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Introduction

One-thousand-one algebra problems: You must wonder what inspired such an endeavor.

One possibility for the inspiration is *1,001 Arabian Nights*. (Okay, I'm really stretching here, but why not?) *1,001 Arabian Nights* is a collection of stories and folk tales, compiled over several centuries. Likewise, *1,001 Algebra II Practice Problems For Dummies* is a collection of math problems and explanations, and some of them involve interesting stories. This book wasn't compiled over centuries (though my editors say it seemed to take that long), but the concepts and ideas involved took mathematicians centuries to develop.

Practice makes perfect. Unlike other subjects in which you can just read or listen and absorb the information sufficiently, mathematics takes practice. The only way to figure out how the different algebraic rules work and interact with one another is to get into the problems — get your hands dirty, so to speak. Many problems appear to be the same, on the surface, but different aspects and challenges have been inserted to make the different problems unique. The concepts become more set in your mind when you work with the problems and have the properties confirmed with your solutions.

Yes, whether it's 1,001 algebra problems or 1,001 mathematical adventures, you'll find them here. Enjoy!

What You'll Find

This book contains 1,001 algebra problems, their answers, and complete solutions to each. There are 17 problem chapters, and each chapter has many different sets of questions. The sets of questions are sometimes in a logical, sequential order, going from one part of a topic to the next and then to the next. Other times the sets of questions represent the different ways a topic can be presented. In any case, you're given brief instructions on doing the problems. And sometimes you're given a particular formula or format to use. Feel free to refer to other algebra books, such as *Algebra II For Dummies*, to give you ideas on how to solve some of the problems.

Instead of just having answers to the problems, you find a worked-out solution for each and every one. Flip to the last chapter of the book for the step-by-step processes needed to solve the problems. The solutions include verbal explanations inserted in the work where necessary. Sometimes an alternate procedure may be offered. Not everyone does algebra exactly the same way, but this book tries to provide the most understandable and success-promoting process to use when solving the algebra problems presented.

How This Workbook Is Organized

This workbook is divided into two main parts: questions and answers. But you probably figured that out already.

Part 1: Questions

The questions chapters cover many different topics:

- **Review of basic operations:** The chapter takes you through some of the main concepts from Algebra I that are essential to working in Algebra II. You'll find problems on powers of binomials and patterns in those powers. Solving linear equations and linear inequalities are fairly straightforward tasks, but it doesn't hurt to review these types of problems to bring your skill level up to speed. Two other topics covered here are radicals and complex numbers. Each topic is special in its own way, but similarities crop up — such as the use of conjugates when simplifying the expressions.
- **Solving nonlinear equations and inequalities:** Quadratic equations are by far one of the most used and referred-to equation types in secondary mathematics. That's why you'll find techniques such as factoring (with the multiplication property of zero), the square root rule, the quadratic formula, and completing the square to be the main methods covered here.

  Throw in some radical equations (square roots, cube roots) and rational equations (fractional expressions), and you have more tricks and techniques to practice so you can increase your repertoire.
- **Graphing lines:** A line is a very basic structure and is easy to graph when you have two points. You'll also find lines to graph when you're given their equations, and then equations to write when you're given information about the line. You get to consider lines that are parallel to one another and others that are perpendicular. The graphing part is simplified when you recognize the basics: a point on the line and the line's slope.
- **Functions:** A function in mathematics has a very specific definition. You can have a function when you have a relationship between sets of numbers and the relationship is described with mathematical operations. The operations take input values and produce output values based on the rules created with the operations. What's particularly special about functions is that there's only one output for every input. The functions you'll find include linear, quadratic, polynomial, rational, exponential, and logarithmic. There are more functions out there, but you get a really good start right here.
- **Systems of equations and inequalities:** When you have two or more statements or equations and want to know whether there are any solutions common to both or all of them at the same time, you're talking about solving systems. The equations can be linear, quadratic, exponential, and so on. You'll use algebraic techniques as well as matrices to solve some of the linear systems.
- **Sequences, sets, and counting techniques:** When you're getting ready for future studies in probability and statistics, you'll want to practice problems involving lists, counting, sets, and set notation. You'll use Venn diagrams and make lists of elements in sets. You'll also write the terms in sequences and add up the terms in series.

Part 2: Answers

This part provides not only the answers to all the questions but explanations of the answers as well. So, you get the solution, and you see how to arrive at that solution.

Beyond the Book

In addition to what you're reading right now, this book comes with a free, access-anywhere Cheat Sheet that includes tips and other goodies you may want to have at your fingertips. To get this Cheat Sheet, simply go to www.dummies.com and type **Algebra II: 1001 Practice Problems For Dummies** into the Search box.

