

## Shipping Grade 6 Solving Equations Clarification

**CCSSM: Grade 6**

**DOMAIN: Expressions and Equations**

**Cluster: Apply and extend previous understandings of arithmetic to algebraic expressions.**

**Standard: 6.EE.2** Write, read, and evaluate expressions in which letters stand for numbers.

**a.** Write expressions that record operations with numbers and with letters standing for numbers.

**CCSSM: Grade 6**

**DOMAIN: Expressions and Equations**

**Cluster: Reason about and solve one-variable equations and inequalities.**

**Standard: 6.EE.5** Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

**Standard: 6.EE.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

**Standard: 6.EE.7** Solve real-world and mathematical problems by writing and solving equations of the form

$x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$  and  $x$  are all nonnegative rational numbers.

## Clarification of Math Discussion Terms

An **OPERATION** is a way of combining numbers that results in a unique number as the answer. The four basic mathematical operations are addition, subtraction, multiplication, and division. The answer to an addition problem is the **SUM**, to a subtraction problem is the **DIFFERENCE**, to a multiplication problem is the **PRODUCT**, and to a division problem is the **QUOTIENT**.

### Classroom Example 1

What is the sum of 8 and 3?

The sum is 11.

What is the product of 8 and 3?

The product is 24.

A letter or **SYMBOL** used to represent a missing or unknown number is called a **VARIABLE**. A known value, a number, is called a **CONSTANT**. A mathematical **EXPRESSION** may contain numbers, operations, and/or variables.

For example:  $5n + 3$ ,  $x - 7$ , 15, and  $2y^3$  are all expressions. In the expression  $5n + 3$ ,  $n$  is a variable and 3 is a constant.

A mathematical **EQUATION** is a statement of equality between two expressions.

For example:  $5n + 3 = x - 7$  or  $2y^3 = 16$  are equations.

### **Classroom Example 2**

What expression represents the sum of a number  $y$  and 3?

The expression is  $y + 3$ .

What equation represents that the difference between a number  $x$  and 7 is 5?

The equation is  $x - 7 = 5$ .

The **ADDITION IDENTITY PROPERTY** states that the sum of any real number and 0 (the additive identity) is the number itself. In symbols,  $a + 0 = a$  and  $0 + a = a$ .

The **MULTIPLICATION IDENTITY PROPERTY** states that the product of any real number and 1 (the multiplicative identity) is the number itself. In symbols,  $a \cdot 1 = a$  and  $1 \cdot a = a$ .

The **MULTIPLICATION PROPERTY OF ZERO** states that the product of any real number and 0 is 0. In symbols,  $a \cdot 0 = 0$  and  $0 \cdot a = 0$ .

### **Classroom Example 3**

The equation  $14 + 0 = 14$  is an example of what property of addition?

The Addition Identity Property is illustrated by the given equation.

What number is the multiplicative identity?

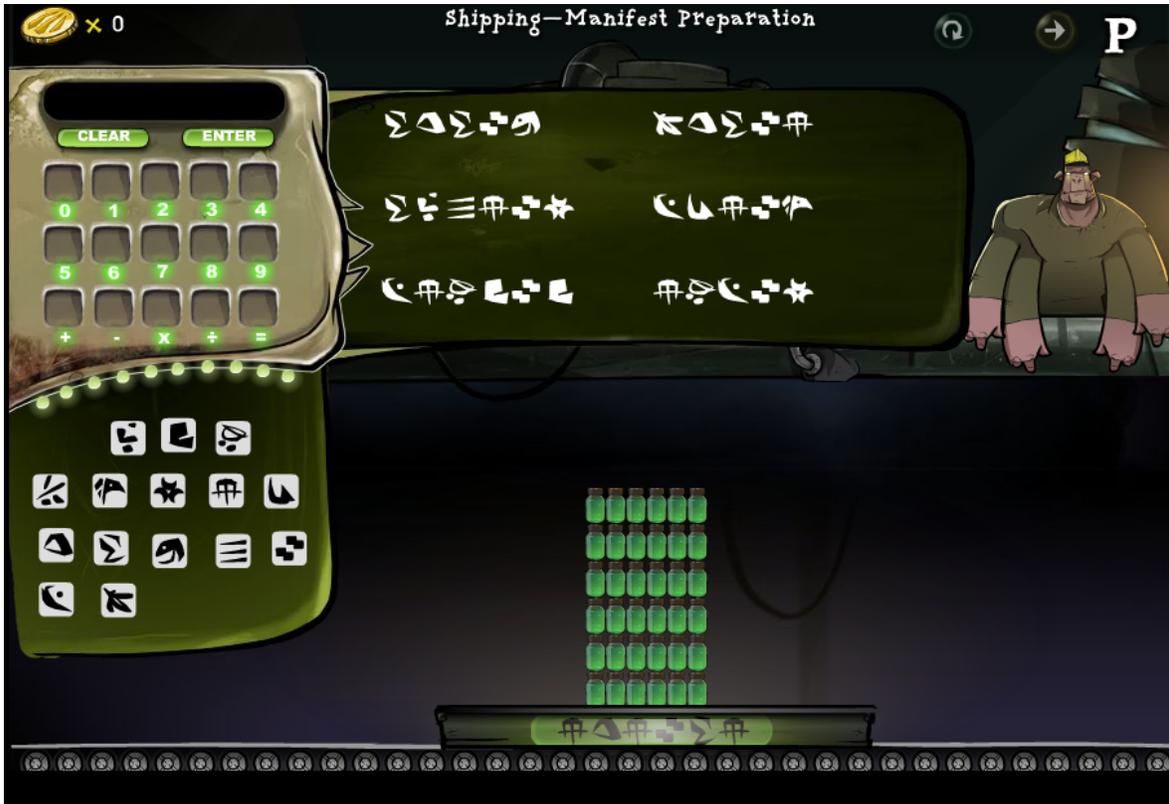
The number 1 is the multiplicative identity.

### **The Math in the Puzzle**

In the Shipping puzzles, a player must use a given equation written in symbols and logical reasoning, to determine the meaning of each symbol on the calculator. Then the player must create an equation, using the calculator symbols, to represent the number of bottles in each shipment.

In the screen shot below, the player must first determine that the symbols under the bottles represent the equation  $6 \cdot 6 = 36$ . By dragging the symbols that represent these numbers, operation, and equal to the calculator positions, the player begins to complete the top equations. Then, using logical reasoning and the properties, the player must use the top equations to assign each symbol to its proper position on the calculator. For

example, the player can easily identify the symbol for = since it appears near the end of every equation, usually in the second to last position. As another example, the player knows the last equation in the first column begins with a two-digit number in which the second digit is 6. The next symbol must then be an operation symbol. The number after the operation symbol and the answer to the problem are both the same digit. The player could reason that the problem must be either 16 divided by 4 equals 4, or 16 minus 8 equals 8. The player then knows the symbol that represents the number 1. The player continues in this manner until all symbols have been placed.



Once the symbols have been placed in their correct positions on the calculator, as in the screen shot below, the player must create the equation to match the new number of bottles on the assembly line.



In the second level of the puzzle, an expression, rather than an equation, is given to describe the first number of bottles on the assembly line. An example appears in the screen shot below. After the player has used the top equations to determine where to place the numbers on the calculator, he must then enter the number of each type of case (one case contains 10 bottles and the other contains 1 bottle) to ship the correct total number of bottles.

