Algebra Basics Curriculum *©2016*

Age(s): Lower Elementary & Upper Elementary (8-12 years)

Description:

The Algebra Basics Curriculum was designed to introduce students to the basic concepts of algebra while learning how to balance and equation and solve for an unknown variable. The 3-Level Problem Cards (yellow, orange & red to indicate the Level) allow for multiple lessons and activities of work. Students begin working on simple equations and work their way through solving for unknown variables, inverse operations & positive and negative integers.

Pre-requisites: Student should be familiar with the basics of positive and negative integers, mathematical symbols and vocabulary, & order of operations.

Materials Included:

- Algebra Board & Box
- Equation Card Pieces
- 3-Level Problem Cards
- Curriculum Guide

Notes for the Instructor: This curriculum covers the following concepts:

1. Linear Equation

Linear equations are of the form ax + b = c, where x is some variable, and a, b, and c are real numbers. To solve a linear equation, you perform a series of opposites:

- If a number is added to the term containing x, you subtract that number from both sides of the equation.
- If a number is subtracted from the term containing the variable, you add.
- If a number multiplies the variable, you divide.
- If a number divides the variable, you multiply.

Just be sure that whatever you do to one side of the equation, you also do to the other side. Think of the equation as two expressions pivoting on either side of a balance scale: You need to keep the sides at the same weight.

When solving an equation in algebra, you will often use an opposite operation such as additive inverse or multiplicative inverse (reciprocal) to work your way toward the answer. You have to undo operations that have been done to the variable. The opposite of an operation is another operation that gets you back where you started. This is used primarily to get rid of numbers that are combined with a variable so you can solve for the variable in an equation.

When you need to use the opposite of basic operations — addition, subtraction, multiplication, and division — you need to remember how the additive inverse and multiplicative inverse work:

The **additive inverse** is the number with the opposite sign. So −3 is the additive inverse of 3 and 16 is the additive inverse of −16.

For example, if you have the problem 4 + x = 10, you have to use an opposite operation to solve for the variable x.
4 + x = 10
(4 – 4) + x = (10 – 4)
0 + x = 6
x = 6

The **multiplicative inverse** is also called the **reciprocal**. The reciprocal is the original number written as the bottom of a fraction with a 1 on the top. So 1/2 is the reciprocal of 2. If a number starts out as a fraction, its reciprocal is just that number written upside-down. So the reciprocal of 4/7 is 7/4. Similarly, the reciprocal of 1/25 is 25/1, or simply 25.

You use a reciprocal if a number multiplies or divides a variable; it gets the variable alone so it can be solved for. For example, if you have the problem 5x = 20, you have to use an opposite operation to solve for the variable x.

$$5x = 20$$

$$\left(\frac{1}{5}\right)5x = \left(\frac{1}{5}\right)20$$

$$x = 4$$

2. Variables

Algebra uses letters, called *variables*, to represent numbers that correspond to specific values. Algebraic variables can represent the unknown and what you're solving for in an algebra problem, as well as known or set values.

Usually, if you see letters toward the beginning of the alphabet in a problem, such as *a*, *b*, or *c*, they represent known or set values, and the letters toward the end of the alphabet, such as *x*, *y*, or *z*, represent the unknowns, things that can change, or what you're solving for.

Here are some of the more commonly used variables:

- *n* often represents some unknown quantity or number — probably because *n* is the first letter in number.
- *x* is often the variable you solve for, maybe because it's a letter of mystery. The letter *x* also is used to indicate multiplication (×). You have to be clear when you use an *x*, that you don't mean multiply.
- *C* and *k* are two of the more popular letters used for representing known amounts or constants. The letter *C* is used frequently in calculus and physics, and it's capitalized in those cases — probably due to tradition.

3. Symbols

The basics of algebra involve symbols. Algebra uses symbols for quantities, operations, relations, or grouping. The symbols are shorthand and are much more efficient than writing out the words or meanings.

Addition (+): This symbol means add or find the sum, more than, or increased by; the result of addition is the sum.

