# BOOKSHELF

*Princeton, 2019, 232 pages. Cover courtesy of Princeton University Press.*
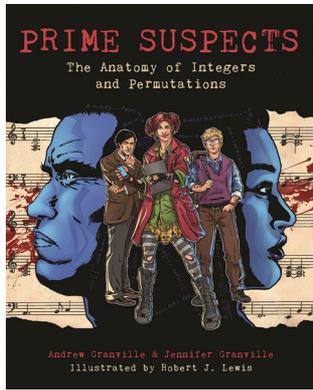
### Prime Suspects
*The Anatomy of Integers and Permutations*
By Andrew Granville and Jennifer Granville
Illustrated by Robert J. Lewis

This sharp and beautifully illustrated graphic novel presents surprisingly deep mathematics in the guise of a forensic investigation of two seemingly unrelated murders. The primary discovery unearthed by the investigators involves the striking similarities between the statistical properties of integer factorizations and the decompositions of permutations into disjoint cycles. Toward the end, the irreducible factors of polynomials over finite fields are also touched upon. The characters are all named after well-known mathematicians; for example the leads are Professor Gauss, Detective von Neumann, and graduate student Emmy Germain. *Prime Suspects* ends with a more traditional exposition of the fundamental mathematical ideas behind the graphic-novel portion of the book, along with a clever musical piece that appears as a clue in the graphic novel, and a list of the many subtle references to mathematicians that occur throughout the book.
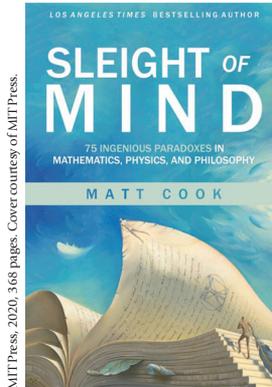
The ideal reader is probably someone who has some experience with the analytic side of number theory, although most mathematicians will find much to appreciate. As a necessity of the medium, the mathematics is treated in a somewhat vague fashion, although snippets of research papers and blackboards visible in the background contain the genuine article. Readers with sufficient background in analytic number theory might enjoy puzzling out the mathematical references and jokes that are hidden in the "easter eggs" that appear on almost every page. For example, a fancy car bears the license plate "−163," a reference to the fact that 163 is the largest square-free $d$ such that the

imaginary quadratic field $\mathbb{Q}(\sqrt{-d})$ has class number one. As another example, a graffito in a sewer declares "EGA Rules," a sly reference to Grothendieck and Dieudonné's revered *Éléments de géométrie algébrique*.



*MIT Press, 2020, 368 pages. Cover courtesy of MIT Press.*

### Sleight of Mind
*75 Ingenious Paradoxes in Mathematics, Physics, and Philosophy*
By Matt Cook

*Sleight of Mind* presents and discusses a wide range of paradoxes in mathematics and physics (although the title mentions "philosophy," one might characterize the philosophical paradoxes as within the field of logic).

The initial thirteen chapters of *Sleight of Mind* are essentially independent of one another and concern topics such as the nature of infinity, Zeno's paradoxes, probability, self-reference, and classical physics (several collaborators are credited with coauthoring the later chapters on physics). A final chapter entitled "Invented or Discovered?" consists of an essay and poem contributed by Grant Sanderson of 3blue1brown fame.

Each chapter begins with a brief overview of a general area along with discussions of related paradoxes. Each paradox is presented with a thorough exposition and several mutually contradictory claims that could plausibly follow (of which the final claim is usually the correct choice). A resolution of the paradox follows with a generous discussion, often aided by black-and-white images. The book discusses seventy-five paradoxes in total and spans over three hundred fifty pages, so each paradox is given its due. Some discussions are longer than others, but most are substantial and have much to offer the studious reader.

*Sleight of Mind* is suitable for a wide range of readers, from mathematically intrepid high school students to professional mathematicians. A small amount of calculus is needed for some of the paradoxes (infinite series, for example, arise in the discussion of Zeno's paradoxes). All of the paradoxes, however, are presented in a clear and thorough manner and the accompanying discussions are frequently enlightening, even for those already familiar with the general ideas.

*The Bookshelf is prepared monthly by* Notices *Associate Editor Stephan Ramon Garcia.*

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