Solving a system of equations in three variables.

You can use:
- Substitution
- Elimination
- Combination of Substitution and Elimination.

One of the main rules when solving a system of three equations is that you must use each equation at least once.

Solve starting with Elimination.

1. $2x - 4y + 3z = 11$
2. $7x + 3y - 5z = -39$
3. $3x + 8y + 4z = 14$

Eliminate y using EQ's 1 and 2.

$3(2x - 4y + 3z = 11)$

$4(7x + 3y - 5z = -39)$

$6x - 12y + 9z = 33$

$+\ 28x + 12y - 20z = -156$

A $\boxed{34x - 11z = -123}$

1. $2x - 4y + 3z = 11$
2. $7x + 3y - 5z = -39$
3. $3x + 8y + 4z = 14$

Eliminate y using EQ's 1 and 3.

$2(2x - 4y + 3z = 11) \rightarrow 4x - 8y + 6z = 22$

$3x + 8y + 4z = 14 \rightarrow +\ 3x + 8y + 4z = 14$

B $\boxed{7x + 10z = 36}$

Use Equations A and B and solve for x & y:

$$\text{(A)}\ 10(34x - 11z = -123) \qquad 340x - 110z = -1230$$
$$\text{(B)}\ 11(7x + 10z = 36) \quad + \quad 77x + 110z = 396$$
$$417x = -834$$
$$\frac{417x}{417} = \frac{-834}{417}$$
$$\boxed{x = -2}$$

Now use either Eq A or B to find z:

$$\text{(B)}\quad 7(-2) + 10z = 36$$
$$-14 + 10z = 36$$
$$+14 \qquad\qquad +14$$
$$\frac{10z}{10} = \frac{50}{10}$$
$$\boxed{z = 5}$$

1. $2x - 4y + 3z = 11$
2. $7x + 3y - 5z = -39$
3. $3x + 8y + 4z = 14$

Now that you know that x= -2 and z=5
use one of the first three equations to find y.

$$3(-2) + 8y + 4(5) = 14$$
$$-6 + 8y + 20 = 14$$
$$8y + 14 = 14$$
$$8y = 0$$
$$\boxed{y = 0}$$

Solution to this system is: (-2,0,5)

Solving a system of equations in three variables starting with SUBSTITUTION:

1. 5x + 3y + 3z =51
2. 4x - 2y + z = 22
3. x + 5y - 2z = 13

1. Solve one of the equations for one of its variables.

you could solve the second equation for z:

$$z = 22 + 2y - 4x$$

1. 5x + 3y + 3z =51
2. 4x - 2y + z = 22
3. x + 5y - 2z = 13

2. Substitute this quantity into both of the other two equations creating a system of equations with just two variables.

Into Eq 1:

$$5x + 3y + 3(22 + 2y - 4x) = 51$$
$$5x + 3y + 66 + 6y - 12x = 51$$
$$-7x + 9y = -15$$

Into Eq 2:

$$x + 5y - 2(22 + 2y - 4x) = 13$$
$$x + 5y - 44 - 4y + 8x = 13$$
$$9x + y = 57$$

3. Solve this resulting system of equations for its two variables.

$-7x+9y=-15 \rightarrow -7x+9y=-15$

$9(\underbrace{9x+y=57}) \rightarrow 81x+9y=513$

$-88x=-528$

$\boxed{x=6}$

solve for y using this second equation and the value of x you just found:

$9(6)+y=57$

$54+y=57$

$\boxed{y=3}$

1. $5x + 3y + 3z = 51$
2. $4x - 2y + z = 22$
3. $x + 5y - 2z = 13$

4. Substitute these two values into one of the original equations and solve for z. $x=6$ $y=3$

using Eq 2:

$4(6)-2(3)+z=22$

$24-6+z=22$

$18+z=22$

$\boxed{z=4}$

Solution to this system is:
(6,3,4)

You can now finish Hwk #20:
Sec 3-6

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