

Using a Calculator

Did you know that scientific and graphing calculators both use the order of operations in computations?

Enter $6 + 8 \times 2 - 15$ into a scientific or graphing calculator. You should get 7 as your answer. The multiplication was done first, followed by addition and subtraction from left to right. If you try this on a four-function calculator, you will get an answer that is very different because operations are performed in the order in which they are entered.

Another great feature of scientific and graphing calculators is the parenthesis key(s). They typically look like this: Ⓒ and Ⓓ or Ⓔ

These keys help to group operations that should be executed first.

Different calculators sometimes require different keys or key strokes to achieve the right solution. Learn how to perform different operations on your calculator as well as how to use the parenthesis key to group parts of an expression or equation. Getting to know your calculator is an important part of being a savvy algebra student.

Follow-up Discussion & Activities

- Have students discuss the mathematical meaning of the word “variable.” Is it accurate to say that a variable is “an unknown quantity”? Have students explain their response. Then, brainstorm examples of problems or situations where they would use variables.
- Practice combining like terms to simplify expressions by writing a very long algebraic expression on the board. Ask students to identify all of the like terms, then combine them to write an expression in simpler form. Is the expression in its “simplest form”?
- Ask students to explain why the order of operations is important when working with expressions and equations. Have students explore what might happen if they did not follow this order by solving several problems using both the correct and incorrect order of operations.
- Many algebra problems contain real numbers that are not integers. Have students simplify simple expressions and solve simple equations containing decimals or fractions to increase their familiarity and ease potential frustrations with these kinds of problems.
- Have students practice taking written sentences and translating them into accurate mathematical statements. Include phrases students often mistranslate, like “twenty subtracted from a number” (which students often write as $20 - x$, when in fact it is $x - 20$).
- Utah State’s National Library of Virtual Manipulatives, located at nlvm.usu.edu/en/nav/topic_t_2.html, is an interactive library stocked with algebra tiles, pentominoes, and other algebra activities that will challenge students and help them become better algebraic thinkers.

Suggested Internet Resources

Periodically, Internet Resources are updated on our web site at www.LibraryVideo.com.

- mtn.merit.edu/resources/math/algebra.html
The Michigan Teacher Network has gathered dozens of web sites that support common math standards in the area of algebra.
- www.mathforum.org/dr.math
Dr. Math answers student and teacher questions in the “Ask Dr. Math” section of “The Math Forum,” a Drexel University site that contains resources and activities to aid all math learners and instructors.
- www.pen.k12.va.us/Div/Winchester/jhhs/math/lessons/algebra.html
The Mathematics Department of John Handley High School in Winchester, VA has assembled an extensive list of algebra lesson plans, worksheets, puzzles and activities.

Suggested Print Resources

- The Math Forum. *Dr. Math Gets You Ready for Algebra: Learning Pre-Algebra Is Easy! Just Ask Dr. Math!* John Wiley & Sons, Incorporated, Hoboken, NJ; 2003.
- Muschla, Judith A. and Gary Robert Muschla. *Algebra Teacher's Activities Kit: 150 Ready-to-Use Activities with Real-World Applications.* John Wiley & Sons, Incorporated, Hoboken, NJ; 2003.

TEACHER'S GUIDE

James Fanelli, M.A. & Megan Carnate, M.Ed.
Curriculum Specialists, Schlessinger Media

TITLES IN THIS SERIES

- ANALYZING INEQUALITIES
- EXPONENTIAL FUNCTIONS
- FUNCTIONS & RELATIONS
- LINEAR EQUATIONS & SLOPE
- PATTERNS & FORMULAS
- POLYNOMIALS
- PYTHAGOREAN THEOREM & RIGHT TRIANGLES
- QUADRATIC FUNCTIONS
- SYSTEMS OF LINEAR EQUATIONS
- VARIABLES, EXPRESSIONS & EQUATIONS

Teacher's Guides Included
and Available Online at:



800-843-3620



Teacher's Guide and Program Copyright 2007 by Schlessinger Media,
a division of Library Video Company

P.O. Box 580, Wynnewood, PA 19096 • 800-843-3620

Executive Producer: Andrew Schlessinger

Programs produced and directed by Center City Film and Video

All rights reserved.

B0790
V6740

Algebra

for Students.

Variables, Expressions & Equations

Grades 7-12

In algebra, students are challenged to make a leap, from the concrete world of numbers and real objects, to an abstract one of letters and symbols. *Algebra for Students* is designed to help students to become more comfortable in the abstract world of algebra through the exploration of problems in the real world, from using a system of linear equations to calculate the cost of a sushi roll to using a quadratic function to describe the path of a kicked football. Animated graphics, real-life locales and vibrant young hosts help to explain math concepts, highlight multiple ways of approaching a problem, illustrate common pitfalls to avoid and tackle some typical test questions.

This guide provides a program overview, background knowledge needed for understanding, vocabulary, discussion questions and activities, tips for using a calculator, as well as print and Internet resources to supplement the teaching of targeted algebra concepts.



Program Overview

Algebra is a way of understanding patterns to explain and solve real-world problems. Many situations, from the age difference between a father and son to the number of slices in a pizza, can be modeled by algebraic expressions, variables and operational symbols.

Expressions with many terms are often simplified to make them easier to evaluate. Like terms, which contain exactly the same variables raised to exactly the same power, are combined using various algebraic properties, such as the Associative and Commutative Properties, to create a simpler expression. Expressions are evaluated by substituting values for all variables and performing the appropriate mathematical calculations according to the order of operations.

