Lesson Plan
Shipping Grade 6 Solving Equations

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: The clarification is an explanation of the indicator and objective and how these math concepts appear in the puzzle.

Materials and/or Set Up*: 1 lunch bag containing 5 pencils; 1 lunch bag with a small hole containing 6 pencils; What's in the Bag?; Operations Observation; Interactive Resource 1; Loading Dock Play Sheet; Interactive Resource 1 Final Results; Special Properties; Interactive Resource 2; Interactive Resource 1 Answers; Interactive Resource 3; Interactive Resource 3 Answers; Symbol Manipulatives; Shipping Calculator Resource Sheet; Assessment*

Relevant Vocabulary: Addition Identity Property, constant, difference, equation, expression, Multiplication Identity Property, Multiplication Property of Zero, operation, product, quotient, sum, symbol, variable

Note to Teacher – Students should have attempted levels 1 and 2 of the Shipping puzzle before this lesson is implemented. This activity does not address place value which is addressed in the second stage of level 2.

In the implementation of this lesson, it is recommended that the ***Interactive Resources*** be projected to encourage a rich and active discussion of math strategies and concepts. In addition, all numbers in the Loading Dock Puzzle are whole numbers.

Activities:

3. Hold up 4 pencils in one hand and a brown lunch bag holding 5 pencils (without revealing the contents of the bag) in the other.
    - Say, "I have 4 pencils in this hand and a number from 0 to 9 pencils in this bag. How could we write an equation representing the total number of pencils I have?" *(4 + ◆ = ❑)*
    - Distribute ***What's in the Bag***. Complete Part I as a whole group. Tell the students that the total number of pencils is a one-digit number. Ask students: What are the possible values of ◆? *(1, 2, 3, 4 or 5)* Tell the students that the total number of pencils is 9 and ask how many pencils must be in the bag. *(5)*
    - Pull out another bag. Explain that 9 pencils were in the bag but that you later discovered a hole in the bag. Some pencils may have fallen out. Write an equation representing this scenario. *(9 - Δ = ∩)* Have students work with a partner to complete Part 2.
    - Have students complete Part 3 of ***What's in the Bag*** with a partner. Students should be encouraged to draw a table of values if necessary. *(a. x = 8, b. x = 8, c. x = 2)*
4. Using ***Operations Observations***, investigate various operations (addition, subtraction, multiplication and division) with regard to one-digit and two-digit sums, differences, products and quotients.

    - Have students look at Scenario 1. Ask students: Is possible to get a two-digit sum when adding 2 single digit numbers and, if yes, give an example of such a case. *(yes, 3 + 8 = 11)* Is it possible for a subtraction problem to have a double digit difference, given 1 single digit number is being subtracted from another. *(no)*
    - Continue with scenario 1, investigating whether multiplication and division are appropriate operations. *(multiplication – yes, 4 x 7 = 28; division – no*)
    - Have students complete the remainder of ***Operation Observations****, in pairs.*

      (Scenario 2: + yes, 1 + 2 = 3; – *yes, 5 – 1 = 4*; x *yes, 2 x 3 = 6*; ÷ *yes, 8/4 = 2*)

      (Scenario 3: + no,; – *yes, 12 – 5 = 7*; x *no*; ÷ *yes, 14/2 = 7*)

      (Scenario 4: + yes, 3 + 10 = 13; – *no*; x *yes, 4 x 12 = 48*; ÷ *no*)

3. Distribute the ***Special Properties*** activity sheet and display  , the equation from the top of the sheet**.** Ask students to record their observations about the equation. *(The symbol*  *appears on both sides of the* ***equation****. All numbers in the equation are single digit numbers. The*  *represents an* ***operation****.)* Ask students: What are some possible values for the symbols? Have the students share several possible solutions until there is at least one example of each of the three properties: Identity Property of Addition, Identity Property of Multiplication, and Multiplication Property of Zero.

