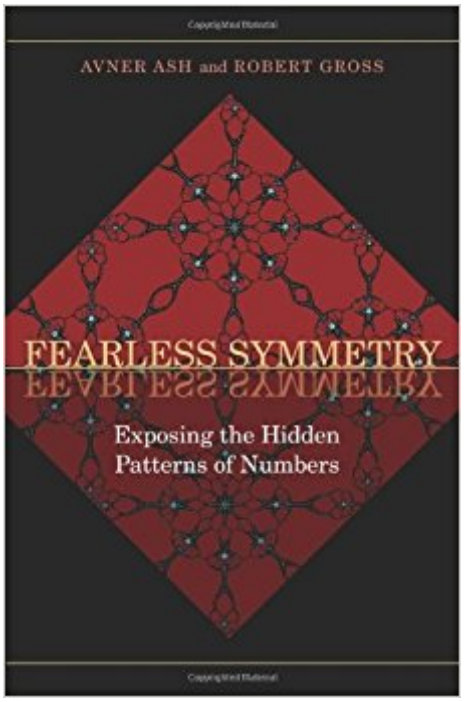
Fearless Symmetry: Exposing The Hidden Patterns Of Numbers



Synopsis

Mathematicians solve equations, or try to. But sometimes the solutions are not as interesting as the beautiful symmetric patterns that lead to them. Written in a friendly style for a general audience, Fearless Symmetry is the first popular math book to discuss these elegant and mysterious patterns and the ingenious techniques mathematicians use to uncover them. Hidden symmetries were first discovered nearly two hundred years ago by French mathematician ÃƒÂ©variste Galois. They have been used extensively in the oldest and largest branch of mathematics--number theory--for such diverse applications as acoustics, radar, and codes and ciphers. They have also been employed in the study of Fibonacci numbers and to attack well-known problems such as Fermat's Last Theorem, Pythagorean Triples, and the ever-elusive Riemann Hypothesis. Mathematicians are still devising techniques for teasing out these mysterious patterns, and their uses are limited only by the imagination. The first popular book to address representation theory and reciprocity laws, Fearless Symmetry focuses on how mathematicians solve equations and prove theorems. It discusses rules of math and why they are just as important as those in any games one might play. The book starts with basic properties of integers and permutations and reaches current research in number theory. Along the way, it takes delightful historical and philosophical digressions. Required reading for all math buffs, the book will appeal to anyone curious about popular mathematics and its myriad contributions to everyday life.

Book Information

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Customer Reviews

"The authors are to be admired for taking a very difficult topic and making it . . . more accessible than it was before."--Timothy Gowers, Nature"The authors . . . outline current research in mathematics and tell why it should hold interest even for people outside scientific and technological fields."--Science News"The book . . . does a remarkable job in making the work it describes accessible to an audience without technical training in mathematics, while at the same time remaining faithful to the richness and power of this work. I recommend it to mathematicians and nonmathematicians alike with any interest in this subject."--William M. McGovern, SIAM Review"Unique. . . . [T]his book is an amazing attempt to provide to a mathematically unsophisticated reader a realistic impression of the immense vitality of this area of mathematics."--Lindsay N. Childs, Mathematical Reviews"To borrow one of the authors' favorite words, this book is an amazing attempt to provide to a mathematically unsophisticated reader a realistic impression of the immense vitality of this area of mathematics. But I think the book has another useful role. With a very broad brush, it paints a beautiful picture of one of the main themes of the Langlands program."--Lindsay N. Childs, MathSciNet

"All too often, abstract mathematics, one of the most beautiful of human intellectual creations, is ground into the dry dust of drills and proofs. Useful, yes; exciting, no. Avner Ash and Robert Gross have done something different--by focusing on the ideas that modern mathematicians actually care about. Fearless Symmetry is a book about detecting hidden patterns, about finding definitions that clarify, about the study of numbers that has entranced some of our great thinkers for thousands of years. It is a book that takes on number theory in a way that a nonmathematician can follow-systematically but without a barrage of technicalities. Ash and Gross are two terrific guides who take the reader, scientist or layman, on a wonderful hike through concepts that matter, culminating in the extraordinary peaks that surround the irresistible, beckoning claim of Fermat's Last Theorem."--Peter Galison, Harvard University