The online practice that comes free with this book offers you the same 1,001 questions and answers that are available here, presented in a multiple-choice format. The beauty of the online problems is that you can customize your online practice to focus on the topic areas that give you trouble. If you're short on time and want to maximize your study, you can specify the quantity of problems you want to practice, pick your topics, and go. You can practice a few hundred problems in one sitting or just a couple dozen, depending on whether you can focus on a few types of problems or prefer a mix of several types. Regardless of the combination you create, the online program keeps track of the questions you get right and wrong so you can monitor your progress and spend time studying exactly what you need.

To gain access to the online practice, you simply have to register. Just follow these steps:

1. **Register your book or ebook at Dummies.com to get your PIN. Go to** www.dummies.com/go/getaccess.
2. **Select your product from the drop-down list on that page.**
3. **Follow the prompts to validate your product and then check your email for a confirmation message that includes your PIN and instructions for logging in.**

If you don't receive this email within two hours, please check your spam folder before contacting us through our technical support website at http://support.wiley.com or by phone at 877-762-2974.

Now you're ready to go! You can come back to the practice material as often as you want — simply log in with the username and password you created during your initial login. No need to enter the access code a second time.

Your registration is good for one year from the day you activate your PIN.

Where to Go for Additional Help

The written directions given with the individual problems are designed to tell you what you need to do to get the correct answer. Sometimes the directions may seem vague if you aren't familiar with the words or the context of the words. Go ahead and look at the solution to see whether that

helps you with the meaning. But if the vocabulary is still unrecognizable, you may want to refer to the glossaries in algebra books, such as *Algebra I For Dummies* or *Algebra II For Dummies*, written by yours truly and published by John Wiley & Sons, Inc.

This book is designed to provide you with enough practice to become very efficient in algebra, but it isn't intended to give the step-by-step explanation on how and why each step is necessary. You may need to refer to *Algebra II For Dummies* or *Algebra II Essentials For Dummies* (also written by me) to get more background on a problem or to understand why a particular step is taken in the solution of the problem.

Algebra is sometimes seen as being a bunch of rules without a particular purpose. Why do you have to solve for the solutions of a quadratic equation? Where will you use that again? The answers to all these questions are more apparent when you see them tied together and when more background information is available. Don't be shy about seeking out that kind of information.

You may become intrigued with a particular topic or particular type of problem. Where do you find more problems like those found in a section? Where do you find the historical background of a favorite algebra process? There are many resources out there, including a couple that I wrote:

- Do you like the applications? Try *Math Word Problems For Dummies*.
- Are you more interested in the business-type uses of algebra? Take a look at *Business Math For Dummies.*

If you're ready for another area of mathematics, look for a couple more of my titles: *Trigonometry For Dummies* and *Linear Algebra For Dummies.*

1 The Questions

IN THIS PART . . .

You get to tackle 1,001 Algebra II problems. Have fun! Here are the general types of questions you'll be dealing with:

Algebra basics, quadratic equations, and graphing lines (Chapters 1 through 4)

All kinds of functions (Chapters 5 through 9)

Conic sections and linear and nonlinear equations (Chapters 10 through 12)

Complex numbers, matrices, sequences, series, and sets (Chapters 13 through 17)

Chapter 1

Reviewing Algebra Basics

The basics of Algebra II consist of the processes learned in earlier exposures to algebra — in this case, all lumped together in one chapter. It's hard to cover every little thing that you'll need to continue your algebra study in this one book, but this is a really good place to start. Under the guise of solving some equations and inequalities, you get to review many of the most important properties and procedures needed to be successful. Anything missing in this discussion is covered in later chapters as part of the problems' explanations.

The Problems You'll Work On

In this chapter, you'll work with simplifying expressions and solving equations and inequalities in the following ways:

- Multiplying binomials and trinomials
- Expanding higher powers of binomials
- Solving linear equations and absolute value equations
- Solving linear inequalities
- Simplifying radical expressions
- Rewriting expressions involving imaginary numbers

What to Watch Out For

Don't let common mistakes trip you up; watch for the following when working with simplifying expressions and solving equations and inequalities:

- Distributing the factor over every term in the parentheses
- Multiplying terms by a negative factor
- Reversing the inequality sense when multiplying or dividing by a negative factor

- Correctly multiplying a binomial and its conjugate
- Simplifying expressions involving powers of *i*

Multiplying Binomials and Trinomials

1–8 *Simplify the expressions by performing the operations and combining like terms.*

