



**BOOK I**

**Gr. 6–8**

# ALGEBRAIC SUDOKU

*A Fun Way to Develop, Enhance, and Review Students' Algebraic Skills*

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## Dear Teacher or Parent,

Welcome to most exciting and beneficial algebraic learning resource on the market today. *Algebraic Sudoku* will teach your child/student algebra in a way never previously accomplished. In this book, the first part in a series of two, you will find 33 Sudoku puzzles, each of which aligns with the standard algebra curriculum. This book is divided into three units:

- Unit I: Foundations
- Unit II: Equations
- Unit III: Linear Equations

Each Sudoku puzzle is like a mini-lesson, with background, discussion, strategy, and demonstration for solving each problem. By solving the algebra problems, students are given enough data that will allow them to reason their way through the remaining cells of the Sudoku puzzle that follows. Each Sudoku puzzle includes a solution key. Every puzzle, along with the problems and mini-lessons associated with it, are presented on a ready-to-use, reproducible master that can be easily copied as transparencies for full-class instruction and discussion.

*Algebraic Sudoku* is an ideal supplement for students currently enrolled in algebra or students planning to take algebra in the near future. It is an excellent tool for kids and grown-ups to keep their algebraic skills sharp after having completed an algebra course. It is wonderful for home-schoolers as well as students in a traditional classroom. It makes an excellent companion during the summer break. Not only is *Algebraic Sudoku* fun and exciting, it challenges students' minds with exhilarating puzzles that develop logic, reasoning skills, concentration, and confidence.

I hope that you find the *Algebraic Sudoku* puzzles, and the mini-lessons and problems associated with each, the most fun and exciting way to achieve algebra mastery.

Sincerely,

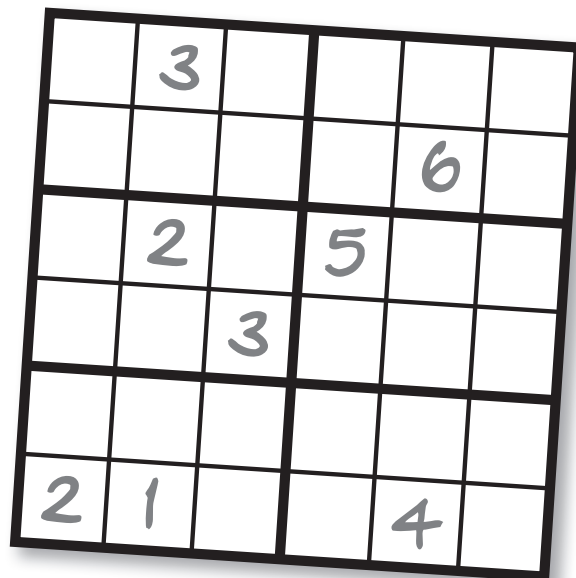
Tony G. Williams, Ed.D.

*Dedicated to my parents, Jean and Grady, who are retired math teachers, and to my wife Sharon and our triplets TLC (Tony, Leah, and Christina)*

*Also, to my brilliant Uncle Charles, and my siblings, Cheryl and Bruce, two committed math educators*

# TABLE OF CONTENTS

Introduction .....	4
How It All Works .....	5
Suggested Strategies .....	6
Pencil Marks.....	7
Unit I: Foundations.....	10
Unit II: Equations.....	21
Unit III: Linear Equations .....	30
Answer Key .....	43



# INTRODUCTION

The word *Sudoku* is Japanese—*su* means *number*, and *doku* refers to a single place on a puzzle board. Although its name is Japanese, the game origins are actually European and American. Sudoku puzzles come in a variety of sizes or grids (9x9, 6x6, 5x5, 4x4, etc.). The objective is to fill the grid with digits so that each column, row, and each of the nine 3x3 sub-grids that compose the puzzle contain all of the digits from 1 to 9. (We will discuss strategy later in this section.) Most of the Sudoku puzzles in the book are of the 6x6 variety, with a few 9x9 and 4x4 grids added to the mix.