This is a delightful book. It gives a general introduction to reciprocity and representations of the Galois group of Q. It covers quadratic reciprocity, unramified primes, and the Frobenius map on(a) p-th roots of unity,(b) p-torson points of elliptic curves,(c) solutions to x^2=W.In some cases, results are proven, and in other cases concrete examples are worked through to explain why the result is plausible. The book goes on to describe several concepts in very general terms without giving precise definitions (etale cohomology, p-adic expansions and modular forms) and concludes with an outline of the proof of Fermat's last theorem.The analogy is drawn with the "physicist trying to

explain string theory to the general public". It is not clear how successful this is. There is a lot of talk of "black boxes" and "patterns" which will not be to everyone's taste. It is also not clear what the intended readership is. A lot of very low level mathematics (like matrix multiplication) is slowly and carefully explained, but at the same time, the impression is that the reader would need a reasonable level of mathematical maturity to persevere to the end of the book.There is a very small number of typos; Robert Gross provides a list on his homepage. The book is supported by a reasonable index and bibliography; one surprising omission is Lemmermeyer's "Reciprocity laws, from Euler to Eisenstein".Overall, the book is an extremely well crafted, coherent and enjoyable read.

There are literally piles of books out there on this formidable but so awesome and relevant subject and this one, Fearless Symmetry by Ash and Gross in my opinion ranks high on that list. To help those interested in the subject to narrow down the number to the best among them I shall mention my favorites: Ian Stewart and Martin Golubitsky: Fearful Symmetry (outstanding); Marcus du Sautoy Symmetry: A Journey into the Patterns of Nature (among the best of the best!); Any books on the subject by the Hargittais, esp. Symmetry through the Eyes of a Chemist; John Conway's The Symmetry of Things (anyone in the field will recognize Conway's name); R. Mirman: Group Theory: An Intuitive Approach; Douglas Hofstadter's Godel, Escher, Bach: An Eternal Golden Braid also concerns the concept of mental representation (I have re-read this about 40 times ... only once in its entirety); and the book I carried with me throughout my collegiate days: Hermann Weyl's classic: Symmetry! It is always of some benefit to have some acquired background in matrix mathematics and number theory, esp. as concerns the Primes, and some knowledge of Kurt Godel's Incompleteness Theory. Algebra and Geometry, it goes without saying, if you want a working knowledge of the subject. Never the less, one can acquire an appreciation for Group Theory without all the baggage. The above mentioned books will equip you with a solid theoretical background and will convey the message of its vital significance to contemporary applications in, well, just about everything!

Unlike most math books, Fearless symmetry is well written. Key concepts from prior chapters are reemphasized in subsequent chapters so readers are less likely to get lost. This is the first book on groups and representation theory that made clear sense to me. I can see where galois therory is going and now have an understanding of the basic form of the proof of Fermat's last theorem.

I finally understand galois field by reading this book.

We may be entering a golden age of popularized mathematics literature. On the heels of John Derbyshire's recent superb book about Algebra, which alternates historical discussion with mathematical primers that illuminate rather than confuse, comes this excellent book that covers the fascinating topic of mathematical symmetry: especially Evariste Galois' final frenzied creation, Group Theory. From its birth to a productive maturity in Number Theory; where it has found extensive practical usage in acoustics, radar, codes and ciphers (and of course particle physics), Fearless Symmetry unfurls the threads of Galois Theory and follows their path through several branches of mathematics. It doesn't utilize Derbyshire's stark method of alternating chapters between history and mathematics. Rather, it enfolds the historical narrative into a clear presentation of the requisite mathematics.Simplified abstraction, is probably the best explanation of the author's technique. Group Theory discussion leads to Andrew Wiles and Fermat's Last Theorem, Fibonacci numbers, Pythagorean Triples and the Riemann Hypothesis. In the process, Fearless Symmetry becomes the first popularized exposition of representation theory and reciprocity laws. It also discusses how mathematicians prove theorems and solve problems. The all-important rules of mathematics are also discussed. This is a wide-ranging work that manages to avoid the obfuscation often found in math books. A willingness to solve problems that are simply and clearly posed are all that's required from the reader. The authors even suggest that readers disinclined to solve problems can skip them. That would be a severe loss given the nature of this book. In any case, the problems are not difficult, offer instantaneous feedback as to the reader's understanding of the material and are an extension of the text. Mathematicians may enjoy the book for its elegance in uniting so many disparate topics. As a non-mathematician (a molecular biologist by training), I can attest to the clarity of the discussion. I found the book fascinating, truly informative, endlessly challenging to my own assumptions of the way math is done. If you don't mind some mathematics on the printed page, this book may provide several hours of sheer intelligent pleasure. Strongly recommended.Mike Birman

Good source

a light approach to mathematical symmetry. presents the basics and builds a little at a time.

Numbers are fascinating. From primitive digits, counting and measure, set theory and the symmetries of group theory, they are presented as fascinating, interconnected, and interesting .

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