Algebra 1R
Chapter 6 & 7 – Day 2

Section 6.2 – Using Linear Combinations to Solve a Linear System

Let It Snow . . . For Winter Get-Aways

Let It Snow Resort offers two winter specials: the Get-Away Special and the Extended Stay Special. Let It Snow claims that the Extended Stay Special is the better deal. The Get-Away Special offers two nights of lodging and four meals for $270. The Extended Stay Special offers three nights of lodging and eight meals for $435. Determine if the Extended Stay Special is the better deal.

1. Write an equation in standard form that represents the Get-Away Special. Let n represent the cost for one night of lodging at the resort, and let m represent the cost for each meal.

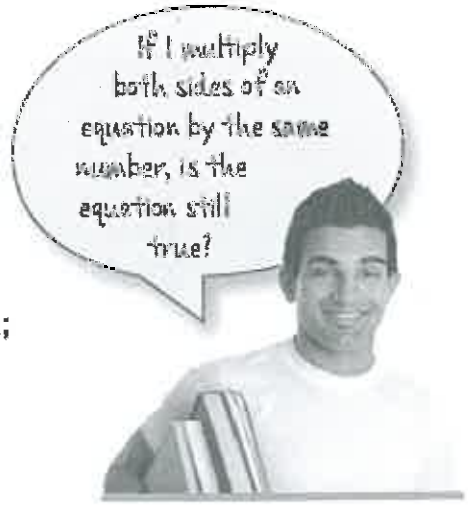
$2n + 4m = 270$

2. Write an equation in standard form that represents the Extended Stay Special. Use the same variables you used in Question 1.

$3n + 8m = 435$

3. How are these equations the same? How are these equations different?

both have the same variables
the variables have different coefficients



4. Complete parts (a) through (h) to write and solve the system comparing the two winter specials.

   a. Multiply each side of the equation that represents the Get-Away Special by −2. Simplify the equation; maintain standard form.

   $-2(2n + 4m = 270)$

   $-4n - 8m = -540$

   b. Write a linear system of equations using the transformed equation you wrote that represents the Get-Away Special and the equation that represents the Extended Stay Special.

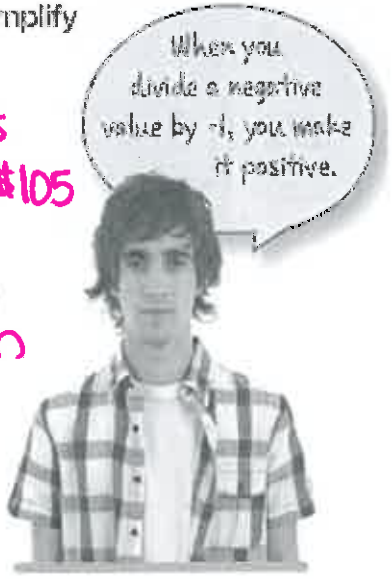
   $-4n - 8m = -540$

   $3n + 8m = 435$

   c. How do the coefficients of the equations in your linear system of equations compare?

   The m's will cross out

   d. Add the equations in your linear system together. Then simplify the result. What does the result represent?



$$\begin{array}{r} -4n - 8m = -540 \\ +\ 3n + 8m = 435 \\ \hline -n = -105 \\ n = 105 \end{array}$$

A night's stay is $105

   e. How will you determine the m-value of the linear system?

   you will take an original equation and substitute $105 in for n, then solve for m.

   f. Determine the value of m for the linear system.

$3n + 8m = 435$

$3(105) + 8m = 435$

$-315 + 8m = 435$

$-315 \quad -315$

$8m = 120$

$m = 15$

   g. What is the solution of the linear system? Interpret the solution of the linear system in the problem situation.

   solution (105, 15)

   A night's stay is $105 and a meal is $15.

Let's consider a system where neither of the x- or y-terms are opposites.

$$\begin{cases} 4x + 2y = 3 \\ 5x + 3y = 4 \end{cases}$$

Multiply each equation by a constant that results in opposite coefficients for one of the variables.

$$3(4x + 2y) = 3(3)$$
$$-2(5x + 3y) = -2(4)$$

$$12x + 6y = 9$$
$$-10x - 6y = -8$$

Now that the y-values are opposites, you can solve this linear system.

Solve the new linear system shown in the worked example.

