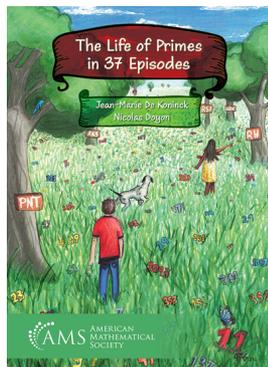


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The Life of Primes in 37 Episodes

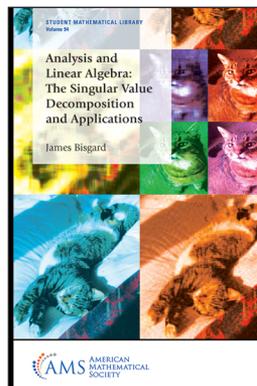
by Jean-Marie De Koninck
and Nicolas Doyon

This is a thoroughly charming, and wonderfully engaging, encounter with the prime numbers and (mostly) analytic number theory. The authors organize their 37 brief chapters roughly around five themes: counting the primes culminating in a proof of the prime number theorem; regularities and

irregularities in the distribution of the primes; primality testing; factoring algorithms; and what we might learn in the near future. The organization is also approximately chronological so the sophistication of the ideas and techniques slowly increases. The actual Episode topics range from the very well known—Fermat numbers and constructability, the zeta function, Dirichlet's theorem—to the more esoteric—sieve methods, gaps between primes, elliptic curve methods of factoring.

The book is not a textbook on analytic number theory; it is more of a brief introduction to some of the field's highlights and techniques. In most cases results are not proved in full detail, but the main ideas of the proofs are described, illustrative examples are provided, and references are given for the diligent reader to follow up. To give you some ideas of the level of detail: Kraitchik's algorithm is explained in two and one-half pages; the result that the sum of the reciprocals of twin primes converges (a very cool fact) is proven in three. An undergraduate, or beginning graduate student, with just a single introductory number theory course under their belt could get a very good big-picture view of the number-theoretic landscape by working through this book. Anyone teaching a course in number theory would discover lots of lovely material and examples to enrich their lectures.

The AMS Bookshelf is prepared bimonthly by AMS Acquisitions Specialist for MAA Press titles Stephen Kennedy. His email address is skennedy@amsbooks.org.



Analysis and Linear Algebra: The Singular Value Decomposition and Applications

by James Bisgard

We probably don't teach enough linear algebra to undergraduates. There is so much beautiful mathematics and so many rich applications that it is unfortunate most undergraduates see only one semester's worth. It is arguably especially unfortunate that in that one semester it's pretty much im-

possible to get to the SVD. *Analysis and Linear Algebra: The Singular Value Decomposition and Applications* provides an opportunity to remedy this gap. Bisgard poses four interesting problems in the first chapter which the SVD can be deployed to solve: determine the best approximating subspace to a given collection of points in \mathbb{R}^n ; find low-rank approximating matrices to help with image compression; find the Moore-Penrose generalized inverse; and find the orthogonal transformation that transforms a given configuration of points as closely as possible to a reference configuration.

The author provides all the necessary background in order to rigorously construct the SVD and ultimately prove that it can be used to solve his four sample problems. Because we are approximating and minimizing distances, it becomes necessary to invoke techniques from analysis. This leads to a very rich intermingling of linear algebra and analysis. The emphasis is on existence and proof. The deep and interesting computational questions associated with efficiently finding an SVD are left to the side. Instead the author proves that it exists and that it solves some very interesting and useful problems. The reader is assumed to have experienced both a first course in linear algebra and in basic real analysis. For a reader with that background, a course out of this book would provide a compelling and deep answer to the question of what linear algebra can be used for.