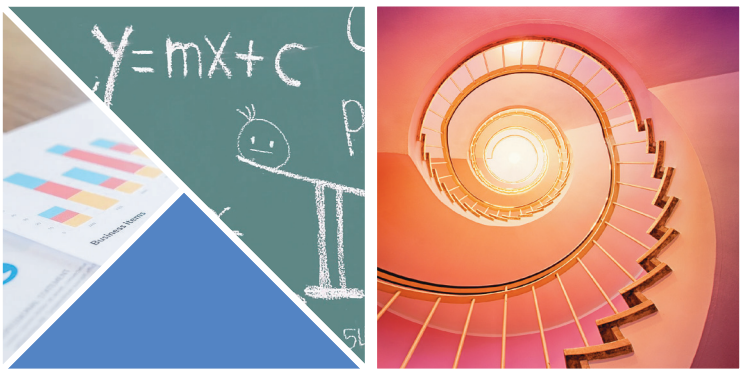
POWER BASICS Algebra



Teacher's Guide

WALCH®
MATHEMATICS

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Table of Contents

To the Teacher

Overview

Power Basics® is a complete textbook program designed to meet the needs of students who are daunted by the length and complexity of traditional textbooks. The goal of all textbook programs is to provide students with important new information. However, in traditional textbook programs, this goal is often overshadowed by other considerations. Many textbooks are written for the above-average reader and cover a wide range of content. They are filled with photographs, illustrations, and other visual elements. For some students, the amount of material is overpowering, the visual elements are distracting, and the rapid pace is unnerving. In Power Basics®, we revisited the basic goal, developing a streamlined textbook program that presents the essential content students need to succeed.

Program Components

As with traditional textbook programs, Power Basics® includes a core textbook and ancillary products designed to round out the program. The student text provides coverage of the essential content in each subject area. A consumable workbook provides a variety of activities for each lesson, including practice activities, extension activities, and activities designed for different learning styles.

The student text includes a collection of station-based activities that provide students with opportunities to extend beyond the mathematical skills and concepts they are learning. These station-based activities foster a collaborative learning experience, while allowing students the opportunity to reflect on and synthesize their thinking. These activities can be found near the end of the book.

Teacher support materials include a teacher's guide and test pack for each student text. The teacher's guide includes the following: an overview of each unit in the student text; suggestions for extension activities; the student text glossary and appendixes; a complete answer key to all practice activities and unit reviews in the student text; an overview/answer key for the station activities; classroom record-keeping forms; and graphic organizers for student use.

For more detailed assessments, the test pack offers a pretest, unit tests for each unit in the student text, a posttest, scoring keys, and test-taking strategies for students. Finally, a practice pack provides additional exercises with a separate answer key, organized by unit.

Student Book Organization

The student text is divided into units. Each unit contains a series of lessons on related topics, with one lesson for each topic. Each lesson begins with a clear, student-centered goal and a list of key words that are introduced in the lesson. The definitions for these words are included in the teacher material for each lesson.

Next comes a brief introduction to the topic of the lesson, followed by instructional text that presents essential information in short, easy-to-understand sections. Each section of instructional text is followed by a practice activity that lets students apply what they have just learned. A Unit Review is provided at the end of each unit to assess students' progress. The review is followed by an Application Activity that encourages students to extend and apply what they have learned.

The student text also includes several special features. "Tip" sections give students useful hints to help them remember specific pieces of information in the student text. "Think About It" sections ask students to use critical-thinking skills. "In Real Life" sections show students how the material they are learning connects to their own lives, answering the perennial question, "When am I ever going to use this?"

The reference section at the back of the student text includes a summary of rules and other important information presented in the text, a glossary (with pronunciation guide) that includes all vocabulary in the Words to Know sections, and an index to help students locate information in the text.

Record-Keeping Forms

To make record-keeping easier, we have provided reproducible class charts that you can use to track students' progress. Fill in your students' names, and make copies of the chart for each unit in the student text. Add lesson numbers, lesson titles, and practice numbers as needed. We have also provided a generic grading rubric for the Application Activities in the student text so that these activities may be assigned for credit, if you wish. You may customize the rubric by adding more grading criteria or adapting the criteria on the sheet to fit your needs.

We're pleased that you have chosen to Power Up your Basic Skills Curriculum with Power Basics®!

Guide to Icons

Teacher's Guide

Teaching Tips

Practical suggestions help you to engage students in the learning process.