$12x + 6y = 9$
$+\ -10x - 6y = -8$
$2x = 1$
$x = \frac{1}{2}$

$4x + 2y = 3$
$4(\frac{1}{2}) + 2y = 3$
$2 + 2y = 3$
$-2 \quad -2$
$2y = 1 \quad y = \frac{1}{2}$

$(\frac{1}{2}, \frac{1}{2})$

Solve each system using linear combinations.

a. $\begin{cases} 2x + y = 8 \\ 3x - y = 7 \end{cases}$

$\frac{5x}{5} = \frac{15}{5}$
$x = 3$

$2x + y = 8$
$2(3) + y = 8$
$6 + y = 8$
$-6 \quad -6$
$y = 2$

(3,2)

b. $\begin{cases} 4x + 3y = 24 \\ 3x + y = -2 \end{cases}$ $-3($

$4x + 3y = 24$
$-9x - 3y = 6$
$-5x = 30$
$\frac{-5x}{-5} = \frac{30}{-5}$
$x = -6$

$3x + y = -2$
$3(-6) + y = -2$
$-18 + y = -2$
$+18 \quad +18$
$y = 16$

$(-6, 16)$

What do 3 & 2 go into? 6

c. $\begin{cases} 3x + 5y = 17 \\ 2x + 3y = 11 \end{cases}$

* Pick a variable to eliminate *

$2(3x + 5y = 17)$
$-3(2x + 3y = 11)$
$6x + 10y = 34$
$-6x - 9y = -33$
$y = 1$

$3x + 5(1) = 17$
$3x + 5 = 17$
$-5 \quad -5$
$\frac{3x}{3} = \frac{12}{3}$
$x = 4$

What's On the Menu Today?

Constance owns a small lunch cart. She changes her menu daily. Yesterday, she offered a chef salad for $5.75 or a hoagie for $5.00. She sold 85 lunches for a total of $464. Determine how many chef salads and hoagies she sold.

1. Write an equation in standard form that represents the total number of lunches in terms of the number of chef salads sold and the number of hoagies sold. Let x represent the number of chef salads sold, and let y represent the number of hoagies sold.

$x + y = 85$

2. Write an equation in standard form that represents the amount of money collected. Use the same variables as those used in Question 1.

$5.75x + 5y = 464$

3. Write a system of linear equations to represent this problem situation.

$x + y = 85$
$5.75x + 5y = 464$

4. Determine the solution of this linear system of equations by using linear combinations. Then, check your answer.

$-5(x + y = 85)$
$5.75x + 5y = 464$
$-5x + -5y = -425$
$5.75x + 5y = 464$
$.75x = 39$
$x = 52$

$x + y = 85$
$52 + y = 85$
$-52 \quad -52$
$y = 33$

$(52, 33)$

CK: $52 + 33 = 85$
$85 = 85$ ✓

$5.75(52) + 5(33) = 464$
$299 + 165 = 464$
$464 = 464$ ✓

5. Interpret your solution to the linear system in terms of this problem situation.

(52,33) 52 chef salads and 33 hoagies were sold

You're My Best Buddy!

The School Spirit Club is making beaded friendship bracelets with the school colors to sell in the school store. The bracelets are black and orange and come in two lengths: 5 inches and 7 inches. The club has enough beads to make a total of 84 bracelets. So far, they have made 49 bracelets, which represents $\frac{1}{2}$ the number of 5-inch bracelets plus $\frac{3}{4}$ the number of 7-inch bracelets they plan to make and sell. Determine how many 5-inch and 7-inch bracelets the club plans to make.

Write an equation in standard form that represents the total number of bracelets the School Spirit Club can make out of the beads that they have. Let x represent the number of 5-inch bracelets, and let y represent the number of 7-inch bracelets.

$x + y = 84$

Write an equation in standard form that represents the number of bracelets the School Spirit Club has made so far. Use the same variables as those used in Question 1.

$\frac{1}{2}x + \frac{3}{4}y = 49$

Write a system of linear equations that represents this problem situation.

$x + y = 84$
$\frac{1}{2}x + \frac{3}{4}y = 49$

Rewrite the equation containing fractions as an equivalent equation without fractions.

① Find LCD (+4) $4\left(\frac{1}{2}x + \frac{3}{4}y = 49\right)$

② mult everything by 4 $2x + 3y = 196$

Determine the solution to the system of equations by using linear combinations and check your answer.

$-2(x + y = 84)$
$2x + 3y = 196$

$-2x - 2y = -168$
$2x + 3y = 196$

$y = 28$

$x + y = 84$
$x + 28 = 84$
$-28 \quad -28$

$x = 56$

CK: $x + y = 84$
$56 + 28 = 84$
$84 = 84$ ✓

$2x + 3y = 196$
$2(56) + 3(28) = 196$
$112 + 84 = 196$
$196 = 196$ ✓

Interpret the solution of the linear system in terms of this problem situation.

There are enough beads for 56 5" bracelets and 28 7" bracelets