4. Review each property, making sure the students have an example of each property as well as the general rule for each property. *(Identity Property of Addition a + 0 = a; 8 + 0 = 8; Identity Property of Multiplication 1 x a = a; 1 x 4 = 4; Multiplication Property of Zero a x 0 = 0; 5 x 0 = 0)*
5. Display ***Interactive Resource 1.*** Facilitate a discussion to determine the values of the symbols given at the bottom.
6. Distribute the ***Shipping Play Sheet*** and explain how to use the chart to determine the values for each symbol. (*In the **Shipping Play Sheet** chart the students will use a ● to indicate a symbol has been correctly matched with its value and an **x** will be used to indicate it is not a match.*)
7. Display ***Interactive Resource 1*** again and share with the students that once a match is made, all of the boxes to the left, right, above and below the match can be eliminated. Work as a class to fill out the ***Shipping Play Sheet*** to solve the puzzle.

5. Using ***Interactive Resource 2*****,** in conjunction with the ***Loading Dock Play Sheet****,* have students work with a partner to find the values of all 15 symbols. Ask students how, if at all, this example differed from the last example. *(This example begins with an expression as opposed to an equation being represented at the bottom of the screen.)*
6. Using ***Interactive Resource 3*** in conjunction with the ***Loading Dock Play Sheet*****,** have students work independently to find the values of all 15 symbols. Encourage students to take careful notes about the steps used to determine the value of each symbol.

Differentiation Suggestions:

- Distribute the ***Symbol Manipulatives*** to assist students in keeping track of the value of the symbols. Students should cut apart the symbols and use them with the ***Loading Dock Calculator Resource Sheet*** to keep track of their answers.
- Facilitate a discussion about the inverse relationships of addition/subtraction and multiplication/division. Demonstrate how to use inverse operations to find solutions for equations.

Assessment

- Distribute **Assessment** resource sheet.

  Answers:

  1. 17

  2. C (52 + x = 79)

Follow Up:

- Have the students return to the puzzle to apply what they learned in the lesson. Ask: Did the lesson help you to clarify the math in the puzzle? Explain. What other strategies could you have used to help you solve the puzzle? Additionally, check teacher stats in the game to determine students' level of understanding.
- Provide the students with the following scenario:

  Karen is packing her truck with boxes of tomatoes to sell at the market. When she is finished loading her truck, there are 17 boxes of tomatoes. On the way, she hits a pothole and boxes of tomatoes go flying. When she arrives at the market there are only 13 boxes left in her truck. Write an equation to represent the number of boxes of lost. Solve the equation and justify your answer. *(t = boxes of tomatoes lost, 17 – t = 13; t = 4; students should justify by substituting the solution into the equation and verifying that it produces the correct value.)*

Real World Connection:

- Provide students with this scenario:

  Bill has earned $100.00 throughout the summer mowing lawns. He wants to buy a new video game that costs $65.00 with part of the money that he earned. He wants to deposit the rest of the money into his savings account. Define a variable to represent the amount of money that Bill will deposit into his savings account. Write an equation that represents the situation and solve for the variable to determine how much money Bill will deposit into his savings account.
  (*Let x = the amount of money that Bill will deposit*
  Then the equation is 100 – x = 65
  Note that it could also be 100 – 65 = x or x + 65 = 100)
  The solution is 35, so Bill will have $35 to deposit into his savings account.)

What's in the Bag?

Part 1: $4 + \blacklozenge = \square$

$\blacklozenge$ = *number of pencils in bag*	$\square$ = *total number of pencils*
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Part 2: $9 - \Delta = \cap$

Δ = *number of pencils that fell out of the bag*	$\cap$ = *total number of pencils left in the bag*
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Part 3: Solve each equation for x.

a. $4 + x = 12$ b. $18 - x = 10$ c. $\frac{14}{x} = 7$

Lesson Plan
Shipping Grade 6 Solving Equations

+ – x ÷ *Operations Observations* + – x ÷

Directions: Determine which operation can replace the ◯ in each scenario. Each blank (__) represents a numerical digit. For example, __ represents a single digit, while __ __ represents a 2-digit number. Complete each chart and provide a mathematical justification. The first one has been done for you.