Calculate It

Useful tips and tricks help students get the most from their calculators.

Mental Math

Oral math activities help learners develop strong mental arithmetic skills.

Differentiation

Different approaches to the content give all learners the opportunity to connect to the material.

Student Text

Tip

Tips give helpful hints to boost understanding and retention.

Think About It

These sections develop critical-thinking.

In Real Life

These features connect learning concepts to students' lives, answering the perennial question, "When am I ever going to use this?"

Workbook

Reinforcement

Reinforcement activities give students additional opportunities to practice what they have learned.

Multiple Intelligences

Different approaches capitalize on different learning styles and interests to help all students connect to the material.

Extension

Deepen and broaden learning with critical-thinking activities, real-life applications, and more.

Classroom Management

Student Name	Lesson No.: _____ Title: _____								
	Practice # __	*Practice # __*	*Practice # __*	*Practice # __*	*Practice # __*	*Practice # __*	*Practice # __*	*Practice # __*	*Unit Review Score*
1.									
2.									
3.									
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Application Activity Rubric

Name _____ Date _____

Unit _____ Activity _____

POINTS	4 all of the time	3 most of the time	2 some of the time	1 almost none of the time
followed directions				
organized material well				
used appropriate resources				
completed the entire activity				
showed an understanding of the content				
produced error-free materials				
drew logical conclusions				
where appropriate, listed sources used				

Use Chart

POWER BASICS WORKBOOK	STUDENT TEXT PRACTICE
Unit 1: Algebra Basics	
Activity 1: What Are Negative and Positive Numbers? I	Practice 1: What Are Negative and Positive Numbers?
Activity 2: What Are Negative and Positive Numbers? II	Practice 1: What Are Negative and Positive Numbers?
Activity 3: Larger and Smaller Numbers	Practice 2: Larger and Smaller Numbers
Activity 4: Actual Values and Absolute Values	Practice 3: Actual Values and Absolute Values
Activity 5: Adding Positive and Negative Numbers I	Practice 4: Adding Positive and Negative Numbers
Activity 6: Adding Positive and Negative Numbers II	Practice 4: Adding Positive and Negative Numbers
Activity 7: Adding Positive and Negative Numbers III	Practice 4: Adding Positive and Negative Numbers
Activity 8: The First Rule of Addition I	Practice 5: The First Rule for Addition
Activity 9: The First Rule for Addition II	Practice 5: The First Rule for Addition
Activity 10: The Second Rule for Addition	Practice 6: The Second Rule for Addition
Activity 11: Subtracting Positive and Negative Numbers I	Practice 7: Subtracting Positive and Negative Numbers
Activity 12: Subtracting Positive and Negative Numbers II	Practice 7: Subtracting Positive and Negative Numbers
Activity 13: Multiplying and Dividing Signed Numbers	Practice 8: Multiplying and Dividing Signed Numbers
Activity 14: Solving Terms	Practice 10: Solving Terms
Activity 15: Solving Expressions	Practice 11: Solving Expressions
Activity 16: Combining Terms	Practice 12: Combining Like Terms
Activity 17: Combining Like Terms	Practice 12: Combining Like Terms
Activity 18: Algebraic Equations I	Practice 13: Algebraic Equations
Activity 19: Algebraic Equations II	Practice 13: Algebraic Equations
Activity 20: Checking Your Work	Practice 14: Checking Your Work
Activity 21: Solving for Variables I	Practice 16: Solving for Variables
Activity 22: Solving for Variables II	Practice 16: Solving for Variables
Unit 2: Solving Equations and Inequalities	
Activity 23: Solving Equations by Subtracting and Adding I	Practice 17: Solving Equations by Subtracting and Adding
Activity 24: Solving Equations by Subtracting and Adding II	Practice 17: Solving Equations by Subtracting and Adding
Activity 25: Solving Equations by Dividing and Multiplying I	Practice 18: Solving Equations by Dividing and Multiplying
Activity 26: Solving Equations by Dividing and Multiplying II	Practice 18: Solving Equations by Dividing and Multiplying
Activity 27: Solving Two-Step Equations I	Practice 19: Solving Two-Step Equations
Activity 28: Solving Two-Step Equations II	Practice 19: Solving Two-Step Equations
Activity 29: Solving Equations with Fractional Coefficients I	Practice 21: Solving Equations with Fractional Coefficients
Activity 30: Solving Equations with Fractional Coefficients II	Practice 21: Solving Equations with Fractional Coefficients
Activity 31: Solving Equations with Squared Variables I	Practice 22: Solving Equations with Squared Variables

