

Preface

The role and usefulness of competitions in mathematics instruction has been debated for decades. If memory holds, I attended a deep and entertaining debate on this topic between a distinguished mathematician Peter John Hilton and a renowned math educator Gilah C. Leder at ICME-6, held in 1988 in Budapest. As this volume demonstrates, competitions problems can be used to enrich classroom instruction, to offer our students an exciting pastime, to raise interest in mathematics, and to enable students to commence their mathematical research. If not for Moscow State University Olympiads and a mathematical circle conducted by Nikolai Konstantinov (one of the authors in this volume!), I would have become a classical pianist and composer and not a mathematician. (By no means am I suggesting here that mathematics is better than music—they both belong to the Pantheon of the Arts.)

I am duty bound to add one warning. If a student does consistently well in mathematical Olympiads, s(he) clearly has a talent, and with a good measure of interest and hard work will go far. However, no discouraging conclusion could be made about a student, who has not sparkled in the Olympiads. Young people develop at diverse speeds. Moreover, mathematics competitions inevitably have an element of sports, the necessity to perform under pressure and within a limited time. High speed of thinking is attractive, but it is not an essential property for a future successful researcher.

This book includes plenary talks and some of the best presentations made in the Topic Study Group 30: Mathematics Competitions of the International Congress on Mathematical Education (ICME-13) in Hamburg, and some of the best presentations from related groups, dedicated to work with gifted students and mathematical enrichment. Each of the chapters, on request of this editor, includes not only original ideas of pedagogy and state-of-the-art methods of mathematical instruction, but also original problems and their

beautiful solutions. I believe that this volume will be a valuable addition to the mathematics literature for secondary teachers and university professors around the world, and their gifted students of all levels, from secondary to graduate students, seeking problems to start their research careers.

The authors of this book comprise a group that impresses me enormously. It includes seven laureates of the Paul Erdős Award and one of the David Hilbert Award presented by the World Federation of National Mathematics Competitions (WFNMC); three past or present Presidents of WFNMC; five past or present WFNMC's Vice Presidents; three WFNMC's Secretaries; laureates of numerous other awards, leaders of and contributors to ICMI studies; authors of many books and countless articles, organizers of the International Mathematical Olympiad (IMO). In fact, in 1994 and 2016, K. P. Shum was the Organizer of two IMO's held in Hong Kong; while in 2013 Maria Falk de Losada served as the President of the International Jury at the Colombian IMO. The authors include many leaders and deputy leaders of national teams IMO teams, coordinators of IMO, organizers of numerous national and international competitions, conferences and congresses, etc.

Each of the 14 chapters addresses many issues and contributes to a multitude of directions, which makes a partition of the material into parts nearly impossible. I attempted to identify the main direction of each chapter and thus help the reader by partitioning the book into seven parts. As you can see, Francisco Bellot-Rosado (Spain) and Kar-Ping Shum (P.R. China) present problems of geometry; Kiril Bankov (Bulgaria), and Luis F. Cáceres-Duque, Jose H. Nieto-Said, and Rafael Sánchez-Lamonedá (Puerto Rico) share combinatorial problems. Role of competitions for a classroom is described by Robert Geretschläger (Austria); Ingrid Semanišinová, Matúš Harminc, and Martina Jesenská (Slovakia); and Iliana Tsvetkova (Bulgaria). Nikolai Konstantinov and Sergei Dorichenko (Russia), describe their famous International Mathematical Tournament of Towns; V.M. Sholapurkar (India) presents a relatively recent competition for college students. Romas Kasuba (Lithuania) shares his lifetime experiences with competitions; while Peter Taylor (Australia) classifies problems of mathematics competitions. Maria Falk De Losada (Colombia) collects valuable observations of the influence of mathematics competitions on their contestants, destined to become world's leading mathematical researchers. Alexander Soifer (USA) opens the book with his view of goals and means of mathematics instruction and closes the book with examples of bridges between problems of mathematical Olympiads and research problems of 'real' mathematics.

It was a delight to organize and run the Topic Study Group jointly with Maria Falk de Losada, thank you, Maria! My gratitude goes to my referees, encompassing four continents, who helped the authors to improve their

chapters in a significant way. I thank all the officials and volunteers of ICME-13 in Hamburg, who allowed us all a pleasure of sharing knowledge and experiences during this Olympics-like forum of nearly 4,000 professionals from 109 countries. My special thanks go to the Convenor and the Chair of the International Program Committee of the ICME-13 Prof. Dr. Gabriele Kaiser for creating the Congress and arranging this splendid opportunity for my group of 18 authors from five continents to unite in a truly Olympic spirit and produce this volume, and to Springer for making it possible for us to preserve the wonderful memories of the Hamburg Congress in the form of this book.

On behalf of all the authors of this book, I wish you, our reader, to get much pleasure of mathematical kind from this book and many other books written by these 18 authors.

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Perspectives from Five Continents

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