



7.4 Applications of Linear Systems

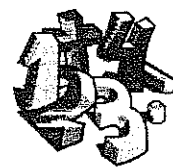
Objective: be able to write a system of linear equations given a word problem

Methods for Solving Systems of Linear Equations:

1. Graphing - if you can easily graph both equations and intersection point contains only integers.
2. Substitution - use when one variable has a coefficient of 1 or -1
3. Elimination - can be used for solving any system - make sure it's in standard form

Steps for Solving Word Problems:

1. _____ what do I know?
2. _____ what am I trying to find?
3. _____ what can I find using the facts that I have?
4. Choose a method for solving system
5. Solve for both missing variables



Examples:

1. The sum of 2 numbers is 20. Their difference is 4. Write a system of equations and solve by elimination.

let 1st # = x
2nd # = y

$$\begin{array}{r} x + y = 20 \\ x - y = 4 \\ \hline \end{array}$$

$$\frac{2x}{2} = \frac{24}{2}$$

$$\boxed{x = 12}$$

$$12 + y = 20$$

$$\boxed{y = 8}$$

$$\begin{array}{l} \text{1st \#} = 12 \\ \text{2nd} = 8 \end{array}$$

2. Shelley decided she would empty the change out of the bottom of her purse. She found 43 coins, consisting of only dimes and nickels. Shelley had \$3.05 in change. How many dimes and nickels did she have in her purse?

let d = dimes
 n = nickels

Need 1 equation for total amount of coins

another equation relating the money ("show me the money")

$$\textcircled{1} \quad d + n = 43$$

$$10d + .05n = 3.05 \quad \text{get rid of decimals}$$

$$-10(d + n = 43) \rightarrow -10d - 10n = -430$$

$$10d + 5n = 305 \rightarrow \frac{10d + 5n = 305}{-10d - 10n = -430}$$

$$\frac{-5n}{-5} = \frac{-125}{-5}$$

$$\boxed{n = 25}$$

$$d + 25 = 43$$

$$\boxed{d = 18}$$

18 dimes
25 nickels

3. Your class sells gift wrap for \$4 a package and greeting cards for \$10 per package. Your class sells 205 packages in all and receives a total of \$1084. Find the number of packages of gift wrap sold and the number of greeting cards sold.

let g = gift wrap # of: $-4(g + c = 205) \rightarrow -4g - 4c = -820$
 c = cards #: $4g + 10c = 1084 \rightarrow 4g + 10c = 1084$

$$\begin{aligned} g + c &= 205 \\ g + 44 &= 205 \\ \hline g &= 161 \end{aligned}$$

161 pkg. gift wrap
44 greeting cards

$$\begin{aligned} 6c &= 264 \\ \hline c &= 44 \end{aligned}$$

4. The community center sells a total of 292 tickets for a basketball game. An adult ticket costs \$3 and student ticket costs \$1. \$470 was collected in ticket sales. Write and solve a system of to find the number of each type of tickets sold.

let a = adult tix s = student tix $89 + s = 292$

$$\begin{aligned} -1(a + s &= 292) & -a - s &= -292 \\ 3a + 1s &= 470 & 3a + s &= 470 \\ \hline 2a &= 178 & a &= 89 \end{aligned}$$

$s = 203$

5. Our class with 26 students is going to a rock concert. There will also be 5 chaperones that will each drive a van or a car. Each van seats 7 people, including the driver. Each car seats 5 people, including the driver. How many vans and cars will be needed? let v = van c = car $\frac{26}{+5} = 31$ total people

$$\begin{aligned} -5(v + c &= 5) \rightarrow -5v - 5c = -25 \\ 7v + 5c &= 31 \rightarrow 7v + 5c = 31 \\ \hline 2v &= 6 \\ \hline v &= 3 \end{aligned}$$

$v + c = 5$
 $3 + c = 5$
 $c = 2$

6. A math test is worth 100 points and has 30 problems. Each problem is worth either 3 points or 4 points. How many 4 point problems are there?

3pt. problems = x
 4pt = y

$$\begin{aligned} -3(x + y &= 30) \rightarrow -3x - 3y = -90 \\ 3x + 4y &= 100 & 3x + 4y &= 100 \\ \hline y &= 10 & y &= 10 \end{aligned}$$

$x + 10 = 30$
 $x = 20$ 3pt.

7. Adrian has a website hosting business. He bought a computer and software for \$1750. Adrian charges \$55 per website hosted and incurs a cost of \$5.00 per website to cover administrative expenses. How many websites must Adrian host to break even?

let $w = \#$ of websites

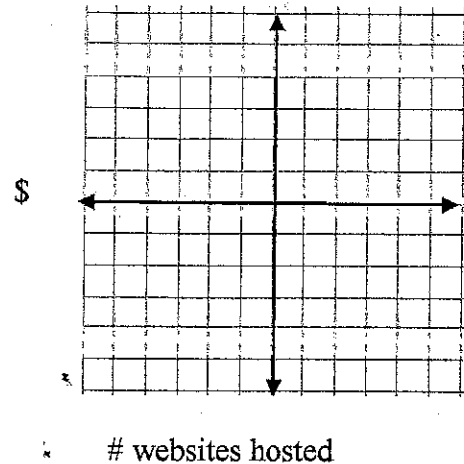
expenses
 $1750 + 5w$

income
 $55w$

$$\begin{array}{r} 1750 + 5w = 55w \\ -5w \quad -5w \\ \hline \end{array}$$

$$\begin{array}{r} 1750 = 50w \\ \underline{50} \quad \underline{50} \end{array}$$

$w = 35$ websites



8. Suppose our class publishes our own version of a *Math Doesn't Suck* newsletter. Expenses are \$0.35 for printing and mailing each copy, plus \$770 total for research and writing. The price of the newsletter is \$0.55 per copy. How many copies of the newsletter must the club sell to break even?

expenses
 $0.35c + 770$

income
 $0.55c$

$$\begin{array}{r} 0.35c + 770 = 0.55c \\ -0.35c \quad -0.35c \\ \hline \end{array}$$

$$\begin{array}{r} 770 = 0.20c \\ \underline{0.20} \quad \underline{0.20} \end{array}$$

$c = 3850$ copies

