

# SHORT GUIDE TO THE BOOK

## What is This Book About?

This book is devoted to timeless bonds between art and mathematics, which are illustrated by artworks from the collection of the Marianna Kistler Beach Museum of Art. The museum is located on the campus of Kansas State University, in the small and lovely town of Manhattan, Kansas. Each chapter of the book starts with a study of an art object from the collection. The emphasis is placed on a pattern structure, symmetry, some mathematically inspired content, or a mathematically motivated technical solution in the production of the object. The discussion contains facts, proofs, problems, solutions, as well as math-related educational art projects.

## Where to See the Art Objects Discussed in the Book?

The reader should not be concerned if he or she never had a chance to visit Manhattan, Kansas: all artworks mentioned in this book from the Marianna Kistler Beach Museum of Art are displayed online in the digital collection of the museum:

**[www.beach.k-state.edu/explore/collection/](http://www.beach.k-state.edu/explore/collection/)**

Moreover, masterpieces discussed in the book are very far from being the only examples of art carrying mathematical features. It is quite possible that the reader's local art museum holds similar examples in its collection; for example, linear perspective and symmetry patterns can be seen in almost any art museum. And moreover, for the reader's convenience, some renown examples *from the collections of the most prominent museums of the world* are listed in almost every chapter. Their reproductions are widely distributed in printed catalogues and online.

## Audience

The book is addressed to readership in a broad spectrum of ages and professional interests. We hope that a person interested in relations between art and mathematics will find something curious, new and challenging in the book. Discussions are enhanced with numerous entertain-

ing illustrations. Not all, but certainly many parts of the book can be comprehended by young readers on their own.

One of our goals was to make the book useful to readers who may want to use it to teach other people about art and mathematics. Thus, the specific format of the book was dictated by possible needs of these particular readers: parents, art teachers, math teachers, math circle instructors ... Moreover, materials presented here originate from real math and art workshops. They took place in the framework of a math enrichment program at Kansas State University (for more details see Section 1.4).

### Navigation

Each chapter can be read independently. Most chapters are structured as follows.

- An art object from the Marianna Kistler Beach Museum of Art with a connection to a particular topic in mathematics is introduced.
- A short discussion of the properties of the selected art object is followed by a review of related topics in mathematics.
- Creative projects and problems of different levels of difficulty complement the review. Answers and solutions are provided at the end of the chapter.
- Whenever it is possible, we share information about the artist that created the selected artwork.
- Most chapters contain lists of additional examples of artworks related to the mathematical topic of the chapter. These famous artworks belong to collections of world renown museums. Their reproductions can be found online and in art catalogues.

Problems in the book vary in their levels of difficulty, and for the reader's convenience we mark the levels with symbols:

- ✦ labels easy short questions,
- ✧ is for intermediate level problems, and
- ✨ marks problems of the most challenging level in this book.

Note that many easy short questions can be used as well as a warm-up at lessons for advanced students.

## Acknowledgments

This project was accomplished with assistance of many professionals.

Of course, this book would not be possible without valuable contributions from the staff of the Marianna Kistler Beach Museum of Art.

I would like to thank the Registrar and Collections Manager Sarah Price, the Assistant Registrar Theresa Marie Ketterer, the Curator Elizabeth Seaton.

My special thanks are due to the Director Linda Duke for the indispensable support during the preparation of the manuscript and the Senior Education Specialist Kathrine Shlageck for many years of fruitful collaboration on math and art workshops for our math circle program.

I would like to thank the copyright holders of the images used in the book for their kind permission of reproduction.

I would like to express my gratitude for professional consultations of Dr. Lado Samushia (Department of Physics at Kansas State University), the Curator of Archives and Librarian Linda Glasgow (Riley County Historical Society and Museum Research Library and Archives), Dr. Nadia Sidorova (Department of Mathematics at University College London).

Valuable comments by my husband Dr. Ilia Zharkov (Department of Mathematics at Kansas State University) and my son Styopa Zharkov brought a fresh angle on some mathematical interpretations discussed in the book.

While working on the biographies of the artists, I spent many hours absorbed in the treasures of the University Archives and Manuscripts in the Department of Special Collections of Kansas State University. I would like to recognize the highly professional and friendly help of the staff of the Archives.

I am very grateful to my esteemed colleague, the determined editor Professor Robert Burckel for the time and effort he spent on improving the manuscript.

The whole project originates in the sessions of Math Circle Seminar at Kansas State University. Many years of shining curiosity and outstanding thirst for knowledge of the participants inspire me and my colleagues to teach mathematics to younger generations. I would like to thank all the students of Math Circle Seminar and their parents for the enjoyable long-lasting experience of communicating math and its applications.

This book is my second collaborative project with my mother, Tamara Rozhkovskaya. The first book, entitled *Math Circles for Elementary School Students*<sup>1</sup> turned out to be a very successful title, very well accepted by both Russian- and English-speaking readers.

As with the first book, it is not possible to express the full extent of my gratitude to my mother for her dedication, encouragement, time and efforts that she put in this project. Through many hours of polishing and perfecting, she brought the project from the state of a draft to a real book. I am very grateful to her for this magic. And another magic happened here: we live very far from each other in opposite parts of the planet, but this collaboration miraculously shortened the distances that separate us. Just for this wonderful reason it would be worth writing a book like this.

*Natasha Rozhkovskaya*

Manhattan KS, USA

May 8, 2016

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<sup>1</sup>Natasha Rozhkovskaya, *Math Circles for Elementary School Students* [in Russian], Tamara Rozhkovskaya Publisher, Novosibirsk (2011); English transl.: MSRI & Am. Math. Soc., Providence, RI (2014).