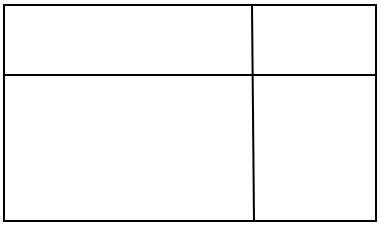
Subtraction (–): This symbol means *subtract*, *minus*, or *decreased by* or *less*; the result is the difference.

Multiplication (×, ·, *): These symbols all mean *multiply* or *times*. The values being multiplied together are the multipliers or factors, and the result is the product. You'll see the dot (·) more often than the times symbol (×) because the dot is easier to write and the times symbol can be confused with the variable *x*

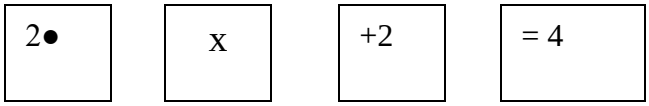
Division (÷, −, /): The division, fraction line, and slash symbols all mean *divide*. The number to the left of the ÷ or / sign or the number on top of the fraction is the dividend. The number to the right of the ÷ or / sign or the number on the bottom of the fraction is the divisor. The result is the quotient.

Presentation I: ***Introduction to Algebra Basics***

1. Remove the wooden algebra board from the box:

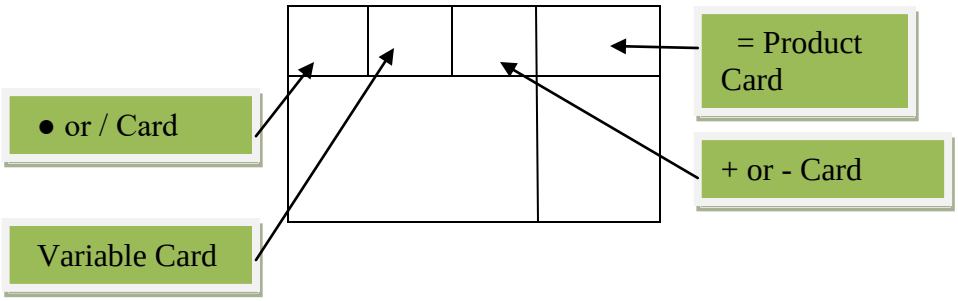


2. ***Assemble the equation pieces into a pile:***



****Please note that the inverse operation is located on the backside of the card.***

3. ***When assembling the equation, make sure that the pieces are in the correct location on the algebra board:***



4. ***Using the equation card pieces, set up the equation 3●x + 4 = 13. The vertical line on the board represents the "equal" sign. Have the student write this same equation in their notebook.***
5. ***Explain the equation as follows: We need to solve for the unknown variable "x". The number "3" is a coefficient of the variable (we are multiplying "x" by 3), and the number "4" and "13" are constants (these numbers do not change).***
6. ***Tell the student, "Our mission is the isolate the "x". This means that we want the "x" (or variable) to be on one side of the equation and everything else on the other side". Another way of stating this is "we are solving for "x"".***
7. ***To do this, we must first eliminate the constant on the left hand side of the equation. Pull the "+4" below the horizontal line and flip it so that it reads "-***

4". This is the inverse of +4. +4 and -4 = 0- thus we have eliminated the constant on the left hand side of the equation.

8. ***Whatever we do on the left hand side of the equation, we must also do to the right side of the equation. So slide the -4 across the vertical line. +13 -4 = 9 (or +9). Replace the "13" with "9".***
9. ***Now we need to eliminate the coefficient. Pull the 3● (multiply by 3) down below the horizontal line and flip it over so that it reads /3 (divided by 3). 3/3 = 1. 1x is the same as x (identity property of multiplication), so we have eliminated the coefficient from the left hand size of the equation.***
10. ***Whatever we do on the left hand side of the equation, we must also do to the right side of the equation. So slide the /3 (divide by 3) card across the vertical line. 9 (or +9)/3 = 3. Replace the "9" with the number "3".***
11. ***Our equation now reads x = 3***

Note: As the student is manipulating the work, they should also be writing out each step in their notebook. The result should look something like this:

3●x + 4 = 13
3●x + 4 – 4 = 13 – 4
3●x = 9
3●x/3 = 9/3
x = 3

Activity Follow-Up & Extensions

1. Have students complete 3-Level Command Cards (yellow, orange & red).