



The Key Elements to Algebra Success

Teacher's Edition

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The Key Elements to Algebra Success

The Key Elements to Algebra Success is a supplemental program that is compatible with any algebra textbook. Ten key elements of algebra have been identified as a result of a review of research literature and input from teachers. The 46 lessons in this book address the key elements of algebra concepts that students find most challenging to understand and master.

Table of Contents

The table of contents provides a list of all lesson topics included in the book and is organized into 10 Key Elements allowing teachers to easily access those lesson topics and themes needed for their students. Additional activities and graphic organizers that complement the lessons are located at the back of the book.

Multiple Representations:

Multiple representations of the concept are incorporated in each lesson. These representations include concrete, pictorial, procedural, verbal descriptions, graphs, tables, formulas, and a problem-solving paradigm. The multiple representations provide students with different learning styles and abilities the opportunity to acquire and apply knowledge of the lesson concept.

Manipulatives

The use of manipulatives is an essential part of discovery-based learning. A manipulative kit is provided with the materials teachers need to present the concepts at the concrete level. There is an overhead transparency set for the teacher to use in modeling the concept and a set of manipulatives for each student to use. The hands-on learning in *The Key Elements to Algebra Success* is an important component that helps students understand the concepts at a foundational level.

Pictorial Representations

Pictorial representations help to scaffold student learning from the concrete to the abstract, or symbolic, level. Students become proficient at the pictorial level through modeling, guided practice, and opportunities for independent practice.

SOLVE

SOLVE is a 5-step problem-solving paradigm taught in the first lesson of *The Key Elements to Algebra Success* and throughout the program. SOLVE is an acronym which gives students step-by-step strategies for finding the solutions to word problems. The ultimate goal of *teaching* SOLVE is to provide students with a problem-solving strategy that can be applied to any concept they will encounter in algebra. The steps are as follows:

S Study the Problem

Underline the question.

Answer the question, "What is this problem asking me to find?" in your own words.

O Organize the Facts

Identify the facts.

Eliminate the unnecessary facts.

List the necessary facts.

L Line up a Plan

Choose an operation or operations.

Write in words what your plan of action will be.

V Verify Your Plan with Action

Estimate your answer.

Carry out your plan.

E Examine Your Results

Does your answer make sense? (Compare your answer to the question.)

Is your answer reasonable? (Compare your answer to the estimate.)

Is your answer accurate? (Check your work.)

Write your answer in a complete sentence.

Graphic Organizers

The graphic organizers are intended to be used as an integral part of the lessons. They are designed to help students organize and display the concepts and information provided during the lessons. The graphic organizers also function as visual learning resources and review tools for the student.

Cooperative Pairs

Working in cooperative pairs is a vital part of *The Key Elements to Algebra Success*. Cooperative learning allows students at various performance levels to work together, using a variety of learning activities, to improve their understanding. Communication about the learning process is an essential element of working in cooperative pairs. This dialogue enhances student learning and creates a sense of responsibility on the part of the students. Cooperative learning can be a catalyst in creating an atmosphere of achievement and a sense of accomplishment on the part of the students when the task is successfully completed.

Lesson Design**Suggested Times**

Lessons have been designed for a 50 to 70 minute class period. Suggested times are provided as a guideline for each lesson, indicating the instructional time needed for each section of the lesson. Each lesson also includes an “If Time Permits” section with additional activities that can be used beyond the 50 to 70 minute lesson base.

Essential Questions

Essential Questions are provided at the beginning of each lesson. The purpose of these questions is to provide the framework for the lesson and guide the learning process. The essential questions are used not only at the beginning of the lesson, but are also an important part of the lesson closure.

Warm-Up

Each lesson begins with a warm-up activity that connects previously learned skills and concepts to the current topic. The warm-up sets the stage for new concepts being introduced in each lesson.

Word Problem Opening

Throughout the program, each lesson concept is bracketed with the SOLVE problem-solving method. Along with the essential question, the “S” step of SOLVE is introduced at the beginning of the lesson. This helps to guide the learning of the student as they progress through the lesson.

Levels of Teacher Support

The lessons are carefully designed with opportunities for modeling, guided practice, and independent practice.

Modeling:

Each lesson contains “modeling boxes” which list step by step instructions on how to model each concept. Modeling steps are provided for concrete, pictorial, and procedural steps of the lesson.

Guided Practice:

Detailed instructions about how to structure guided practice are given in each lesson. Guided practice is led and closely monitored by the teacher. Students may work individually or in pairs during the guided practice.