Today, Sudoku is played all over the world. Many newspapers have added the game alongside the crossword puzzle and, as a result, have reported a jump in circulation. *USA Today's* most recent list of best-selling books tracked that seven of the top 100 were compilations of Sudoku puzzles. Also, millions of dollars are being made from Sudoku software, games, and online programs. But why? The most obvious reason is that Sudoku is fun; challenging, but fun! There is a sense of accomplishment one receives when successfully completing a puzzle. Sudoku tests one's ability to concentrate, reason, and think logically.

When you combine the excitement of Sudoku with the importance of algebra, you have a winning combination. Students who successfully complete an algebra course are twice as likely to graduate from college as students who lack such preparation (Adelman, 1999; Evan, Gray, and Olchefske, 2006). The majority of employees who earn more than \$40,000 a year completed algebra in high school (Achieve, Inc., 2006). A national poll revealed that two-thirds of the students who completed algebra were well-prepared for demands of the workplace (Carnevale and Desrochers, 2003). And yet, there are increasing numbers of students who are not prepared for and fail to successfully complete algebra, as is evident by the vast and growing demand for remedial mathematics education courses among students in four-year colleges and community colleges across the nation. Data shows that 71% of America's degree-granting institutions offer an average of 2.5 remedial courses for skill-deficient students (Business Higher Education Forum, 2005). Overall, these deficiencies are further intensified by factors such as income and race. Research shows that most children from low-income backgrounds enter school with far less knowledge than peers from middle-income backgrounds, and the achievement gap in mathematical knowledge progressively widens throughout their PreK-12 years (National Mathematics Achievement Panel, 2008). However, these achievement gaps can be significantly reduced or even eliminated if low-income and minority students increase their success in high school mathematics and science courses (Evan, Gray, and Olchefske, 2006).

Algebra is essentially both the bridge and the gateway for many students. Algebra can lead students into an exciting world with opportunities awaiting them. We, as math educators, must be as innovative as possible in reaching our students, in enabling our students to reach their fullest potential. I hope this book will be a valuable resource as you strive for success in the classroom.

# ADDING LIKE AND UNLIKE SIGNS

When adding like signs, simply add the absolute values, and keep the sign for your sum.

Examples:

$$A) 7 + 10 = 17$$

$$B) -7 + (-10) = -17$$

When adding unlike signs, subtract the absolute values of the numbers, and use the sign of the number with greatest absolute value in your answer.

Examples:

$$A) -7 + 16 = 9$$

$$B) 7 + (-16) = -9$$

**Directions:** Add, and place the sums in the appropriate cells of the Sudoku grid. Then solve the puzzle.

(A1) $-3 + (-4) =$	(C8) $\frac{1}{2} + (-6\frac{1}{2}) =$	(H2) $-4\frac{3}{5} + (-2\frac{2}{5}) =$
(A4) $2.7 + 2.3 =$	(D3) $17 + (-14) =$	(H3) $100 + (-98) =$
(A9) $-1 + 0 =$	(D6) $-3.929 + -0.071 =$	(H6) $-5.72 + 10.72 =$
(B1) $-8\frac{7}{8} + \frac{7}{8} =$	(D9) $-19 + 10 =$	(H9) $0 + (-6) =$
(B4) $-4.28 + 5.28 =$	(F1) $-4\frac{1}{5} + (-\frac{4}{5}) =$	(I1) $-9\frac{3}{4} + 5\frac{3}{4} =$
(B7) $-2 + 7 =$	(F4) $30 + (-23) =$	(I3) $51 + (-50) =$
(B8) $4.2 + (-0.2) =$	(G2) $6.2 + (-1.2) =$	(I5) $-13.3 + 4.3 =$
(B9) $-20 + 13 =$	(G3) $17 + (-8) =$	(I6) $-9.7 + 11.7 =$
(C4) $4.35 + 4.65 =$	(G6) $0.55 + 0.45 =$	(I8) $-1.68 + (-1.32) =$
(C7) $21 + (-23) =$	(H1) $34 + (-37) =$	(I9) $33 + (-38) =$

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
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6									
7									
8									
9									

# SUBTRACTING SIGNED NUMBERS

Subtracting is the same as adding the opposite (or additive inverse) of the number being subtracted.

