

Preface

Although mathematical olympiad competitions are carried out by solving problems, the system of Mathematical Olympiads and the related training courses cannot involve only the techniques of solving mathematical problems. Strictly speaking, it is a system of mathematical advancing education. To guide students who are interested in mathematics and have the potential to enter the world of Olympiad mathematics, so that their mathematical ability can be promoted efficiently and comprehensively, it is important to improve their mathematical thinking and technical ability in solving mathematical problems.

An excellent student should be able to think flexibly and rigorously. Here the ability to do formal logic reasoning is an important basic component. However, it is not the main one. Mathematical thinking also includes other key aspects, like starting from intuition and entering the essence of the subject, through prediction, induction, imagination, construction, design and their creative abilities. Moreover, the ability to convert concrete to the abstract and vice versa is necessary.

Technical ability in solving mathematical problems does not only involve producing accurate and skilled computations and proofs, the standard methods available, but also the more unconventional, creative techniques.

It is clear that the usual syllabus in mathematical educations cannot satisfy the above requirements, hence the mathematical olympiad training books must be self-contained basically.

The book is based on the lecture notes used by the editor in the last 15 years for Olympiad training courses in several schools in Singapore, like Victoria Junior College, Hwa Chong Institution, Nanyang Girls High School and Dunman High School. Its scope and depth significantly exceeds that of the usual syllabus, and introduces many concepts and methods of modern mathematics.

The core of each lecture are the concepts, theories and methods of solving mathematical problems. Examples are then used to explain and enrich the lectures, and indicate their applications. And from that, a number of questions are included for the reader to try. Detailed solutions are provided in the book.

The examples given are not very complicated so that the readers can understand them more easily. However, the practice questions include many from actual

competitions which students can use to test themselves. These are taken from a range of countries, e.g. China, Russia, the USA and Singapore. In particular, there are many questions from China for those who wish to better understand mathematical Olympiads there. The questions are divided into two parts. Those in Part A are for students to practise, while those in Part B test students' ability to apply their knowledge in solving real competition questions.

Each volume can be used for training courses of several weeks with a few hours per week. The test questions are not considered part of the lectures, since students can complete them on their own.

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