BOOK REVIEWS

Robert Bilinski

Mathematics: Problem-Solving Challenges for Secondary School Students and Beyond by D. Linker and A. Sultan
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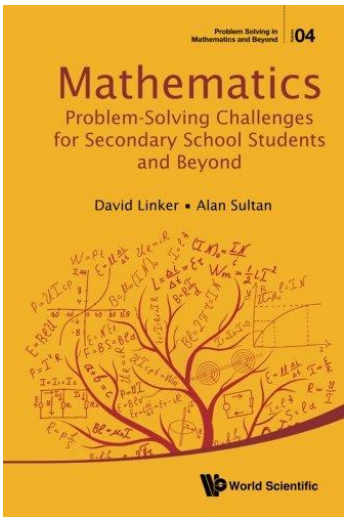
Reviewed by ***Robert Bilinski****, Collège Montmorency.*

The world abounds in marvellous endeavours to promote mathematics, but few get a chance at visibility outside of their niches. Luckily for us, once in a while, some contest organizers compile and publish a compendium book of problems. It takes dedication, hard work and perseverance to riffle through past contests, choose the cream of the crop, organize the problems, complete them with solutions, and polish the whole thing off. The New York City Interscholastic Math League (NYCIML) has been around for 33 years and last year they published such a book. The NYCIML started in the fall of 1984 as a contest for high schools in the New York area. It has since grown to include teams from other parts of the United States, and now more than 100 teams participate each year. The contest has always had 4 categories: senior A and B, junior and frosh. Each year, students playing in the league have a few contests to write, depending on which grade they are enrolled in. An interesting aspect of the league's organization is that past participants become part of its executive committee.



The book's authors have different backgrounds. David Linker is on the contest and problem side of things; he participated in contests as a student and then coached teams as a mathematics teacher. He later became the head of the NYCIML and led it for a period of 11 years, all the while building a career at the City College of New York. Alan Sultan is a professor of mathematics at the City University of New York. He published 5 books and about 40 articles, specializing more on knowledge transfer and permanent education of high school mathematics teachers.

The book is divided into 9 chapters and includes an appendix. The chapters follow a standard structure, each collecting problems from the NYCIML covering different branches of mathematics, namely (in order): arithmetic and logic, algebra, geometry, trigonometry, logarithms, counting, number theory, probability and, lastly, functional equations. We can also see a progression in the complexity of the mathematical content. Each chapter contains anywhere from 33 to 162 problems,

with most of them having around 50. The problems in each chapter are organized in three levels, from simpler to harder. But the complexity does not necessarily come from more complicated mathematics: some of the level 2 and 3 problems are not mathematically hard, instead featuring some kind of textual subtlety or word play. Level 3 problems are also generally more abstractly posed, while level 1 problems seem to be more "concrete" situations. Here are some examples.

Problem 1 of Chapter 2 (level 1). Find the largest integer x such that $\frac{24}{x+3}$ is an integer.

Problem 61 of Chapter 2 (level 2). If a and b are positive integers such that $a^2 + 24 = b^2$, compute the largest possible value of $a + b$.

Problem 153 of Chapter 2 (level 3). Find four ordered pairs of integers (x, y) such that $x^3 = y^3 + 217$.

The appendix of the book consists of an enumeration of mathematical results in the fields of each of the chapters. Contrary to most problems books, the authors opted for an answer section in each chapter instead of having a single solution section at the end of the book.

I appreciated that quite a few problems had multiple solutions. This is a definite plus. The problems also have a huge diversity, with only few problems resembling each other. Another interesting point is the number of problems touching different branches of math at the same time. For example, the authors put a counting problem as the first of the geometry section because of its geometric context (the problem asks how many diagonals are there in a given polygon). I do not know whether it was done on purpose, but the first problem of the counting section is also a geometry problem (namely, how many intersection points can two functions have). Even though I am an avid problem solver, I saw quite a few problems with a new twist or that I have never seen before: take, for example, problem 21 of the probability chapter that mixes probabilities with a Boolean implication.

It would have been nice to include references to the contest year and level from which each problem was taken. As someone who has been in the problem solving world for over 30 years and an owner of quite a collection of problem solving books, I figured I could date some problems from the way they were written, but I did not check my guesses.

A book of this kind can be used by teachers and math club organizers to spice up their presentations, while Mathletes would find it useful as a training tool to help them prepare for competitions. Maybe you know someone who is preparing for a math exam? This book is definitely a good starting point for that math teenage whiz in your family. If you know someone interested in keeping their mind sharp and who likes problem solving, this book would make a good gift for them.

Good reading!