

Preface

Of all of our inventions for mass communication, pictures still speak the most universally understood language.

Walt Disney

An *icon* (from the Greek *εἰκῶν*, “image”) is defined as “a picture that is universally recognized to be representative of something.” The world is full of distinctive icons. Flags and shields represent countries, graphic designs represent commercial enterprises; paintings, photographs and even people themselves may evoke concepts, beliefs and epochs. Computer icons are essential tools for working with a great variety of electronic devices.

What are the icons of mathematics? Numerals? Symbols? Equations? After many years working with visual proofs (also called “proofs without words”), we believe that certain geometric diagrams play a crucial role in visualizing mathematical proofs. In this book we present twenty of them, which we call icons of mathematics, and explore the mathematics that lies within and that can be created. All of our icons are two-dimensional; three-dimensional icons will appear in a subsequent work.

Some of the icons have a long history both inside and outside of mathematics (yin and yang, star polygons, the Venn diagram, etc.). But most of them are essential geometrical figures that enable us to explore an extraordinary range of mathematical results (the bride’s chair, the semicircle, the rectangular hyperbola, etc.).

Icons of Mathematics is organized as follows. After the Preface we present a table with our twenty key icons. We then devote a chapter to each, illustrating its presence in real life, its primary mathematical characteristics and how it plays a central role in visual proofs of a wide range of mathematical facts. Among these are classical results from plane geometry, properties of the integers, means and inequalities, trigonometric identities, theorems from calculus, and puzzles from recreational mathematics. As the American

actor Robert Stack once said (speaking of icons of a different sort), “these are icons to be treasured.”

Each chapter concludes with a selection of Challenges for the reader to explore further properties and applications of the icon. After the chapters we give solutions to all the Challenges in the book. We hope that many readers will find solutions that are superior to ours. *Icons of Mathematics* concludes with references and a complete index.

As with our previous books with the MAA, we hope that both secondary school and college and university teachers may wish to use portions of it as a supplement in problem solving sessions, as enrichment material in a course on proofs and mathematical reasoning, or in a mathematics course for liberal arts students.

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