The power of algebra is the ability to model a real-world situation, like the cost of items at a movie theater, with an equation, and obtain quantitative information about the situation by solving the equation. Some algebraic equations are relatively simple and solved in just one or two steps, while other equations are more complex and require multiple mathematical manipulations in order to obtain a solution.

Background

Before studying the content discussed in the video, students should already:

- Understand the meanings of basic arithmetic operators.
- Know properties of real numbers and their applications.
- Understand order of operations and how to apply the rules for order of operations.
- Have an introduction to the Associative Property, the Commutative Property and the Distributive Property.

Vocabulary

variable — A symbol, usually a letter, that represents a number or set of numbers that can change.

constant — A known quantity that stays the same; or, a monomial that is a real number.

algebraic expression — A mathematical phrase that contains constants, variables and operational symbols. Expressions do not contain equality or inequality signs.

term — A constant, a variable, or the product or quotient of constants and variables.

coefficient — A numerical factor multiplied by a variable or variables in an expression.

monomial — A number, a variable, or a product of a number and one or more variables.

(Continued)

polynomial — A monomial or a sum or difference of monomials.

binomial — A polynomial with two terms.

trinomial — A polynomial with three terms.

simplifying an expression — Making an expression more manageable, while retaining equality, by combining like terms and using algebraic properties to reduce the number of terms and operator symbols.

like terms — Terms that contain exactly the same variables raised to exactly the same power. Combining like terms is the grouping together of like terms, by adding or subtracting, so that an expression is in its simplest form.

Commutative Property — A rule stating that the order in which addends or factors are added or multiplied does not change the value of the expression. For any real numbers a and b , $a + b = b + a$ and $a \cdot b = b \cdot a$.

Associative Property — A rule stating that the way in which addends or factors are grouped during addition or multiplication does not change the value of the expression. For any real numbers a , b and c , $(a + b) + c = a + (b + c)$ and $(a \cdot b) \cdot c = a \cdot (b \cdot c)$.

Distributive Property — A rule stating that the product of a number and the sum or difference of two numbers equals the product of the sum or difference of the two numbers. For any real numbers a , b and c , $a(b + c) = ab + ac$ and $a(b - c) = ab - ac$.

order of operations — The rules telling what order to perform operations within an equation: (1) simplify within parentheses or other brackets; (2) simplify exponents; (3) multiply and divide from left to right; and (4) add and subtract from left to right.

evaluating an expression — Assigning numeric values to the variables in an expression and then calculating its value using the order of operations.

equation — A mathematical sentence stating that two expressions are equal.

solving an equation — Finding all the values of a variable that makes an equation a true statement.

isolating the variable — Using the properties of equality to get a variable by itself and with a coefficient of one on one side of an equation.

Properties of Equality — A set of rules stating that any value added, subtracted, multiplied or divided on one side of an equation must undergo the same operation using the same value on the other side of the equation, allowing both sides of the equation to remain balanced.

Pre-viewing Discussion

- A basic understanding of the arithmetic operations involving real numbers is an essential skill for algebra students. Review the addition, subtraction, multiplication and division of real numbers with students, including calculations that involve integers and decimals. (Continued)

- Have students look through math textbooks from younger grades and identify basic addition, subtraction, multiplication and division number sentences. Discuss how unknown values are shown, whether it's with a question mark, blank line, or empty square. Ask students to explain the strategies they have used in the past to solve these number sentences.
- Consider the expression $4 \times 10 - 16 \div 8 + 7$. Ask students to find the value of the expression and explain the steps they took. Is more than one correct answer possible?

Problems

1. Consider the expression $2x^2 + 2y - 4x - 5y + xy^2 + x^2$.
 - (a) Identify all sets of like terms in the expression.
 - (b) Simplify the expression.
 - (c) Evaluate the expression when $x = 2$ and $y = 5$.
2. Susan's mother is 72 years old. She is 12 years older than twice Susan's age. How old is Susan? Check your solution.

Solutions

1. (a) There are two sets of like terms in the expression: $2x^2$ and x^2 ; $-5y$ and $2y$.
 - (b) Use the Associative and Commutative Properties to rearrange and group the like terms, then simplify:
$$2x^2 + 2y - 4x - 5y + xy^2 + x^2 = (2x^2 + x^2) - 4x + (2y - 5y) + xy^2$$
$$= 3x^2 - 4x - 3y + xy^2$$
 - (c) $3x^2 - 4x - 3y + xy^2 = 3(2)^2 - 4(2) - 3(5) + (2)(5)^2$
$$= 3(4) - 8 - 15 + (2)(25)$$
$$= 12 - 8 - 15 + 50$$
$$= 39$$
2. Let x equal Susan's age. Susan's mother is 12 years older than twice Susan's age, which is represented by the expression $2x + 12$, and is equal to 72. This results in the equation $2x + 12 = 72$. Now solve for x :
$$2x + 12 = 72$$
$$\underline{- 12 = - 12}$$
$$2x = 60$$
$$\underline{\frac{2x}{2} = \frac{60}{2}}$$
$$x = 30 \quad \text{Susan is 30 years old.}$$
Check the solution by substituting 30 for x in the original equation:
$$2x + 12 = 72$$
$$2(30) + 12 \stackrel{?}{=} 72$$
$$60 + 12 \stackrel{?}{=} 72$$
$$72 = 72 \quad \checkmark$$