

Preface

Mathematical Olympiads have a tradition longer than one hundred years. The first mathematical competitions were organized in Eastern Europe (Hungary and Romania) by the end of the 19th century. In 1959 the first International Mathematical Olympiad was held in Romania. Seven countries, with a total of 52 students, attended that contest. In 2010, the IMO was held in Kazakhstan. The number of participating countries was 97, and the number of students 517.

Obviously, the number of young students interested in mathematics and mathematical competitions is nowadays greater than ever. It is sufficient to visit some mathematical forums on the net to see that there are tens of thousands registered users and millions of posts.

When we were thinking about writing this book, we asked ourselves to whom it will be addressed. Should it be the beginner student, who is making the first steps in discovering the beauty of mathematical problems, or, maybe, the more advanced reader, already trained in competitions. Or, why not, the teacher who wants to use a good set of problems in helping his/her students prepare for mathematical contests.

We have decided to take the hard way and have in mind all these potential readers. Thus, we have selected Olympiad problems of various levels of difficulty. Some are rather easy, but definitely not exercises; some are quite difficult, being a challenge even for Olympiad experts.

Most of the problems come from various mathematical competitions (the International Mathematical Olympiad, The Tournament of the Towns, national Olympiads, regional Olympiads). Some problems were created by the authors and some are folklore.

The problems are grouped in three chapters: Algebra, Geometry and Trigonometry, and Number Theory and Combinatorics. This is the way problems are classified at the International Mathematical Olympiad.

In each chapter, the problems are clustered by topic into self-contained sections. Each section begins with elementary facts, followed by a number of carefully selected problems and an extensive discussion of their solutions. At the end of each section the reader will find a number of proposed problems, whose complete solutions are presented in the second part of the book.

We encourage the beginning reader to carefully examine the problems solved at the beginning of each section and try to solve the proposed problems before examining the solutions provided at the end of the book. As for the advanced reader, our advice is to try finding alternative solutions and generalizations of the proposed problems.

In the second edition of the book, we added two new sections in Chaps. 1 and 3, and more than 60 new problems with complete solutions.

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