Scenario 1:

__ ◯ __ = __ __

Operation	Yes or No	Justification
Addition +	***yes***	***Two single digits will have a sum that is a 2-digit number when the sum is 10 or greater. For example, 3 + 8 = 11***
Subtraction –		
Multiplication x		
Division ÷		

Scenario 2:

__ ◯ __ = __

Operation	Yes or No	Justification
Addition +		
Subtraction –		
Multiplication x		
Division ÷		

+ – x ÷ *Operations Observations* + – x ÷

Scenario 3:

__ __ ◯ __ = __

Operation	Yes or No	Justification
Addition +		
Subtraction –		
Multiplication x		
Division ÷		

Scenario 4:

__ ◯ __ __ = __ __

Operation	Yes or No	Justification
Addition +		
Subtraction –		
Multiplication x		
Division ÷		

Special Properties

1. Examine the equation above. Record your observations:

_____

_____

_____

2. Write a possible solution to the equation above.

Property: _____

3. Write another possible solution that is not an example of the property in question 2.

Property: _____

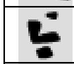
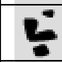
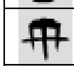
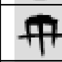
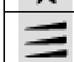
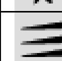
4. Write another possible solution that is not an example of either property listed above.

Property: _____

Interactive Resource 1

Shipping Play Sheet

Directions: Use a • to indicate yes, and **x** to indicate no in the chart.

	0	1	2	3	4	5	6	7	8	9	+	-	x	÷	=			Symbol Value
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		

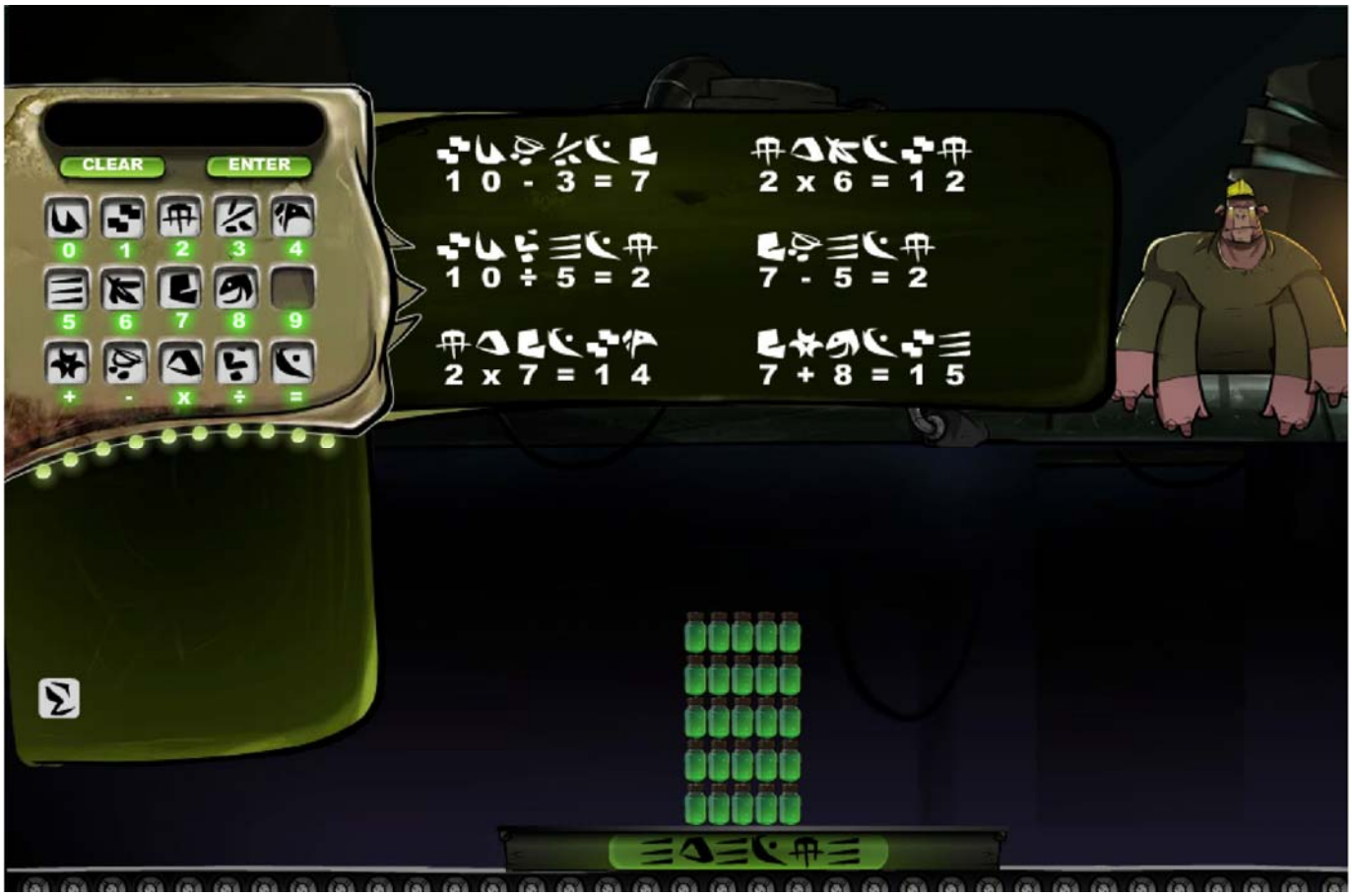
Use this space to take notes or make calculations:

