Introduction

This book is about the art and craft of teaching a mathematical circle. It contains a collection of math circle materials and the know-how that has been accumulated during many years of teaching extracurricular mathematics to middle-school students.

The book has four parts. The first part, which contains a full-year curriculum for a middle-school mathematical circle, is composed of 29 lessons. A typical lesson includes a detailed discussion of some mathematical topic and a set of problems to work on. Some lessons are organized as math games, tournaments, and Olympiads.

The second part of the book is devoted to math entertainment: it describes contests and games that can be used to make your mathematical circle more dynamic.

The third part discusses the principles of teaching in a mathematical circle.

The last part contains hints, answers, and solutions.

Finally, the appendix contains a blank table for converting decimal to binary. This goes along with Session 6.

The format of the book is somewhat unusual. Some of the lessons are presented as transcripts of actual sessions that include students’ questions, teachers’ comments and observations, and so on. In my opinion, this format would help the reader appreciate the fun and joy of a math circle lesson.

Lessons and Problem Sets

Every lesson in the book is accompanied by a collection of problems and exercises.

The main problem set, which contains between five and eight problems, could be offered to the students after the lecture. The majority of the problems in a set are related to the topic of the lecture. Others could review previous material or simply provide an entertaining diversion. The problems in a set vary in difficulty: the most difficult ones are marked with an asterisk or are separated from the main set by a divider (a horizontal line).
Additionally, some lessons come with sets of exercises that give students extra practice in the core problem-solving techniques presented in class. Typical examples of such topics are divisibility, remainders, combinatorics, and graph theory.

Finally, some of the lessons include additional problems, which can be used for practice, for Olympiads, etc.

Easy-to-print problem sets can be found on the website that accompanies the book: www.ams.org/bookpages/mcl-20.

Each lesson in this book is intended to be presented during an hour-and-a-half or a two-hour class. (This time includes lecture, time for independent problem solving, and discussion of the solutions to homework problems.)

However, all students are different: for more advanced groups, you may do with a shorter lesson. For a group of younger students, you may need to present a single lesson over the course of two lectures or skip some of the more advanced material.