1. $(2x+3)(4x-2)=$

2. $3x^2+(x+4)(x-1)=$

3. $(3x+1)(x-3)+(x+2)(5x-4)=$

4. $5(x-3)(x+2)+3(x-3)(x-2)+1=$

5. $(x+4)\left(x^2-3x+5\right)=$

6. $(x-1)\left(3x^2+2x-1\right)=$

7. $(2x+1)(x-3)(x+4)=$

8. $(x-3)(x+3)(7x+11)=$

Using Pascal's Triangle to Multiply Binomials

9–12 *Use Pascal's Triangle to expand the binomial powers.*

9. $(x-3)^3=$

10. $(x+2)^5=$

11. $(3x-2y)^4=$

12. $\left(a^2+b\right)^6=$

Solving Linear Equations

13–18 *Solve the linear and absolute value equations for x.*

13. $4x + 2 = 3(x - 3)$

14. $5x + 2(x + 7) = 3(x - 2)$

15. $|3x - 2| = 14$

16. $|4x + 1| - 2 = 3$

17. $4|x - 6| = 8$

18. $3|2x - 5| + 5 = 8$

Solving Linear Equations for Variables

19–24 *Solve for the indicated variable.*

19. Solve for l in $P = 2l + 2w$.

20. Solve for s_1 in $P = 2s_1 + s_2$.

21. Solve for b_2 in $A = \frac{1}{2}h(b_1 + b_2)$.

22. Solve for F in $C = \frac{5}{9}(F - 32)$.

23. Solve for t in $A = P + Prt$.

24. Solve for n in $a_n = a_1 + (n - 1)d$.

Solving Linear Inequalities

25–34 Solve the inequalities.

25. $3x - 4 \le 5x + 6$

26. $4(x - 3) > x + 6$

27. $-3 \le 2x + 7 < 9$

28. $0 < 7 - 3x < 13$

29. $|x + 6| < 4$

30. $|2x - 3| \ge 5$

31. $|4x - 5| + 1 \le 4$

32. $2|6x - 5| > 20$

33. $4x - 9 < 2x + 1 \le 3x - 1$

34. $2x + 6 \le x + 3 < 3x + 11$

Making Radical Expressions Simpler

35–44 Simplify the radical expressions.

35. $\sqrt{50}$

36. $\sqrt{300}$

37. $\sqrt{180}$

38. $\sqrt{960}$

39. $(1 + \sqrt{2})^2$

40. $(\sqrt{3} - \sqrt{5})^2$

41. $\frac{2}{2+\sqrt{6}}$

42. $\frac{10}{5-\sqrt{5}}$

43. $\frac{4+\sqrt{10}}{4-\sqrt{10}}$

44. $\frac{12-\sqrt{3}}{4-2\sqrt{3}}$

Working with Complex Expressions

45–50 Simplify the complex numbers.

45. i^{138}

46. i^{1001}

47. $(4-i)^2$

48. $(3+2i)^2$

49. $i(2i)^3$

50. $4i^{21}(1+i)^2$

Chapter 2

Solving Quadratic Equations and Nonlinear Inequalities

A quadratic expression is one containing a term raised to the second power. When a quadratic expression is set equal to 0, you have an equation that has the possibility of two real solutions; for example, you may have an equation for which the answers are $x = 1$ or $x = 3$. Nonlinear inequalities can have an infinite number of solutions, so those answers are written with expressions such as $x > 8$ or $x > -2$; these solutions can also be written using interval notation.

The Problems You'll Work On

In this chapter, you'll work with quadratic equations and inequalities in the following ways:

- Solving simple equations using the *square root rule*
- Rewriting quadratics as the product of two binomials in order to solve them
- Applying the *quadratic formula*
- Completing the square
- Solving quadratic-like equations
- Finding the solutions of quadratic and other nonlinear inequalities

What to Watch Out For

Don't let common mistakes like the following ones trip you up when working with quadratic equations and inequalities:

- Forgetting to consider $\pm x$ when using the *square root rule*
- Reducing the fraction incorrectly when applying the *quadratic formula*

- Stopping too soon when solving quadratic-like equations
- Eliminating values as solutions when they create a 0 in the denominator of a fraction

Applying the Square Root Rule on Quadratic Equations

51–60 Solve the equations using the square root rule.

51. $x^2 = 81$

52. $x^2 - 144 = 0$

53. $3y^2 - 75 = 0$

54. $5z^2 - 125 = 0$

55. $9x^2 = 4$

56. $98x^2 = 18$

57. $x^2 = 11$

58. $y^2 = 20$

59. $4x^2 = 200$

60. $3z^2 - 726 = 0$

Solving Quadratic Equations Using Factoring

61–76 Solve the quadratic equations by factoring and applying the Multiplication Property of Zero.

61. $x^2 + 2x - 35 = 0$

62. $y^2 - 4y - 96 = 0$