Use Chart, *continued*

POWER BASICS WORKBOOK	STUDENT TEXT PRACTICE
Activity 32: Solving Equations with Squared Variables II	Practice 22: Solving Equations with Squared Variables
Activity 33: Solving Equations with Parentheses I	Practice 23: Solving Equations with Parentheses
Activity 34: Solving Equations with Parentheses II	Practice 23: Solving Equations with Parentheses
Activity 35: The Distance/Rate/Time Formula I	Practice 24: The Distance Formula
Activity 36: The Distance/Rate/Time Formula II	Practice 24: The Distance Formula
Activity 37: Setting Up Algebraic Equations I	Practice 25: Setting Up Algebraic Equations
Activity 38: Setting up Algebraic Equations II	Practice 25: Setting Up Algebraic Equations
Activity 39: Inequality Symbols	Practice 26: Inequality Symbols
Activity 40: Inequalities with Variables	Practice 27: Inequalities with Variables
Activity 41: Solving Inequalities I	Practice 29: Solving Inequalities
Activity 42: Solving Inequalities II	Practice 29: Solving Inequalities
Activity 43: Solving Inequalities III	Practice 29: Solving Inequalities
Activity 44: Solving Inequalities in Two Steps I	Practice 30: Solving Inequalities in Two Steps
Activity 45: Solving Inequalities in Two Steps II	Practice 30: Solving Inequalities in Two Steps
Activity 46: Simplifying Inequalities	Practice 31: Simplifying Inequalities
Unit 3: Graphing Linear Equations	
Activity 47: Vertical Number Lines	Practice 32: Vertical Number Lines
Activity 48: Graphing Points on the Coordinate Plane I	Practice 33: Graphing Points on the Coordinate Plane
Activity 49: Graphing Points on the Coordinate Plane II	Practice 33: Graphing Points on the Coordinate Plane
Activity 50: Graphing a Line on the Coordinate Plane	Practice 34: Graphing Lines on the Coordinate Plane
Activity 51: The Table Method of Graphing Linear Equations I	Practice 35: The Table Method of Graphing Linear Equations
Activity 52: The Table Method of Graphing Linear Equations II	Practice 35: The Table Method of Graphing Linear Equations
Activity 53: The Intercept Method of Graphing Linear Equations	Practice 36: The Intercept Method of Graphing Linear Equations
Activity 54: Finding Linear Slope I	Practice 37: Finding Linear Slope
Activity 55: Finding Linear Slope II	Practice 37: Finding Linear Slope
Activity 56: The Formula for Finding Slope I	Practice 38: The Formula for Finding Slope
Activity 57: The Formula for Finding Slope II	Practice 38: The Formula for Finding Slope
Activity 58: Positive and Negative Slope	Practice 39: Positive and Negative Slope
Activity 59: Graphing a Line When You Know the Slope and One Point	Practice 40: Graphing a Line When You Know the Slope and One Point
Unit 4: Polynomial Operations	
Activity 60: Adding and Subtracting Terms	Practice 41: Adding and Subtracting Like Terms
Activity 61: Ordering Polynomials I	Practice 42: Ordering Polynomials
Activity 62: Ordering Polynomials II	Practice 42: Ordering Polynomials
Activity 63: Adding and Subtracting Polynomials	Practice 43: Adding and Subtracting Polynomials

