchers will find a gold mine of information. At the same time, because of the book's breadth, most statistics teachers will find that many chapters are of minor interest.

Many terms and topics found in the book—*constructivism, rubrics, portfolios, journals, authentic assessment*—are familiar to those involved in mathematics education and are now dispersing through the statistics-education community. Just as it has been difficult to change assessment practices, and therefore pedagogical practices, in mathematics education, so will it be in statistics education. To implement the many ideas for assessment and to think about the corresponding pedagogical changes are overwhelming. Teachers can find comfort in chapter 3, contributed by Shirley Colvin and Kenneth Vos, on authentic assessment models: "It is better to try at least one different assessment technique than be paralyzed with all this information and refuse to try any new assessment program" (p. 36). This book will help me do just that.—*Kevin S. Jones, Southwest Texas State University, San Marcos, TX 78666.*

Diophantus and Diophantine Equations, Isabella Grigoryevna Bashmakova, 1997. xiv + 90 pp., $21.95 paper. ISBN 0-88385-526-7. Mathematical Association of America, P.O. Box 91112, Washington DC 20090-1112, (301) 617-7800.

The name Diophantus conjures up images of indeterminate equations and number theory for most mathematics teachers. Their number-theory experiences helped them appreciate the challenges of the type of problems posed by Diophantus. Bashmakova's book describes Diophantus's work and makes a historical case well beyond the realm of number theory to incorporate evidence of his geometric thinking. This evidence focuses attention on the symbolism of mathematics during his and subsequent eras. Bashmakova relates mathematics to historical developments by Bombelli, Viète, Fermat, Euler, and Jacobi in a manner that extends the reader's understanding while providing insights about interesting extensions by these luminaries.

This book may well challenge those who have limited experience relating algebraic curves to number theory. However, exploring the mathematics in this book is well worth the effort because the book unifies domains of geometry, number theory, and analysis while using history to lend insights into the evolution of the ideas. The book is well-crafted, wasting few words and offering considerable historical information while inviting the reader to explore a great deal of mathematics.—*Alan Osborne, Professor Emeritus, Ohio State University, New Albany, OH 43054.*

Elementary Mathematical Models: Order Aplenty and a Glimpse of Chaos. Dan Kalman, 1997. 360 pp., $32.50 paper. ISBN 0-88385-707-3. Mathematical Association of America, P.O. Box 91112, Washington, DC 20090-1112, (301) 617-7800.

This book is designed for college instructors teaching an entry-level mathematics course. The author suggests that this book be used in a course that takes the place of the traditional college-algebra course required of most students. The author used four main principles in writing this book:

- Introduce each new mathematical operation in the context of a believable problem.
- Weave all the topics into an integrated whole.
- Provide as a theme a method that can be used in a large number of problem contexts.
- Emphasize conceptual understanding of how the mathematics contributes to solving problems over technical mastery of each mathematical topic for its own sake.

This book emphasizes the applicability of mathematical models as demonstrated by many real-world applications. These problems include numerical, graphical, and theoretical methods; sequences; linear, quadratic, geometric, and logistic growth; linear and quadratic graphs, functions, and equations; and chaos.

I found the book a refreshing alternative to college-algebra textbooks and would recommend it to instructors who are seeking changes.—*Kenneth L. Shaw, Florida State University, Panama City, FL 32405.*

Exploring Functions with the TI-83, Brendan Kelly, 1997. 78 pp., $14.95 paper. ISBN 1-895997-09-7; **Exploring Statistics with the TI-83,** Brendan Kelly, 1997. 96 pp., $14.95 paper. ISBN 1-895997-11-9. Brendan Kelly Publishing, 2122 Highview Dr., Burlington, ON L7R 3X4, (905) 335-3359.

These books allow teachers and students to easily integrate the graphing calculator into teaching and learning mathematics. Each exploration in the book begins with a little piece of mathematical history then, through step-by-step explanation and lists of calculator key sequences, presents such varied topics as finding the roots of an equation, working with parametric equations, and using high-end statistical analysis, such as chi-square frequency function and *F* distribution. Following the explanation for each exploration are practice exercises for students. A fully worked-out solution to each exercise is included in the answer-key section at the end of each publication. The exercises require higher mental activity than do many high school mathematics textbooks.

