

## BOOK REVIEWS

John Grant McLoughlin

*How to Solve It: A New Aspect of Mathematical Method (2<sup>nd</sup> Ed.)*  
by George Pólya (with a new foreword by John Conway), published by  
Princeton University Press, 2004

ISBN 0-691-11966-X, paper, 288 pages, US\$16.95.

Reviewed by **Curt Crane**, *Cobequid Educational Centre, Truro, NS.*

Originally published in 1945, the Princeton Science Library has recently decided to re-release George Pólya's signature piece, *How to Solve It*. This decision comes at a good time, since there isn't another book on the market quite like it. While problems are intermixed into the commentary, the book really is not about the problems themselves. Rather, the approach that one takes in solving these problems is the focus of the book.

What is the unknown? What are the data? What is the condition? Pólya repeats this mantra throughout as a guideline for attacking any problem the intrepid mathematician may encounter. He outlines a set of guidelines and practices that readers may use to tackle any problem they encounter, ranging from isolating the unknown value to searching for a related problem.

The book's primary purpose is as a tool for the mathematics teacher. The first part of the book deals entirely with some approaches and techniques which teachers may use in the classroom to help develop the problem-solving skills of their students. Pólya uses the following problem as an example: "Find the diagonal of a rectangular parallelepiped of which the length, the width, and the height are all known." While intrepid mathematics teachers may be able to solve this basic problem on their own, this is not Pólya's concern. Instead, he discusses methods the mathematics teacher may use to assist a student in determining how to tackle the problem. Through the use of sample dialogues, teachers are shown how to help students transform the problem into something they can solve, without explicitly telling the students the steps involved. It is this problem-solving process which Pólya cherishes.

Much of the book is a dictionary of heuristic terminology, which should be of interest to the reader. Unfortunately, this is presented in alphabetical order; as such, it tends to lack flow and cohesion (Pólya himself recommends that it not be read too quickly). Nevertheless, the section is rife with sample problems. One example from the *Reductio ad absurdum* definition is to write numbers using each of the ten digits exactly once, in such a way that the sum of the numbers is exactly 100. For example, one could arrange the ten digits as follows:  $19 + 28 + 30 + 7 + 6 + 5 + 4 = 99$ . However, this total falls one short of 100. After several failed attempts, the students may begin to suspect that there is more to this problem than they originally suspected; is it indeed even possible to arrange the digits such that they sum to 100? Is there a way to prove that this is not possible?

The book concludes with 20 mathematics problems at the level of a high school student, or possibly a good middle school student, complete with

optional hints and solutions to further emphasize Pólya's method of problem solving. For example, question #4 states "To number the pages of a bulky volume, the printer used 2989 digits. How many pages has the volume?" The hints suggest that the reader find a problem related to this one; for example, how many digits would be required to create a volume of 9 pages? 99 pages? By solving these simpler problems first, the original problem becomes clearer.

While the manner in which the book is organized can make it difficult to read at times, *How to Solve It* should be both enjoyable and informative for mathematics teachers everywhere. Students and other mathematicians may also be able to learn from Pólya's approach to problem solving.

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*USA and International Mathematical Olympiads 2003*

Edited by Titu Andreescu and Zuming Feng, published by the Mathematical Association of America, 2004

ISBN 0-88385-817-7, paperbound, 104 pages, US\$26.95.

Reviewed by **Ian VanderBurgh**, *University of Waterloo, Waterloo, ON.*

This book has solid mathematical value but perhaps little practical value. It contains problems, hints, and solutions for the United States of America Mathematical Olympiad (USAMO), the International Mathematical Olympiad (IMO), and the Team Selection Test for the US IMO team, all from the year 2003. There is also a glossary, a list of problem credits, and a summary of results from the USAMO and IMO from the last several years.

There is no doubt that there is good mathematics in this book. Each problem has a hint, and many problems have multiple solutions, some of which are, not surprisingly, quite ingenious. The solutions do contain a few typos to stumble over, and, for my money, are written and laid out in such a way as to make them quite difficult to understand.

While students who are preparing for olympiads could definitely get some value from these problems, I do have two additional reservations. First, there are only 18 problems in this book and the problems are hard enough so as to be accessible to relatively few. Second, all of these problems and at least one solution to most of them are easily obtainable with a few minutes searching on the Internet.

Thus, unless you have a keen interest in seeing hints to these problems, in seeing multiple solutions, or reading about the recent history of the US-AMO and US performance at the IMO, then I would suggest looking for a compilation of more problems which are harder to come by free of charge.