Word Problems for systems of Linear Equations.

Grab your paper, pencil and graphing calculator. Solve the following problems using either a substitution method, an addition/subtraction method, or a graphical method. In each problem, set up a system of equations.

1. Two small pitchers and one large pitcher can hold 8 cups of water. One large pitcher minus one small pitcher constitutes 2 cups of water. How many cups of water can each pitcher hold?

2. A test has twenty questions worth 100 points. The test consists of True/False questions worth 3 points each and multiple choice questions worth 11 points each. How many multiple choice questions are on the test?

3. Margie is responsible for buying a week's supply of food and medication for the dogs and cats at a local shelter. The food and medication for each dog costs twice as much as those supplies for a cat. She needs to feed 164 cats and 24 dogs. Her budget is $4240. How much can Margie spend on each dog for food and medication?

4. An exam worth 145 points contains 50 questions. Some of the questions are worth two points and some are worth five points. How many two point questions are on the test? How many five point questions are on the test?

5. The Lakers scored a total of 80 points in a basketball game against the Bulls. The Lakers made a total of 37 two-point and three-point baskets. How many two-point shots did the Lakers make? How many three-point shots did the Lakers make?

6. The admission fee at a small fair is $1.50 for children and $4.00 for adults. On a certain day, 2200 people enter the fair and $5050 is collected. How many children and how many adults attended?

7. A landscaping company placed two orders with a nursery. The first order was for 13 bushes and 4 trees, and totalled $487. The second order was for 6 bushes and 2 trees, and totalled $232. The bills do not list the per-item price. What were the costs of one bush and of one tree?

SOLUTIONS

1.

Let x = small pitcher an y = large pitcher

$2x + y = 8$
$y - x = 2$

Solve by any method mentioned.
If done algebraically:
$2x + y = 8$
$-x + y = 2$
subtract:
$3x = 6$
$x = 2$
The small pitcher holds 2 cups of water.
$2(2) + y = 8$
$4 + y = 8$
$y = 4$
The large pitcher holds 4 cups of water.

2.

Let x = T/F questions
Let y = Multiple Choice questions

$x + y = 20$
$3x + 11y = 100$

Solve by any method mentioned.
If done algebraically:
$x + y = 20$
$3x + 11y = 100$
$3(x + y = 20)$
$3x + 11y = 100$
$3x + 3y = 60$
$3x + 11y = 100$
$-8y = -40$
$8y = 40$
$y = 5$
There are 5 multiple choice questions.
$x + 5 = 20$
$x = 15$
There are 15 T/F questions.

3.

Let c = cost per cat
Let d = cost per dog

$164c + 24d = 4240$
$d = 2c$

Solve by any method mentioned.
If done algebraically with substitution:
$164c + 24d = 4240$
$d = 2c$

$164c + 24(2c) = 4240$
$164c + 48c = 4240$
$212c = 4240$
$c = 20$
She can spend $20 on each cat.
$d = 2c$
$d = 2(20) = 40$
She can spend $40 on each dog.

4.

Let x = the number of two point questions.
Let y = the number of five point questions.

$2x+5y = 145$ (equation for the total number of points)
$x+y = 50$ (equation for the total number of questions)

I will solve using the substitution method:

$x-x+y = 50 - x$

$y = 50-x$
$y = -x +50$

$2x+5y = 145$
$2x+5(-x+50) = 145$ Substitute.
$2x-5x+250 = 145$ Distribute.
$-3x+250 = 145$ Simplify.
$-3x+250-250 = 145-250$ Solve for x.
$\frac{-3x}{-3} = \frac{-105}{-3}$
$x = 35$

$y = -x +50$
$y = -35 +50$
$y = 15$

My solution to this system is (35,15)

Check:
$2x+5y = 145$
$2(35)+5(15) = 145$
$70+75 = 145$ ☺

$x+y = 50$
$35+15 = 50$ ☺

**There are 35 two point questions on the test.
There are 15 five point questions on the test.

5.

Let x = the number of two-point shots
Let y = the number of three-point shots

2x +3y = 80 (equation for the total number of points)
x +y = 37 (equation for the total number of baskets)

I will solve using the combinations method.

2x +3y = 80
-2[x +y = 37] = -2x -2y = -74

2x +3y = 80
-2x -2y = -74
---
y = 6

x +y = 37
x+6 = 37
x+6-6 = 37 – 6
x = 31

My solution to this system is (31,6)

Check:
2x +3y = 80
2(31) + 3(6) = 80
62 +18 = 80 ☺

x +y = 37
31+6 = 37 ☺

**The Lakers scored 31 two-point shots and 6 three-point shots

6.

number of adults: a
number of children: c

total number: $a + c = 2200$
total income: $4a + 1.5c = 5050$

Now I can solve the system for the number of adults and the number of children. I will solve the first equation for one of the variables, and then substitute the result into the other equation:

$a = 2200 - c$

$4(2200 - c) + 1.5c = 5050$
$8800 - 4c + 1.5c = 5050$
$8800 - 2.5c = 5050$
$-2.5c = -3750$
$c = 1500$

$a = 2200 - (1500) = 700$

There were 1500 children and 700 adults.

7.

I'll pick variables ("b" for the number of bushes and "t" for the number of trees) and set up a system of equations:

first order: $13b + 4t = 487$
second order: $6b + 2t = 232$

Multiplying the second row by -2, I get:

$13b + 4t = 487$
$-12b - 4t = -464$

This says that $b = 23$. Back-solving, I get that $t = 47$. Of course, the exercise didn't ask for the values of the two variables. Translating back into English, the solution is:

Bushes cost $23 each; trees cost $47 each.