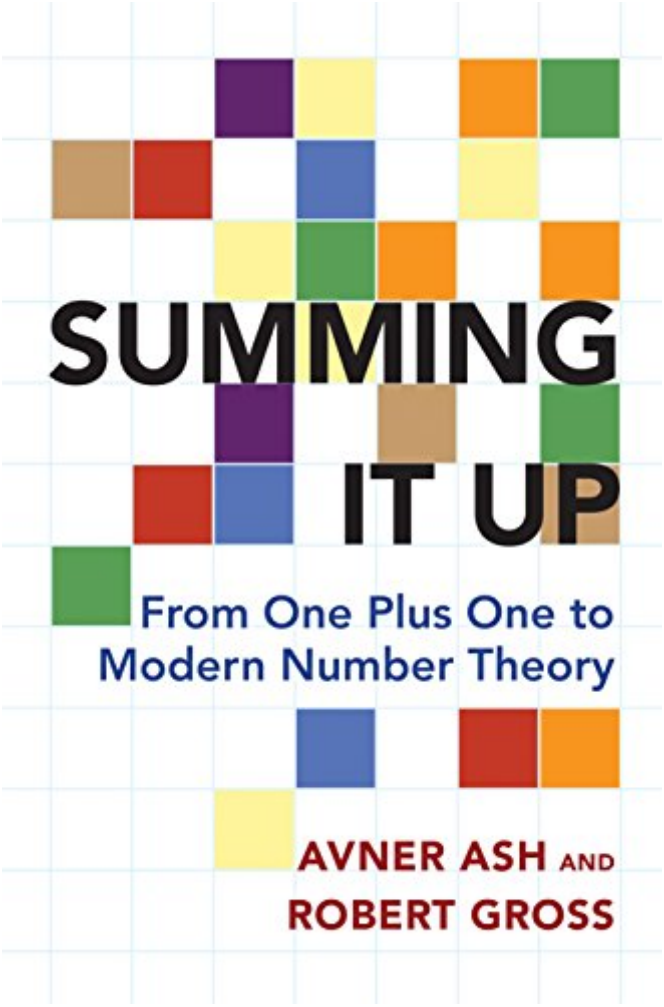
Summing It Up: From One Plus One To Modern Number Theory



Synopsis

We use addition on a daily basisâ ”yet how many of us stop to truly consider the enormous and remarkable ramifications of this mathematical activity? Summing It Up uses addition as a springboard to present a fascinating and accessible look at numbers and number theory, and how we apply beautiful numerical properties to answer math problems. Mathematicians Avner Ash and Robert Gross explore addition’s most basic characteristics as well as the addition of squares and other powers before moving onward to infinite series, modular forms, and issues at the forefront of current mathematical research. Ash and Gross tailor their succinct and engaging investigations for math enthusiasts of all backgrounds. Employing college algebra, the first part of the book examines such questions as, can all positive numbers be written as a sum of four perfect squares? The second section of the book incorporates calculus and examines infinite seriesâ ”long sums that can only be defined by the concept of limit, as in the example of 1+1/2+1/4+. . .=? With the help of some group theory and geometry, the third section ties together the first two parts of the book through a discussion of modular formsâ ”the analytic functions on the upper half-plane of the complex numbers that have growth and transformation properties. Ash and Gross show how modular forms are indispensable in modern number theory, for example in the proof of Fermat’s Last Theorem.Appropriate for numbers novices as well as college math majors, Summing It Up delves into mathematics that will enlighten anyone fascinated by numbers.

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Customer Reviews

I have the earlier two books by Ash and Gross. I particularly like "Elliptic Tales," and so was anticipating this introduction to modular forms. But this book doesn't quite work.The book is divided into three parts -- 1) finite sums, 2) infinite sums, and 3) modular forms. The recurring theme that binds together the three parts is expressing numbers as sums of squares and of calculating the number of ways this can be done. In this connection, Bernoulli numbers (and functions) allow the authors to segue from the first part to the second. The discussion of Bernoulli numbers, the Riemann zeta-function, and generating functions is woefully brief -- considering the conceptual leap required from the first part to the second and considering that the target readership is assumed to have no background in complex analysis. But this is a minor quibble.The third part attempts to introduce modular forms and in this connection discusses SL2(Z), fundamental domains, q-expansions, dimensions of vector spaces of modular forms, Hecke operators, and L-functions. The chapter on applications includes some desultory discussion of partitions that doesn't lead anywhere and a worked example for the number of ways 6 can be expressed as a sum of squares -- yet which doesn't really employ the topics mentioned above. It seems to be a mix of weak heuristic explanation coupled with one solitary example. If the target reader is a scientific layman, I doubt he'll be able to follow the discussion. If a math undergrad, the discussion won't be ample enough, nor will it be precise and structured enough.To be fair, the math is difficult. My contention is that anyone trying to make this palatable to a lay readership will fail.

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