Use Chart, *continued*

POWER BASICS WORKBOOK	STUDENT TEXT PRACTICE
Activity 64: Multiplying Variables with Exponents	Practice 44: Multiplying Variables with Exponents
Activity 65: Multiplying Monomials I	Practice 45: Multiplying Monomials
Activity 66: Multiplying Monomials II	Practice 45: Multiplying Monomials
Activity 67: Dividing Variables with Exponents	Practice 46: Dividing Variables with Exponents
Activity 68: Dividing Monomials	Practice 47: Dividing Monomials
Activity 69: Multiplying a Polynomial by a Monomial I	Practice 48: Multiplying a Polynomial by a Monomial
Activity 70: Multiplying a Polynomial by a Monomial II	Practice 48: Multiplying a Polynomial by a Monomial
Activity 71: Multiplying Binomials I	Practice 49: Multiplying Binomials
Activity 72: Multiplying Binomials II	Practice 49: Multiplying Binomials
Activity 73: Multiplying Binomials III	Practice 49: Multiplying Binomials
Activity 74: Multiplying Special Binomials	Practice 50: Multiplying Special Binomials
Activity 75: Finding Factors	Practice 51: Finding Factors
Activity 76: Finding the Greatest Common Factor I	Practice 52: Finding the Greatest Common Factor
Activity 77: Finding the Greatest Common Factor II	Practice 52: Finding the Greatest Common Factor
Activity 78: The Differences Between Two Squares I	Practice 53: The Difference Between Two Squares
Activity 79: The Difference Between Two Squares II	Practice 53: The Difference Between Two Squares
Activity 80: Factoring Trinomials I	Practice 54: Factoring Trinomials
Activity 81: Factoring Trinomials II	Practice 54: Factoring Trinomials
Activity 82: Factoring Other Negative Trinomials I	Practice 56: Factoring Other Negative Trinomials
Activity 83: Factoring Other Negative Trinomials II	Practice 56: Factoring Other Negative Trinomials
Activity 84: Factoring Other Negative Trinomials III	Practice 56: Factoring Other Negative Trinomials
Activity 85: Combining Factoring Skills	Practice 58: Combining Factoring Skills
Unit 5: Quadratic Equations	
Activity 86: What Is a Quadratic Equation?	Practice 59: What Is a Quadratic Equation?
Activity 87: Making Quadratic Equations Equal Zero	Practice 61: Making Quadratic Equations Equal Zero
Activity 88: Solving Special Binomial Quadratic Equations I	Practice 62: Solving Special Binomial Quadratic Equations
Activity 89: Solving Special Binomial Quadratic Equations II	Practice 62: Solving Special Binomial Quadratic Equations
Activity 90: Solving Special Binomial Quadratic Equations III	Practice 62: Solving Special Binomial Quadratic Equations
Activity 91: Solving Perfect Square Quadratic Equations	Practice 63: Solving Perfect Square Quadratic Equations
Activity 92: Types of Quadratic Equations Solved by Factoring	Practice 64: Types of Quadratic Equations Solved by Factoring
Activity 93: Solving the Four Types of Quadratic Equations I	Practice 65: Solving the Four Types of Quadratic Equations
Activity 94: Solving the Four Types of Quadratic Equations II	Practice 65: Solving the Four Types of Quadratic Equations

Use Chart, *continued*

POWER BASICS WORKBOOK	STUDENT TEXT PRACTICE
Activity 95: Solving the Four Types of Quadratic Equations III	Practice 65: Solving the Four Types of Quadratic Equations
Activity 96: The Quadratic Formula I	Practice 66: The Quadratic Formula
Activity 97: The Quadratic Formula II	Practice 66: The Quadratic Formula
Activity 98: The Quadratic Formula with Negative Coefficients I	Practice 67: The Quadratic Formula with Negative Coefficients
Activity 99: The Quadratic Formula with Negative Coefficients II	Practice 67: The Quadratic Formula with Negative Coefficients
Activity 100: Using the Quadratic Formula to Solve Word Problems	Practice 68: Using the Quadratic Formula to Solve Word Problems

Unit 1: Algebra Basics

This unit presents the concepts students will need as a foundation for algebra. The first lesson gives an overview of signed numbers. In the second lesson, once students are comfortable with negative and positive numbers, they learn how to do operations with signed numbers, including multiplying and dividing with negative numbers. Lesson 3 builds on this knowledge to introduce basic algebra concepts such as using variables to represent unknown numbers. Students then learn how to combine numbers and variables in algebraic expressions. Lesson 4 introduces the idea of equations, including equations with variables and algebraic expressions.

Lesson 1—Negative and Positive Numbers

Goal: To Identify negative and positive numbers

WORDS TO KNOW

absolute value	the distance of a number from zero on a number line; written as $\|x\|$
actual value	what a number is really worth, as opposed to its absolute value
negative number	a number with a value of less than zero; the opposite of a positive number
positive number	a number with a value of more than zero; the opposite of a negative number. It may or may not be indicated with a plus sign (+).
signed number	a positive or negative number; its value in relation to zero can be shown by a plus (+) or minus (–) sign.