Independent Practice:

Independent practice is provided through practice problems and homework in each lesson. Independent practice is structured to take place in the lesson following modeling and guided practice sections. Teachers can use the independent practice as a tool for informal formative assessment.

Word Problem Closure

At the end of the lesson, the SOLVE problem introduced at the beginning of the lesson is revisited. The student completes the additional steps of SOLVE, applying the lesson concept in a problem-solving situation.

Closure

Closure is a crucial part of every lesson and provides the teacher an opportunity to evaluate if the lesson objectives have been met. Teachers use the essential questions to reinforce the concept from the lesson, help organize the learning, and bring the lesson to its conclusion. A quick discussion of the essential questions will allow the teacher to informally assess student understanding of the material.

Homework

Homework is provided at the end of each lesson to give students ample opportunity to practice the lesson concept.

Quizzes

The lesson quizzes consist of 10 multiple-choice questions. These 10 questions cover the material taught in the lesson. The quizzes can also be used as homework, class work, review for a test, or as warm-ups.

Review Activities

Review activities are provided for many lessons. There are a variety of engaging activities including scavenger hunts, chain reactions, “I Have, Who Has”, and Mystery Squares. The activities are designed to provide multiple practice opportunities for the students in puzzle and game formats. The review activities incorporate the essential elements of cooperative learning and communication about the concepts.

The Key Elements to Algebra Success and the English Language Learner (ELL)

- **SOLVE** – SOLVE is a step-by-step procedure to attack word problems. SOLVE helps students to identify key words needed to solve the problem and to map out a plan with pictures and phrases. Steps can be written in the student's native language while they are still becoming familiar with the process of SOLVE and gradually transitioning into English.

The steps of SOLVE have been modified slightly for use with ELL students. The modified steps provide additional support and involve verbal communication about the process, which is a vital link for the ELL student:

S - Underline the question. TPIAMTF (This problem is asking me to find) – the _____. The students cannot just restate the question if they start their answer with the word "the".

O - Circle the necessary facts. Be as brief as possible and teach the students abbreviations right away - (\$, #, lb, cm, pkg. etc.)

L - Choose an operation and discuss a plan out loud. – +, •, /

number of nuts + number of bolts = total

total • number of boxes = answer

V - Estimate out loud, do the math. Estimate (ballpark figure sometimes) then fill in blanks in the L step.

E - Choose your answer.

- **Cooperative Pairs** – Cooperative learning provides the opportunity to work, question, and communicate with others regarding mathematics at all stages of learning. Activities are done in an interactive setting, encouraging language development along with mathematical development. This includes the pairing of ELL students who speak the same language(s) with others who may be at varying stages of their English language development.

- **Modeling with Manipulatives** – Students participate in activities leading to the discovery of on-grade-level mathematical concepts. Through this process, they develop mathematical understanding while exploring ways of expressing their discoveries in English. Manipulative use is consistent throughout the program. The appearance of each manipulative, their meaning, as well as the language used to describe the actions of these manipulatives remain the same throughout.
- **Word Walls** – Updated through the use of KEAS lessons, new math vocabulary words (and their meaning/pictorial representation) are added for every new concept as they are discovered. The Word Wall is an interactive tool for all learners and provides an additional language resource for ELL students. Additionally an Operation Word Wall is created by each class and used for solving word problems throughout the year. As an added resource, words can be written in both English and the native language of the learner. Pictures/descriptions are also encouraged next to words wherever appropriate.
- **Video Clips of Each Lesson** – Clips are available for use in class at www.algebrakeyelements.com, the video clips can help overcome the significant classroom language barriers ELL students face. These video clips, model the concepts, procedures, and show key vocabulary words in English as a way of familiarizing students with appropriate vocabulary used to build a concept.

Algebra Success Materials List

Lesson 1:

Paper for foldable (3 sheets of different colors for each student)

Lesson 2:

Overhead integer chips
Red and yellow counters for students

Lesson 3:

Overhead integer chips
Red and yellow counters for students

Lesson 4:

Overhead integer chips
Red and yellow counters for students
Paper for foldable (1 sheet per student)

Lesson 5:

Overhead integer chips
Red and yellow counters for students

Lesson 6:

Overhead integer chips
Red and yellow counters for students
Wall-size four-quadrant grid
Optional: graphing calculators

Lesson 7:

Overhead integer chips
Red and yellow counters for students
Cups

Lesson 8:

Overhead integer chips
Red and yellow counters for students
Cups

Lesson 9:

