Math 1201

7.1 Developing Systems of Linear Equations

In this chapter, you will model situations using a system of linear equations. You will need to understand and define the variables that are being used to represent the unknown quantity.

Although you will solve linear systems in this chapter, the focus here in 7.1 is limited to verifying solutions. You will substitute an ordered pair (x, y) into both equations at the same time to make sure the solution satisfies both equations. First we need some definitions.

Linear Equation: an equation that graphs a line. The highest power for any variable in a linear equation is 1.

System of Linear Equations: two or more linear equations; also called **linear system**

Solution to a System: a pair of values, (x, y), that satisfy both equations

The first step in creating any system of equations is identifying any unknown quantities. Lets look at an example:

Example 1:
John bought 8 books. Some books cost \$13 each and the rest of the books cost \$24 each. He spent a total of \$209. Write a system of linear equations that could represent the given situation.

Let \$13 books be a

Let \$24 books be b

① $a + b = 8$

② $13a + 24b = 209$

Example 2:
A school district has buses that carry 12 passengers and buses that carry 24 passengers. The total passenger capacity is 780. There are 20 more small buses than larger busses.

(A) Create a linear system that models this situation.

let small bus be: s
let large bus be: ℓ

① $12s + 24\ell = 780$
② $s = \ell + 20$

(B) Suppose you are told there are 35 small buses and 15 large buses. Verify that this is a solution.

$s = 35$
$\ell = 15$

① $12s + 24\ell = 780$
$12(35) + 24(15) = 780$
$420 + 360 = 780$
$780 = 780$
LHS = RHS

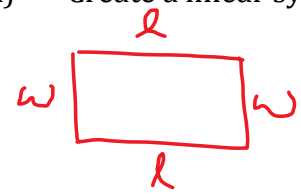
② $s = \ell + 20$
$35 = 15 + 20$
$35 = 35$
LHS = RHS

Since 35 and 15 satisfy both equations, both numbers are a solution to the linear system.

Example 3:

The perimeter of a Newfoundland flag is 16 ft. The length is 2 ft longer than the width.

(A) Create a linear system to model this situation.



$l + l + w + w = 16$

① $2l + 2w = 16$

② $l = 2 + w$

(B) Jonas has determined that the Newfoundland flag is 5 ft long and 3 ft wide. Is he correct?

$l = 5$

$w = 3$

① $2l + 2w = 16$

$2(5) + 2(3) = 16$

$10 + 6 = 16$

$16 = 16$

LHS = RHS

② $l = 2 + w$

$5 = 2 + 3$

$5 = 5$

LHS = RHS

5 and 3 do satisfy the system of equations.

Example 4:

CBRH raised $195 by collecting 3000 items for recycling. The school receive 5¢ for each pop can and 20¢ for each plastic bottle.

5¢ = $0.05
20¢ = $0.20

(A) Write a linear system to model this situation.

Let c be cans
Let b be bottles

① $c + b = 3000$

② $0.05c + 0.2b = 195$

(B) The school collected 2700 pop cans and 300 plastic bottles. Use the linear system to verify these numbers.

① $c + b = 3000$

$2700 + 300 = 3000$

$3000 = 3000$

LHS = RHS

② $0.05c + 0.2b = 195$

$0.05(2700) + 0.2(300) = 195$

$135 + 60 = 195$

$195 = 195$

LHS = RHS

What have you noticed about the number of variables and the number of equations in each example so far?

There has to be at least the same number of equations as variables to solve a linear system.

Example 5:
Create a situation relating to coins that can be modelled by the linear system and explain the meaning of each variable.

$$x + y = 24$$
$$0.25x + 0.05y = 4.50$$

Alex has 24 coins in his pocket. Some are quarters, the rest are nickels. The total amount of money in his pocket is $4.50. Determine how many nickels and how many quarters he has.

Example 6:
A store sells wheels for skateboards in packages of 4 and wheels for inline skates in packages of 8. Create a situation about wheels that can be modelled by the linear system below. Explain the meaning of each variable.

$$4s + 8i = 440$$
$$s + i = 80$$

There are 80 packages of inline skate wheels and skateboard wheels, combined, at the store. There are 440 wheels in total at the store. How many packages are for skateboards and how many packages are for inline skates.

Textbook Questions: page 401 - 402 #4, 5, 6, 8, 12