CMS NOTES

Math and Art: An Introduction to Visual Mathematics

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Book Reviews bring interesting mathematical sciences and education publications drawn from across the entire spectrum of mathematics to the attention of the CMS readership. Comments, suggestions, and submissions are welcome.

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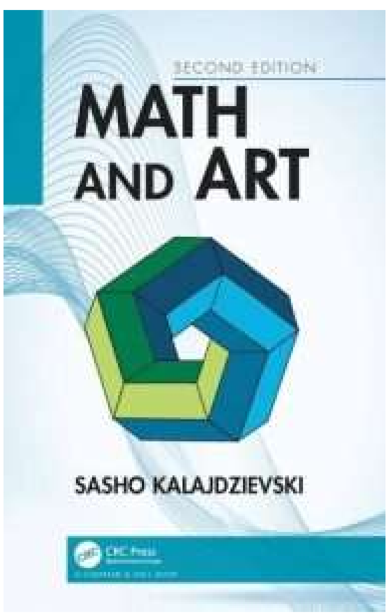

by Sasho Kalajdzievski
CRC Press, 2022
ISBN: 978-0367076115
Reviewed by Robert Dawson

This book presents various topics in mathematics visually, with copious illustrations. The topics are, not unreasonably, almost all drawn from geometry or neighboring areas. The table of contents includes “Euclidean Geometry”, “Plane Transformations”, “Similarities, Fractals, and Cellular Automata,” “Hyperbolic Geometry,” “Perspective,” “Some Three-Dimensional Objects,” and “Topology.” The reader should have some exposure to linear algebra (or be prepared to learn it rather fast!) and complex numbers (ditto.) The level of algebra assumed is low enough that while the classical “impossible constructions” of the squared circle, duplicated cube, and trisected angle are mentioned (in section 1.2) the author merely assures the reader that they have been proved to be impossible and moves on.

The level of the book, then, is about right for a liberal-arts math course. The author, in the introduction, suggests its use as “an unorthodox geometry textbook,” and indeed has based it on the content of a course of this type, entitled “Math in Art”, taught at the University of Manitoba.

What are its strengths? The section on plane transformations is well written, given the constraint of working without any formal group theory. The third chapter, on “similarities, fractals, and cellular automata” feels a little stuck-together. The segue from fractals to cellular automata is managed by way of the Sierpinski triangle, which arises in both contexts: but truly the two have little in common. Unfortunately, neither chapter contains a great deal about art.

The fifth chapter, on perspective, is where the book comes closest to living up to its title. The subject matter applied directly to art, and the illustrations are interesting, including pre-perspective medieval works, sketches by Dürer and da Vinci, perspective illusions by Escher and de May, a piece of Op art by Riley, and one of Termes' six-vanishing-point spheres.

I found the section on hyperbolic geometry interesting but weaker. It's a difficult topic, and the author is to be commended for attempting to include it at all. It begins with inversive geometry, and various illustrations of mirror balls (including Escher's classic *Hand with Reflecting Sphere.*) Section 4.4 involves Euclidean constructions of hyperbolic objects in the Poincaré model: while this is a valid drafting exercise, it's a weird hybrid mathematically. The chapter ends, predictably, with hyperbolic disc tilings by Escher, Leys, and others.

Artistically, the section on three-dimensional objects is perhaps the most successful. While it has less mathematical content than most other chapters, it contains many examples of mathematical sculptures, both real and virtual. Here the connection between the math and the art feels most natural. Works like this are easier to construct than the reader might think: it is a pity that the book does not contain a little about software such as POV-Ray (www.povray.org) that would empower the reader to explore. Even 3D printing is becoming more accessible these days.

As a textbook, I feel this book would succeed only if the course were very much built around it: as the author hints, it would not fit a traditional undergraduate geometry course. It might be a useful resource for high school art teachers, provided they are not afraid of algebra, though I think for this purpose Fathauer's *Tesselations: Mathematics, Art, and Recreation* (CRC, 2021; reviewed here Sept. 2021) might be a better choice. The professional mathematician, or upper-level math undergraduate, will not find a great deal new, but will enjoy some of the illustrations. The interested layperson should find it challenging and interesting.