Lesson 2—Operations with Signed Numbers

Goal: To learn how to add, subtract, multiply, and divide positive and negative numbers

WORDS TO KNOW

subtrahend	in a subtraction problem, the number to be subtracted, or taken away, to find the difference between the two numbers; in 7 – 5, the subtrahend is 5.
sum	the answer to an addition problem

Lesson 3—Algebra Concepts

Goal: To understand and use basic algebra terms and concepts

WORDS TO KNOW

algebraic expression	an expression that includes at least one variable, such as $x + 8$
coefficient	a constant that multiplies a variable; for example, in $9x$, 9 is the coefficient of x.
combining like terms	adding or subtracting like terms—numbers with the same variable and the same exponent—to make an expression shorter
dividend	in a division problem, the number that is to be divided by the other number; in $42 \div 6$, the dividend is 42.
divisor	in a division problem, the number that divides the dividend; in $42 \div 6$, the divisor is 6.
expression	a mathematical phrase that combines operations, numbers, and/or variables
like terms	terms that have the same variable and the same exponent; in the algebraic expression $3y^2 + 6y + 2y + 4$, the like terms are $6y$ and $2y$.
parentheses	a pair of curved marks ( ) with two uses in algebra. Parentheses are used to show that the number or numbers inside the parentheses should be multiplied by the number outside the parentheses, for example, $3(2 + 4)$. They are also used to separate mathematical expressions, for example, $(2 + 3) – (1 + 1)$.
solve	to find the value of the variable that makes a number sentence true
term	a number, a variable, or a combination of numbers and variables
unknown number	a number whose value is not known
variable	a letter or other symbol that represents a number. A variable does not always represent one specific number; its value can change, or vary.

Lesson 4—Algebraic Equations

Goal: To learn how to combine like terms, perform inverse operations, and check your work

WORDS TO KNOW

equation	a number sentence that says that one expression is equal to another; formed by placing an equal sign between the two expressions. Equations may include variables, as in $3 – n = 10$.

inverse operation operation that is the inverse, or opposite, of another operation, and undoes the action of that operation. Addition and subtraction are inverse operations; multiplication and division are inverse operations.

solution the value for a variable that makes an equation true

Notes on Application Activities in Student Text

Activity	Skills Applied	Product
People in Math	gathering information preparing a written presentation	paragraph
Patriotic Percentages	gathering information critical thinking computing	original equations

Additional Activity Suggestions

- Give your learners a sense of how negative numbers are used in real life. Have learners look at financial or business-related charts and graphs with a negative range (for example, the stock pages in the newspaper). Ask them to see how information such as debts, losses, trade deficits, budget deficits, and so on (concepts expressed in negative terms) are expressed and tracked.

- Many learners may have trouble recognizing the relevance of algebra to real life. Have them research how algebra is related to other fields of study. Many of the sciences, for example, use algebra because it allows scientists to symbolically represent things and relations between things. Ask students to choose a particular career field and describe its use of algebra.

Mental Math

- To reinforce skills with negative numbers, orally present learners with a string of operations such as "Start with the number three. Subtract seven. Multiply the result by minus two. Add eight to the result" and so forth. Learners should not write anything down or use calculators to keep up with you. If at the end many learners are no longer correct, go over spots that might have given them trouble, such as getting the wrong sign when multiplying negatives.

Differentiation

- Review the translation of word problems into equations. For example, "$5 is what percent of $20?" becomes $5 = x\%\ (20)$. Have learners keep a log of their activities for a week and then figure the percentage of time they spend on their jobs, schoolwork, home care, eating, leisure, and so forth. Be sure they use the algebraic formula for their calculations.

Unit 2: Solving Equations and Inequalities

This unit builds on students' understanding of solving simple equations. Lesson 5 presents the different approaches for solving simple equations, then combines approaches to solve more complex equations, such as equations with fractional coefficients and equations with squared variables. Students also learn how to use the distance formula and how to set up algebraic equations. Lesson 6 introduces the concept of inequalities. Students learn the meanings and uses of the different inequality symbols and how to solve inequalities.