Examples:

$$A) -5 - 10 = -5 + (-10) = -15$$

$$B) 12 - (-23) = 12 + 23 = 35$$

**Directions:** Subtract, and place the differences in the appropriate cells of the Sudoku grid. Then solve the puzzle.

(A5) $7 - 10 =$	(D5) $15 - 20 =$	(G1) $-2.5 - (-7.5) =$
(A7) $-3 - 6 =$	(E1) $-6 - 3 =$	(G6) $18 - 24 =$
(B1) $4 - (-4) =$	(E2) $0 - (-3) =$	(G7) $-5 - 2 =$
(B4) $-9 - (-4) =$	(E3) $0.77 - 2.77 =$	(H2) $-29 - (-20) =$
(B5) $5 - (-1) =$	(E4) $0 - 1 =$	(H4) $-3 - 5 =$
(B6) $-\frac{7}{8} - \frac{1}{8} =$	(E6) $-3\frac{7}{12} - 3\frac{5}{12} =$	(H5) $-4\frac{3}{5} - (-6\frac{3}{5}) =$
(B8) $-5.2 - 1.8 =$	(E7) $19 - 14 =$	(H6) $0 - (-4) =$
(C3) $23 - 30 =$	(E8) $-18 - (-24) =$	(H9) $6.1 - 11.1 =$
(C4) $-24 - (-20) =$	(E9) $-36 - (-32) =$	(I3) $-26 - (-32) =$
(C9) $-1 - 1 =$	(F5) $-1 - 3 =$	(I5) $-48 - (-55) =$
(D2) $-4 - (-8) =$	(F8) $-7.25 - 1.75 =$	(I8) $49 - 53 =$

	A	B	C	D	E	F	G	H	I
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# MULTIPLYING AND DIVIDING SIGNED NUMBERS

When multiplying or dividing *rational numbers* (negative and positive whole numbers, fractions, decimals, etc.), the rules are easy to remember. When multiplying or dividing two unlike signs (- + or + -) the product or quotient is always **negative**. When multiplying or dividing like signs (+ + or - -) the product or quotient is always **positive**.

Here are a few examples:

A)  $-6 \cdot 3 = -18$

B)  $-15 \div (-5) = 3$

C)  $24 \div (-6) = -4$

D)  $-7 \cdot -9 = 63$

**Directions:** Multiply or divide, and place the products or quotients in the appropriate cells of the Sudoku grid. Then solve the puzzle.

(A4) $-35 \div (-7) =$	(D5) $-27 \div 3 =$	(F6) $111 \div (-37) =$
(A8) $42 \div (-6) =$	(D7) $-5 \cdot -1 =$	(G1) $-63 \div 21 =$
(A9) $-3 \cdot 3 =$	(D8) $33 \div (-11) =$	(G4) $-7 \cdot (-1) =$
(B1) $-14 \cdot -\frac{1}{2} =$	(E1) $-\frac{2}{3} \cdot -6 =$	(G6) $\frac{3}{5} \div -\frac{3}{25} =$
(B5) $8 \cdot -\frac{1}{8} =$	(E3) $\frac{3}{5} \div (-\frac{1}{5}) =$	(G7) $-4 \div (-\frac{1}{2}) =$
(B9) $72 \div (-9) =$	(E5) $-2 \cdot (-3) =$	(H1) $-0.1 \cdot 10 =$
(C3) $-81 \div (-9) =$	(E7) $99 \div (-11) =$	(H5) $28 \div (-7) =$
(C4) $24 \cdot -0.25 =$	(E9) $-1.75 \cdot 4 =$	(H8) $-0.4 \cdot 5 =$
(C6) $-48 \div 6 =$	(F2) $56 \div (-7) =$	(I1) $100 \div (-20) =$
(C9) $-13 \div (-13) =$	(F3) $-175 \div (-25) =$	(I2) $-42 \div 6 =$
(D4) $-\frac{1}{4} \cdot 32 =$	(F5) $-25 \cdot -\frac{1}{5} =$	(I6) $-4 \div (-\frac{2}{3}) =$

	A	B	C	D	E	F	G	H	I
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6									
7									
8									
9									