

Preface

The high school curriculum provides rich opportunities for students to learn and do mathematics through problem solving. High school students, as they become ready for college and other postsecondary opportunities, are ready for complex and real-life situations, and they are increasingly able to extract abstract ideas from real-life applications. As stated in *Principles and Standards for School Mathematics*: “In high school, students’ repertoires of problem-solving strategies expand significantly because students are capable of employing more complex methods and their abilities to reflect on their knowledge and act accordingly have grown” (NCTM 2000, p. 334).

Building on NCTM recommendations (NCTM 2011), the Common Core State Standards for Mathematics (CCSSM) further develop the standards for how students should go about doing mathematics, and thus include standards for “mathematical practice” in addition to standards for “mathematical content.” Teachers have the new challenge of maintaining an environment conducive to problem solving in their classrooms while meeting the requirements of the CCSSM. The purpose of this book is to guide high school teachers in their efforts to implement these standards, both for mathematical content and for mathematical practice. As the title suggests, our emphasis here is on meeting the standards through a problem-solving approach, not only as a means of practicing what has been learned but also as a tool to “build new mathematical knowledge” (NCTM 2000, p. 52). Overall, the Common Core State Standards for Mathematics are well suited for a problem-solving approach.

To develop mathematical problem-solving skills and to support the Common Core State Standards, we highlight two approaches. First, rich problems are presented that provide a starting point for lessons, and not just an opportunity to practice what has already been learned. Our hope is that teachers will use these problems to launch lessons and allow the embedded mathematics to be revealed through classroom discourse. The second approach presents a carefully designed series of expressions and questions that allow mathematical ideas to emerge. Not every section has an equal treatment of the two approaches, as certain concepts and problems lend themselves differently to each.

This book, containing forty-four tasks, is organized mainly by the major content areas for the high school Common Core standards, with a chapter for each: Algebra, Functions, Geometry, Statistics and Probability, and Number and Quantity. Modeling does not have its own chapter, as it is represented across all of the content areas, and explicit reference is made to it where appropriate. Each chapter is organized by the domains of the CCSSM, with a section including a problem or several problems for each domain and targeting specific clusters of standards. Each problem is labeled as a “Task.”

Although every domain required of all students is represented, not every standard or cluster is represented, and only interesting problems that lend themselves to meaningful implementation of content standards have been included. Our intent was not to be exhaustive, but to present exemplary problems as models for teachers. At the end of each section, the Standards for Mathematical Practice best met by the problems in the section are discussed. Although the temptation for busy teachers may be only to look at the tasks themselves, we hope that teachers also read the discussion of the problems, where we provide ideas for implementation of the tasks, possible modifications of the tasks, and common misconceptions related to the concepts inherent in the tasks.

This book is intended for use by high school mathematics teachers to support a traditional text for students, providing a source for rich problems to motivate and launch lessons as well as to exemplify mathematics learning through problem solving. In many cases, suggestions for modifying or extending the problems are given so that instruction may be differentiated. Teacher educators may use this book as a supplemental text in a methods course or a curriculum course for preservice teachers in secondary mathematics. This would help preservice teachers become familiar with the Common Core State Standards for Mathematics and how they may be implemented. Finally, teachers should find the “CCSS Overview for Middle and High School Mathematics,” located in the appendix, helpful in providing a “vertical” overview of the major content areas and how they are emphasized through the middle and high school grades.