The easy-to-follow format will quickly cure graphing-calculator phobia. These resources are especially useful for teachers who have never used graphing calculators. They quickly teach the most common functions of the calculator and are correlated to the most common areas of the high school curriculum. These publications are a must for any high school mathematics department that uses TI-83 calculators. The mathematical cartoons are a nice touch throughout both publications.—*Terry Kaminski, Grand Centre High School, Cold Lake, AB T9M 1V7.*

The Magical Maze: Seeing the World through Mathematical Eyes, Ian Stewart, 1997. vii + 268 pp., $24.95 cloth. ISBN 0-471-19297-X. John Wiley & Sons, 605 Third Ave., New York, NY 10158-0012, (212) 850-6336.

Fans of Ian Stewart have reason to rejoice with *The Magical Maze: Seeing the World through Mathematical Eyes.* Those who have yet to become fans will also be intrigued. This delightful book gives the reader many insights

into new and old mathematical puzzles and dilemmas by restructuring these labyrinths and looking at them from multiple perspectives.

This acclaimed author uses the metaphor that "mathematics is a maze" because "being a mathematician involves navigating, with confidence, through an intricate network of logical possibilities" (p. 2). With each path taken through this intricate maze of mathematics, the reader's understanding of mathematical insights deepens.

Stewart presents us with eight junctions and eight passages through the maze. The first junction exposes the reader to the magic of numbers through the lens of the natural world as well as that of the human mind. Here the Fibonacci sequence is linked with modular arithmetic and the geometry of nature. In junction 2 the reader passes through such intriguing sections as "Panthers Don't Like Porridge," which leads to a discussion of the tower of Hanoi puzzle, a Sierpinski carpet, and the Pythagorean theorem. Junction 3 brings the reader to "Marilyn and the Goats," which addresses the controversy that occurred when Marilyn vos Savant attempted to solve the famous Monty Hall problem. Junction 4 presents "The Slime Mold Saga," which consists of tessellations and symmetry situations. In junction 5, "The Patterns of Tiny Feet," one finds networks and oscillations. "Turing's Train Set," an adventure into logic and circuits, as well as the "game of life," is found in junction 6. Junction 7, "Queen Dido's Hide," describes optimization problems and Fermat's principle.

As an afficionado of chaos, I must confess that I began my journey with junction 8, the "Gallery of Monsters," in which Stewart highlights some of the excitement and appeal of chaos theory and fractal geometry. He summarizes many of the paths that he explored in his previous best-seller *Does God Play Dice?*

For those who love mathematics, this book will justify your passion. For those who do not, it might lead to a paradigm transformation.—*Marilyn K. Simon, Walden University, Del Mar, CA 92014.*

The Mathematical Olympiad Handbook: An Introduction to Problem Solving, A. Gardiner, 1997. xii + 229 pp., $27.95 paper. ISBN 0-19-850105-6. Oxford University Press, 2001 Evans Rd., Cary, NC 27513, (800) 451-7556.

This valuable reference for mathematics teachers contains problems from the first thirty-two years of the British Mathematical Olympiad, 1965–1996. Although they do not depend on any particular prerequisite skills, the problems are intended for high school students. The book is clearly arranged, with a section on refresher mathematics, a section containing the problems, and a section on hints and solutions. The hints are distinguished from the solutions, so that the reader can read only the hint and continue solving the problem. The author recommends these challenging problems as practice for students who are preparing for competitions. Teachers could also use these problems in middle and high school courses to add rigor to the mathematics curriculum. The book contains a bibliography of other problem-solving books and a listing of the British team members who participated in the International Mathematical Olympiad.—*Leah McCoy, Wake Forest University, Winston-Salem, NC 27109.*

Mathematics Problems via Down-Under, Derek Holton, 1997. i + 101 pp., $14.70 paper. ISBN 0-9066588-39-1. The Mathematical Association, 259 London Rd., Leicester, LE2 3BE, UK, 0116-270-3877.

This book contains ten problem sets used between 1987 and 1996 in New Zealand to select students for an annual mathematics camp. The camp prepares teams of students for competition in the International Mathematical Olympiad. The chapters include the statements of the problems, hints, solutions, and extensions. Each set contains problems of varying difficulty. Problems are included from such areas as number theory, algebra, geometry, probability, and logic. The informal, conversational style of the hints and solutions encourages students to explore ideas and fosters insight into the problem-solving process. The author refers to various mathematical tools and theorems, for example, the principle of mathematical induction, Euler's theorem, and the pigeonhole principle; however, he urges students to use their own insight into possible solutions rather than rely heavily on well-established mathematical techniques, for example, "Only use calculus if you know it and are desperate." The "extension" sections allow students to explore ways of generating new problems from old ones.