Overhead integer chips
Red and yellow counters for students
Cups

Lesson 12:

Straightedge
Wall-size four-quadrant grid
Optional: Red and blue markers for students (or any two different colors)
Optional: Red and blue overhead pens (or any two different colors)

Lesson 13:

Tape measures
Paper for the foldable (1 sheet per student)
Wall-size four-quadrant grid
Scissors

Lesson 14:

Wall-size four-quadrant grid

Lesson 15:

Wall-size four-quadrant grid

Lesson 16:

Wall-size four-quadrant grid

Lesson 17:

Paper for the foldable (1 sheet per student)
Wall-size four-quadrant grid

Lesson 18:

Paper for the foldable (1 sheet per student)
Wall-size four-quadrant grid
Optional: graphing calculators

Lesson 19:

Wall-size four-quadrant grid

Lesson 20:

Wall-size four-quadrant grid
Optional: graphing calculators

Lesson 21:

Wall-size four-quadrant grid
Tape Measures
Optional: graphing calculators

Lesson 22:

Wall-size four-quadrant grid
Optional: graphing calculators

Lesson 23:

Wall-size four-quadrant grid
Paper for the foldable (1 sheet per student)
Scissors
Optional: graphing calculators

Lesson 24:

System of Equations foldable from Lesson 23

Lesson 25:

System of Equations foldable from Lesson 23
Optional: graphing calculators

Lesson 27:

Optional: graphing calculators

Lesson 29:

Overhead algebra tiles
Student red and yellow algebra tiles for each cooperative pair

Lesson 30:

Overhead algebra tiles
Student red and yellow algebra tiles for each cooperative pair

Lesson 31:

Overhead algebra tiles
Student red and yellow algebra tiles for each cooperative pair

Lesson 33:

Overhead algebra tiles
Student red and yellow algebra tiles for each cooperative pair

Lesson 34:

Overhead algebra tiles
Student red and yellow algebra tiles for each cooperative pair
Paper for the foldable (1 sheet per student)
Scissors

Lesson 35:

Overhead algebra tiles
Student red and yellow algebra tiles for each cooperative pair

Lesson 36:

Calculators
Wall-size four-quadrant grid
Paper for the foldable (1 sheet per student)
Scissors
Optional: graphing calculators

Lesson 37:

Calculators
Optional: graphing calculators

Lesson 38:

Calculators

Lesson 39:

Optional: graphing calculators

Lesson 40:

Overhead integer chips

Red and yellow counters for each cooperative pair

Calculators

Tape measures

Paper for the foldable (1 sheet per student)

Scissors

Lesson 41:

Any type of Straightedge

Lesson 42:

Scissors

Calculators

Lesson 43:

Calculators

Protractor

Any type of Straightedge

Lesson 44:

Number cubes

Red and yellow counters for each cooperative pair

Paper for the foldable (1 sheet per student)

Calculators

Lesson 45:

Paper for the foldable (3 sheets per student)

Calculators

Lesson 46:

Overhead integer chips

Red and yellow counters for each cooperative pair

Algebra Success Word Wall

Lesson 1

SOLVE Posters

Addition

Sum
Increase
Plus
More than
Add

Subtraction

Minus
Difference
Less Than
Subtract

Multiplication

Product
Times
Of
Multiply

Division

Quotient
Split up
Divide

Exponents

To the power of
Square
Cube

Equal

Is
Total

Lesson 2

Integers
Zero pairs
Add "Push together" to
addition

Lesson 3

Add "Take away" to
subtraction
Create the Possibility

Lesson 4

$4 \bullet 2$ gain 4 groups
of positive 2 items
 $4 \bullet ^{-}2$ gain 4 groups
of negative 2 items
 $^{-}4 \bullet 2$ lose 4 groups
of positive 2 items
 $^{-}4 \bullet ^{-}2$ lose 4 groups
of negative 2 items

Lesson 5

$6 \div 2$ Divide 6 into
2 equal groups. How
many are in each group?
 $^{-}6 \div 2$ Divide $^{-}6$
into 2 equal groups. How
many are in each group?
 $^{-}6 \div ^{-}2$ Divide $^{-}6$ into
equal groups of negative
2. How many equal
groups do you have?