Lesson Plan
Shipping Grade 6 Solving Equations

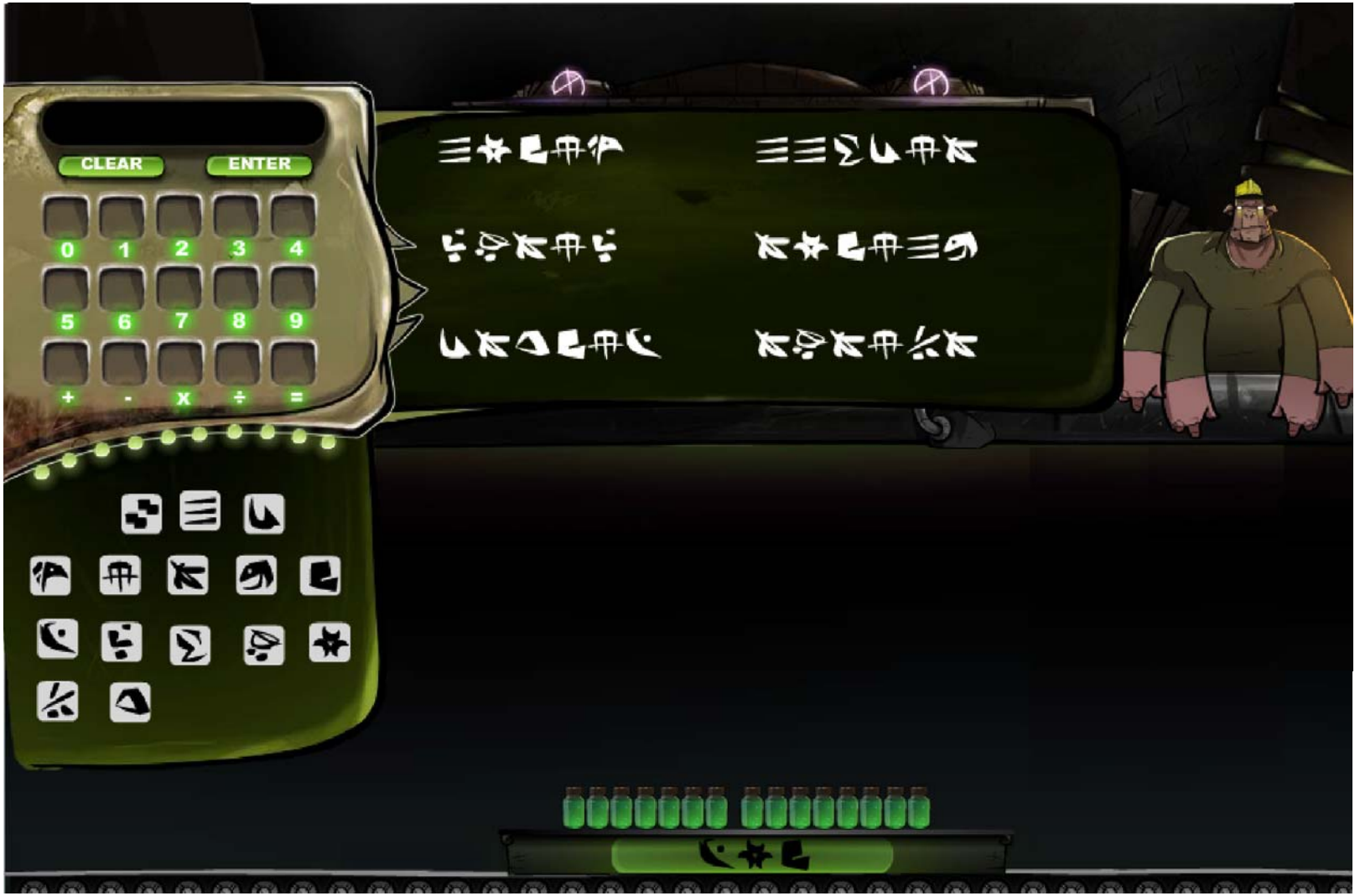
Shipping Play Sheet

Steps	Reasoning and Justification

Interactive Resource 1 - Answers



Interactive Resource 2



Lesson Plan
Shipping Grade 6 Solving Equations

Shipping Play Sheet for Interactive 2 -Answers

Directions: Use a • to indicate yes, and **x** to indicate no in the chart.

	0	1	2	3	4	5	6	7	8	9	+	-	x	÷	=			Symbol Value
								•										7
	•																	0
						•												5
			•															2
												•						-
															•			=
													•					x
										•								9
									•									8
							•											6
					•													4
											•							+
		•																1
				•														3
														•				÷

Interactive Resource 3

Lesson Plan
Shipping Grade 6 Solving Equations

Shipping Play Sheet for Interactive 3-Answers