This book should be a good resource for teachers who wish to challenge their students with problems that go beyond usual textbook exercises.—*Phil Buckhiester, North Georgia College and State University, Dahlonega, GA 30597.*

Over and Over Again, Gengzhe Chang and Thomas W. Sederberg, 1997. xiv + 309 pp., $31.50 paper. ISBN 0-88385-641-7. Mathematical Association of America, P.O. Box 91112, Washington, DC 20090-1112, (301) 617-7800.

This volume is about transformation and iteration, the application of a transformation "over and over again." The first nineteen chapters focus on iterations in the context of such topics as arithmetic and geometric means, isoperimetric questions, matrix manipulations, and Lagrange interpolation. The authors discuss transformations having a smoothing property and consider various measures of smoothness. For ordered n-tuples, $(a_1, a_2,..., a_n)$, for example, the difference $\max\{a_i\} - \min\{a_i\}$ can be such a measure, as can the number of sign changes in the sequence $\{a_i\}$. Equilateral triangles are regarded as the smoothest of all triangles; and circles, as the smoothest of all closed curves.

Later chapters deal with more advanced topics, especially dynamic systems and chaos, as well as Bézier curves and surfaces. The latter topics are important in computer-aided geometric design.

This well-written book investigates many interesting applications of iterations, including a number of problems drawn from various mathematical olympiads. Some chapters are quite accessible mathematically, whereas others require greater sophistication. An example of the few quirks is the reference to convex hulls in the isoperimetric problem in chapter 18, although a *convex hull* is defined in chapter 27. The book is a valuable supplement to other resources.—*Diane M. Spresser, James Madison University, Harrisonburg, VA 22807.*

The Prime Highway, Richard L. Francis, 1997. Gr. 10 and up. 110 pp., $10.95 spiral. ISBN 0-89278-001-0. Carolina Biological Supply Co., 2700 York Rd., Burlington, NC 27215, (800) 334-5551.

This book is a useful source of information in which the author has woven together information about well-known mathematicians, concepts, and terms as they relate to the topic of prime numbers. The author associates familiar highway sights with terms used in prime numbers. A few examples include stop signs, which represent prime numbers; towns, which are exact squares; bridges, which represent powers of 2; and railroad crossings, which represent prime numbers ending in 1. Triangular and perfect numbers and a number that is one more than a factorial are also represented by a road sign or border-crossing indicator. The author's technique should generate students' interest.

The beginning of each chapter briefly describes a mathematician who is known for work on prime numbers. The twin-prime problem, Mersenne and Fermat primes, and Pythagorean triples are used to illustrate prime numbers and the associated symbols along "The Prime Highway." At the end of each chapter is an activity to locate additional signs along the highway or expand on a topic. The last chapter presents a series of challenging problems using perfect numbers, rational and irrational numbers, factorials, and pi.

The last pages in the spiral-bound book contain an illustration of "The Prime Highway," additional prime-number applications, and a list of prime numbers less than 25 000.

The author uses a novel approach to a topic that otherwise might not intrigue many students. The presentation of the material is clear and accurate.

The author recommends the book for grades 10 and up. I believe that the book could be used

in earlier grades because many of the mathematical ideas have been compressed downward in the curriculum.—*Michael Ragon, Erasmus Hall High School of Science and Mathematics, Brooklyn, NY 11226.*

Techniques of Problem Solving, Steven G. Krantz, 1997. xiii + 465 pp., $29. American Mathematics Society, P.O. Box 6248, Providence, RI 02940-6248, (800) 321-4267.

Steven Krantz is a teacher, scholar, and artist. How else could he have written a book that not only introduces students to many of the great problems of mathematics but also informs them about the process of solving these problems? Although many books include collections of intriguing problems, *Techniques of Problem Solving* uses clear development and lucid explanations to guide students through the process of problem solving. The development is not, however, an artificial stepwise approach, any more than doing mathematics is a linear enterprise. The text gives compelling examples that capture students' interest and encourages them to work problems at the end of the chapter. Each of the eight chapters contains problems that cluster around a basic theme, such as counting techniques, geometry, logic, or algebra. However, the mathematics splashes from one chapter to another, blending ideas and approaches into a pleasing and honest mathematical framework. Although the book would be excellent for a senior-level capstone course in mathematics, it would also appeal to advanced lower-division or strong high school students as well.

