

ZMATH 2012b.00751**Tapp, Kristopher****Symmetry. A mathematical exploration.**

Berlin: Springer (ISBN 978-1-4614-0298-5/hbk; 978-1-4614-0299-2/ebook). xiv, 215 p. (2012).

The author starts with a very concrete introduction to symmetry in the plane, using rigid motions for a definition. In Chapters 12 and 13 he ends with a description of symmetry using linear mappings and matrices. To be able to do so the reader is introduced to the Euclidean space which in turn needs (real) numbers (Chapter 10) and infinity (Chapter 11, including Cantor's Theorem). Along the way there is a "problem oriented" introduction to (symmetry) groups (Chapter 2), isomorphisms (Chapter 3), subgroups and product groups (Chapter 5), and permutations (Chapter 6). Before that, in Chapter 4, border and wall patterns are described and classified. After that the author proceeds to symmetry in the 3-dimensional space – the symmetry of solid objects (Chapter 7), which in Chapter 8 leads to the platonic solids. They are discussed quite into detail, also using graphs, and going up to the Euler characteristic. The volley ball, the HIV virus and the soccer ball (in a later exercise) are also discussed. Chapter 9 (Symmetry and Optimization) contains another application of the type: The sphere is the least-surface-area way to enclose a given volume. Here some experiments with soap solution help to find minimal area surfaces, which automatically turn out to be "symmetric". Each chapter contains exercises of different levels, many of them will be fun to do. A large typesetting and the use of colours makes reading pleasant. And by the way, the "reader" and the "reviewer" is female in this book, which despite all the respective discussion is still surprising for the male reader. The book can serve very well as an introduction to algebraic combinatorics for math students and also for many interested students of other fields, specially Computer Science and natural sciences. An instructor resource page with power point lectures is available. I think, the blurb of the book (see below) is quite realistic: Publisher's description: "This textbook is perfect for a math course for non-math majors, with the goal of encouraging effective analytical thinking and exposing students to elegant mathematical ideas. It includes many topics commonly found in sampler courses, like Platonic solids, Euler's formula, irrational numbers, countable sets, permutations, and a proof of the Pythagorean Theorem. All of these topics serve a single compelling goal: understanding the mathematical patterns underlying the symmetry that we observe in the physical world around us. The exposition is engaging, precise and rigorous. The theorems are visually motivated with intuitive proofs appropriate for the intended audience. Students from all majors will enjoy the many beautiful topics herein, and will come to better appreciate the powerful cumulative nature of mathematics as these topics are woven together into a single fascinating story about the ways in which objects can be symmetric."

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