Lesson 6

Function
Relation
Input
Output
Independent
Dependent
Domain
Range
Equation
Expression
x-axis
y-axis
Coordinate
Ordered Pairs
x-coordinate
y-coordinate
Origin
Quadrant
 $f(x)$
Linear
Non-linear
Slope
Vertical Line Test

Lesson 7

Variable
Balanced
Inverse Operation

Lesson 8

Constant
Coefficient

Lesson 9

Like Terms

Lesson 10

Inequality
 Less than or equal to (\leq)
 Greater than or equal to (\geq)
 Less than ($<$)
 Greater than ($>$)
 Open circle ($<$ and $>$)
 Closed circle (\leq and \geq)
 Solution

Lesson 11

Absolute Value - $|5|$
 No solution - $|| =$ to a negative
 Distribute
 Greater $>$, \geq



Less than $<$, \leq

**Lesson 12**

Rate of Change
 Vertical Distance
 Horizontal Distance
 Ratio

Lesson 13

Rise
 Run

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
 Positive Slope
 Negative Slope
 Zero Slope
 Undefined Slope

Lesson 14

$y = mx + b$
 $m = \text{slope} = \frac{\text{rise}}{\text{run}}$
 $b = y\text{-intercept}$
 Slope-intercept form

Lesson 15

Horizontal line
 $y = a$ number
 Vertical line
 $x = a$ number

Lesson 16

Standard Form
 $ax + by = c$

Lesson 19

Parallel Lines
 Perpendicular Lines
 Reciprocal
 Right Angle

Lesson 20

Shift up
 Shift down
 Shift left
 Shift right
 Less steep
 Steeper

Lesson 21

Scatter Plot
 Scale
 Break line
 Correlation Coefficient (r)
 Positive Correlation
 Negative Correlation
 No Correlation
 Line of Best Fit

Lesson 22

Linear Inequality
 \leq , solid
 \geq , solid
 $<$, dotted
 $>$, dotted

Lesson 23

Systems of Equations by Graphing
 Intersect in one point
 Parallel – No Solution
 Same line – Many Solutions

Lesson 24

Systems of Equations by Substitution

Lesson 25

Systems of Equations by Combination/Elimination

Lesson 27

System of Linear Inequalities

Lesson 28

Monomials
 Base
 Exponent
 Area
 Length
 Width

Laws of Exponent

$$k^c \cdot k^d = k^{c+d}$$

$$\frac{k^c}{k^d} = k^{c-d}$$

$$k^0 = 1$$

$$k^{-1} = \frac{1}{k}$$

$$(k^c)^d = k^{c \cdot d}$$

$$(k \cdot m)^c = k^c \cdot m^c$$

$$\left(\frac{k}{m}\right)^c = \frac{k^c}{m^c}$$

Lesson 29

Polynomial
Binomial
Trinomial

Lesson 30

Distributive Property

Lesson 31

Box Method
FOIL

Lesson 33

Prime Factorization
Factor
Greatest Common Factor (GCF)

Lesson 34

Split the Middle Term
Factoring by Grouping

Lesson 35

Difference of Squares
 $x^2 - y^2 = (x + y)(x - y)$
Factoring Perfect Squares
Trinomials
 $x^2 + 2xy + y^2 = (x + y)(x + y) = (x + y)^2$
 $x^2 - 2xy + y^2 = (x - y)(x - y) = (x - y)^2$

Lesson 36

Quadratic Equation
Quadratic Functions
 $y = ax^2 + bx + c$
Parabola
Maximum Point
Minimum Point
Vertex
Symmetry
Axis of Symmetry
 $x = \frac{-b}{2a}$

Lesson 38

Exponential Functions
Exponential Growth
Exponential Decay
Initial Amount
Rate
Time

Lesson 39

Matrix
Row
Column
Elements
Scalar Multiplication

Lesson 40

Measures of Central Tendency
Mean
Median
Mode
Measures of Variability
Lower extreme
First Quartile
Third Quartile
Upper Extreme
Range
Interquartile Range
Box-and-Whisker Plots

Lesson 41

Midpoint Formula
 $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Lesson 42

Pythagorean Theorem
 $a^2 + b^2 = c^2$
Distance Formula
 $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

Lesson 43

Line Graphs
Intervals
Title
Histogram
Frequency Table
Tally Marks
Percent
Central Angle
Protractor
Stem-and-Leaf Plot
Stem
Leaf
Misleading Graphs

Lesson 44

Theoretical Probability
Outcomes
Experimental Probability
Simple Probability
Compound Probability
Independent Events
Dependent Events

Lesson 45

Survey
Population
Sample
Census
Random Sample
Bias Sample
Cluster Sample
Quota Sample
Systematic Sample
Convenience Sample

Lesson 46

Radicals
Square Roots $\sqrt{\quad}$
Perfect Squares