Directions: Use a • to indicate yes, and **x** to indicate no in the chart.

	0	1	2	3	4	5	6	7	8	9	+	-	x	÷	=			Symbol Value
				•														3
													•					x
														•				÷
		•																1
							•											6
			•															2
	•																	0
										•								9
								•										7
											•							+
						•												5
									•									8
												•						-
															•			=
					•													4

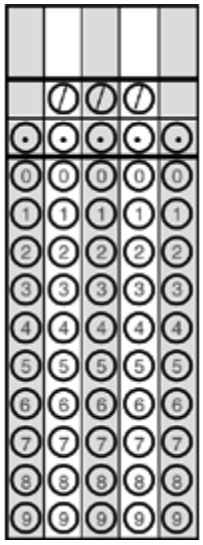
Symbol Manipulatives

Shipping Calculator Resource Sheet

0	1	2	3	4
5	6	7	8	9
+	–	x	÷	=

Assessment

1. In the equation x – 7 = 10, what is the value of x?



2. Sally has saved $52 toward the purchase of a new phone. The cost of the phone is $79. Which of these equations can be used to find the amount Sally still needs in order to be able to purchase the phone?

   A. $x - 52 = 79$

   B. $52 - x = 79$

   C. $52 + x = 79$

   D. $52x = 7$

