7.1 Developing Systems of Linear Equations

$2x + 3y = 5$ is a Linear Equation (degree 1 equation)

More than one linear equation makes a **System of Linear Equations**. This is also called a linear system.

Example: $3x - 4y = 22$
$x - 2y = 6$

The **solution** to a system of linear equations is a pair of values that satisfy both equations. The solution has to make both equations true.

Example: Is (10, 2) a solution to the system given above?

x y

$3x - 4y = 22$
$3(10) - 4(2) = 22$
$30 - 8 = 22$
$22 = 22$ ✓

$x - 2y = 6$
$10 - 2(2) = 6$
$10 - 4 = 6$
$6 = 6$ ✓

Yes (10,2) is a solution.

Example 1: A school district has 12 passenger and 24 passenger buses. The total passenger capacity is 780. There are 20 more small buses than large. Write a system of equations to solve the problem.

Step 1: Define the variables then write the equations.

Let: 12 passenger buses = x & 24 passenger buses = y

Equation #1) $12x + 24y = 780$

Equation #2) $x - y = 20$ or $x - 20 = y$ or $x = y + 20$

Does 35 small buses and 15 large buses satisfy the system?

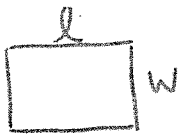
x y

$12(35) + 24(15) = 780$
$420 + 360 = 780$
$780 = 780$ ✓

$x = y + 20$
$35 = 15 + 20$
$35 = 35$ ✓

yes, it satisfies the system

$P = 2l + 2w$



$l = 5$ ft

Example 2: A rectangular flag has a perimeter of 16 ft. Its length is 2ft more than the width. Write a system and use it to determine the length and width of the rectangle.

Let l = length
w = width

$$\begin{cases} 16 = 2l + 2w \\ l = 2 + w \end{cases}$$

Guess & check:

(4, 2) $16 = 2(4) + 2(2)$
$16 = 8 + 4$ $16 = 12$ ×

(5, 3) $16 = 2(5) + 2(3)$
$16 = 10 + 6$
$16 = 16$ ✓

Example 3: A school raised $195 by collecting 3000 items for recycling. They received 5 cents/pop can and 20 cents/large plastic bottles. Does 2700 pop cans and 300 plastic bottles satisfy the system?

Let: cans = c & bottles = b

	Refund	Number of items	Money raised
Cans	0.05	c	$0.05c$
Bottles	0.20	b	$0.20b$

$0.05c + 0.20b = 195$
$c + b = 3000$

$c = 2700$
$b = 300$

$0.05(2700) + 0.20(300) = 195$
$135 + 60 = 195$
$195 = 195$ ✓

$2700 + 300 = 3000$
$3000 = 3000$

Yes it satisfies the equation

Example 4: A store sells roller skate wheels in packs of 4 and inline skates in packs of 8. Create a situation for the following system of equations.

$8i + 4r = 440$ ← in total the store sold 440 wheels
$i + r = 80$ ← in total the store sold 80 packs of wheels

i = inline
r = roller

page 401 #4,5,6,7,9,11,12,13