Lesson 5—Solving Equations

Goal: To learn how to simplify and solve equations and equations with squared variables

WORDS TO KNOW

constant — a term that has no variable; the value remains constant.

cubed — multiplied by itself, then by itself again; shown with the exponent 3, as in 4^3, or $(4 \bullet 4 \bullet 4)$

denominator — the number on the bottom of a fraction

distance formula — a general rule for finding the distance covered, if you know the rate and time traveled. Distance = (rate) (time), or $d = rt$.

exponent — a small, raised number that shows repeated multiplication of the same factor. The number in the exponent shows how many times the number is used as a factor, such as 5^3, in which 5 is used as a factor 3 times: $5 \bullet 5 \bullet 5$.

formula — a general rule for finding the value of something; often written with variables

numerator — the number on the top of a fraction

reciprocal — one of two numbers whose product is 1; the reciprocal of any number x is $\frac{1}{x}$. For example, 7 and $\frac{1}{7}$ are reciprocals of each other, since $7 \bullet \frac{1}{7} = 1$.

square root — the square root of a number is the factor that, when multiplied by itself, gives the number. The symbol for "square root of" is $\sqrt{\ }$, as in $\sqrt{9} = 3$.

squared — multiplied by itself; can be shown with the exponent 2, as in 3^2, or $3 \bullet 3$

squared variable — a variable that is multiplied by itself, shown with the exponent 2, as in x^2, or $x \bullet x$

Lesson 6—Solving Inequalities

Goal: To learn to solve for variables in inequalities

WORDS TO KNOW

inequality	a mathematical statement that says that two expressions may not be equal; formed by placing an inequality symbol ($\neq$, $>$, $<$, $\geq$, $\leq$) between the expressions
inequality symbol	symbol that shows that two expressions may not be equal
simplify	collect like terms

Notes on Application Activities in Student Text

Activity	Skills Applied	Product
Saving Your Money	gathering information computing critical thinking	optional activity: graph
Road Trip!	computing critical thinking problem solving	travel plan
The Price of Credit	gathering information computing preparing a visual presentation	optional activity: line graph

Additional Activity Suggestions

- Have learners write word problems about the ages of their friends or family members, such as "My aunt is 6 years older than my mother. My mother is 24 years older than I am. I am 16. How old is my aunt?" Learners can then exchange problems and set up algebraic equations to figure out the ages of their classmates' friends and family members.

- To give learners a physical demonstration of adding together like terms, have the members of your class organize themselves into groups of "like terms." Use a parameter such as the first letter of their first names, or the type of shoes they are wearing as the basis for grouping. After the learners have regrouped themselves, give them a new parameter and have them regroup.

Differentiation

- You can use small objects such as pennies to help your learners understand that working with inequalities is the same as working with equations. Start by asking learners to put a set number of pennies on one side of their desks and an unequal number of pennies on the other side. Ask them to perform various simple operations on both groups of objects to drive home the fact that no matter what they do or how many different things they do, as long as they do everything to both piles, the relationship between the piles will stay the same: the pile that started out greater will remain greater, and the pile that started out smaller will remain smaller. (Dividing by a negative number is an exception to this rule—if an inequality is divided by a negative number, the direction of the sign changes. However, since dividing by a negative number is something that can't be shown physically, this exception shouldn't make the exercise less effective.)

- Use manipulatives to give learners a concrete understanding of equations. Use transparencies or actual objects such as counters. If you use actual objects, write the equal sign and operation signs on pieces of paper or oaktag.

  Start by showing simple equations without variables. For example, to show $3 + 1 = 4$, arrange 3 counters in one pile and 1 counter in another pile, then put a card with a plus sign between the piles. Add an equal sign. Then arrange 4 counters in a pile on the other side of the equal sign.

  Next, move on to equations with variables by placing unequal quantities of items on either side of the equal sign; for example, place 4 items on the left and 6 items on the right. Ask learners if the number of items on each side of the equal sign is the same. (No.) Ask them what you need to do to make both sides the same. (Add 2 counters to the left side.) Follow students' directions to make both sides the same. Then set up an equation where some objects on one side are hidden from view. For example, you might arrange 6 items on the left side of the equation in two groups of 3, then cover one group with a sheet of paper. Arrange 6 items on the right of the equal sign. Ask students how the items under the paper would be described in algebraic terms. (An unknown number or unknown quantity.) Next, ask how you could represent the unknown quantity. (With a variable.) Allow students to agree on a variable to represent the unknown quantity and write it on the paper covering the hidden items. Then have them direct you to solve for the variable by performing inverse operations, adding or subtracting objects on both sides. For example, if your equation was 3 items + x items = 6 items, students should direct you to take 3 items from each side to get x by itself. Then ask students to describe the solution in algebraic terms. ($x = 3$.) Lift the paper with the variable on it to reveal the objects below, showing that the solution is correct.

  If you like, follow up on this demonstration by having students work in pairs or small groups with counters or other manipulatives to create and solve several equations in the same way.