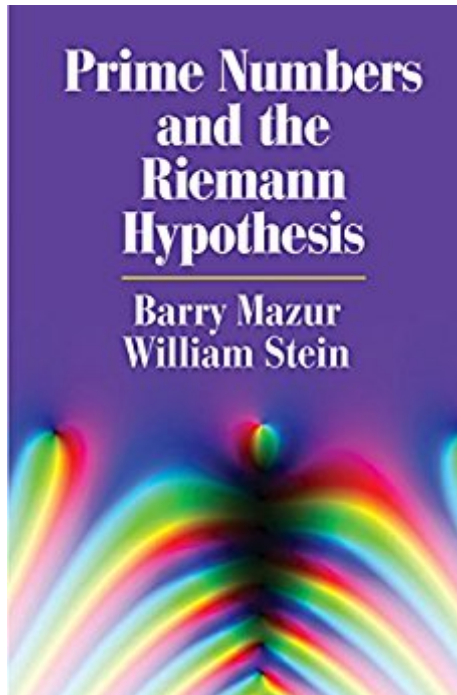


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Prime Numbers And The Riemann Hypothesis



Synopsis

Prime numbers are beautiful, mysterious, and beguiling mathematical objects. The mathematician Bernhard Riemann made a celebrated conjecture about primes in 1859, the so-called Riemann hypothesis, which remains one of the most important unsolved problems in mathematics. Through the deep insights of the authors, this book introduces primes and explains the Riemann hypothesis. Students with a minimal mathematical background and scholars alike will enjoy this comprehensive discussion of primes. The first part of the book will inspire the curiosity of a general reader with an accessible explanation of the key ideas. The exposition of these ideas is generously illuminated by computational graphics that exhibit the key concepts and phenomena in enticing detail. Readers with more mathematical experience will then go deeper into the structure of primes and see how the Riemann hypothesis relates to Fourier analysis using the vocabulary of spectra. Readers with a strong mathematical background will be able to connect these ideas to historical formulations of the Riemann hypothesis.

Book Information

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Customer Reviews

A couple of books on the Riemann hypothesis have appeared for the general public: Derbyshire 2003, Du Sautoy 2003, Sabbagh 2003, Rockmore 2005, Watkins 2015, van der Veen and van der Craats 2015 and now Mazur-Stein 2016. More for mathematicians are Koblitz 1977, Edwards 2001, and Stopple 2003. From general expositions, one should also mention the paper of Conrey of 2003 which won the Conant prize for expository writing as well as a nice paper of Bombieri of 1992. Is this too much for the subject? No. A problem like the Riemann hypothesis can never be written too much about, especially if texts are written by experts. It is the open problems which drive mathematics. The Riemann hypothesis is the most urgent of all the open problems in math and like a good wine, the problem has become more valuable over time. What helped also is that since the time of Riemann, more and more connections with other fields of mathematics have emerged. The book of Veen-Craats and Mazur-Stein have emerged about at the same time. They are both small and well structured. Veen-Craats has been field tested with high school students and has focus mostly on the gorgeous Mangoldt explicit formula for the Chebychev prime distribution function, sometimes called the "music of the primes". Mazur-Stein do it similarly, however stress more on the Riemann spectrum and go didactically rather gently into the mathematics of Fourier theory as well as the theory of distributions. The book is carefully typeset, has color prints and some computer code for Sage. While Veen-Craats has many nice exercises, an exercise of Mazur-Stein led me to abandon other things for a couple of weeks, since it was so captivating. So be careful! A student who has taken basic calculus courses, should be able to read it.

The good: Use of many of numerical calculations and graphs to illustrate the ideas. Down to earth explanation of otherwise advanced concepts from pure math, e.g.: i) distributions (things which have integrals but aren't really the derivatives of any function); ii) zeroes of the Riemann zeta function in the so-called critical strip and how they relate to primes; iii) fourier analysis. The book is unusual (and should be praised) for attempting to explain serious maths to a wide audience (though there are others, e.g. Ash/Gross, Penrose, and Susskind/Friedman/Hrabovsky). Also some of the calculations appear to be genuinely novel (e.g. see Mumford's blog on this). Moreover unlike with many other popular science books, the authors are experts in the topic they're writing about. Finally the book is short and approachable. The bad: The book needed an editor. (It's not reasonable to just leave this to the authors, and their colleagues who would not receive remuneration for doing so and are otherwise busy). The authors frequently use the phrases such as "if you wish", "if you like", "if it can be called that". This only detracts from the writing, often forcing a re-read of a sentence. I don't blame the authors for this, as we all write like that, but an editor would pick that up. Occasionally

verbs appear where they ought not, e.g. on page 6 line -2 we get "there are two ways to begin to do this" when in fact it ought to be "there are two ways to do this" (there was at least one other example, and I'm being lazy in not finding it again). On page 131 the equals sign appears 3 times too often on lines 8, 10 and 11.

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