The text includes solutions to the odd-numbered problems, and an instructor's manual with complete solutions is available. In summary, this superb book connects the worlds of great mathematical problems with effective classroom instruction.—*Martin Vern Bonsangue, California State University, Fullerton, CA 92834.*

Through Mathematical Eyes: Exploring Functional Relationships in Math and Science, Ron Richhart, ed., 1997. ix + 172 pp., $19.95. ISBN 0-425-07217-X. Heinemann, 361 Hanover St., Portsmouth, NH 03801-3912, (800) 541-2086.

This second volume of the Moving Middle Schools series is a wonderful collection of essays about the teaching and learning of functions written by participants in Performance Assessment Collaboratives in Education (PACE), a collaborative of urban educators. The project was centered in middle schools. The authors and participants were engaged in a two-year process to develop curricula and instructional strategies that created classrooms where growth toward high common standards and reflection was emphasized for both students and teachers. The participants designed and drafted curricula, took them to the students for active learning and portfolio feedback, revised the curricula, and taught them again. In this publication, these participants turn into authors and share their experiences.

The result is a captivating, easy-to-read set of essays that describe and reflect on the many experiences related to this project. Each essay describes one facet of the curricula developed to help students understand a crucial mathematical concept or functional relationships. The essays systematically take the reader through a significant change process that challenges the notions that "more steps is more math" or that adding the topics of budgets and area transforms arithmetic into middle school mathematics. Instead, they create a new image of mathematical learning, demonstrate what it looks like, and collaborate to seek contexts that build insight. This book describes a standards-oriented process of change.—*Rich Wyllie, Downers Grove, IL 60516.*

What Is Mathematics?: An Elementary Approach to Ideas and Methods, 2nd ed., Richard Courant, Herbert Robbins, and Ian Stewart, 1996. 566 pp., $18.95 paper. ISBN 0-19-510519-2. Oxford University Press, 2001 Evans Rd., Cary, NC 27513, (800) 451-7556.

This revised edition of the 1941 text remains a treasured gem that should be mined by mathematicians, teachers, students, and anyone interested in meaningful mathematics. The revision adds extensions and commentary to several of the chapters, including a chapter titled "Recent Developments." That chapter addresses such well-known topics as the Goldbach conjecture and twin primes, the four-color problem, and Fermat's last theorem. A nice touch is the inclusion of reference page numbers at the beginning of each topic in this chapter to enable the reader to return to the point where the topic was addressed earlier in the book.

Another wonderful quality of this book is that although it is written in a thoughtful and systematic order, the chapters are independent, so that readers may choose to read the sections in any order. Because each chapter begins with general information and gradually moves to more advanced mathematics and detailed discussions of the topic, readers can also choose the level of depth to pursue in a topic. I read this book from the beginning and found it difficult to put down, similar to the way some people read mystery novels, just waiting to see what comes next. The book begins with natural numbers and continues with rational numbers and the number system of mathematics. These topics are followed by chapters on geometry, topology, functions, limits, and calculus.

This edition has some minor typographical errors; the information is otherwise accurate and well thought out and presented.

Problem solving is interwoven throughout the book, which makes it relevant today even though it was originally written more than a half-century ago. The emphasis on understanding mathematics is admirable, something to which I believe that we are desperately trying to return. This book will help me in my own teaching of mathematics and in my quest to help students understand mathematics and find it meaningful. It will become an important reference on my bookshelf.—*Cynthia M. Barb, Kent State University—Stark Campus, Canton, OH 44720.*

Projects

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Linked Learning in Mathematics Project

A large urban district of Milwaukee Public Schools (MPS) has an algebra-for-all policy that currently affects all ninth graders and will affect all eighth graders beginning in the year 2000. The Linked Learning in Mathematics Project (LLMP) is a professional-development project designed to prepare teachers to implement algebra-for-all in MPS.

Funded by the National Science Foundation, LLMP is conducted jointly through Marquette University and Educational Development Center. All phases of LLMP are closely tied to the NSF-funded Milwaukee Urban Systemic Initiative, now in its second year. Fifty-five teachers and principals participated in the project during the 1997–1998 school year, the first year of funding; and another fifty teachers and principals will participate in the 1998–1999 school year, the final year of funding. Teachers participate in teams of two or more teachers from the same school; principals participate in the project in a limited capacity.

Each cohort of participants takes part in an eight-day summer institute. During the school year, participants are enrolled in a three-credit course entitled "Algebraic Thinking: Framework, Activities, and Implementation." The course emphasizes strategies for understanding student thinking in algebra and for helping students experience success in algebra-related mathematics. Although workshop and class