3-Variable Elimination + Cramer's Rule

$$x + 8y + 2z = -12$$
$$3x + y + 7z = 38$$
$$4x - 3y + 6z = 47$$

① $-3x - 24y - 6z = 36$
$+\ 3x + y + 7z = 38$
$-23y + z = 74$

② $-4x - 32y - 8z = 48$
$+\ 4x - 3y + 6z = 47$
$-35y - 2z = 95$

③ $2[-23y + z = 74]$
$-35y - 2z = 95$

$-46y + 2z = 148$
$-35y - 2z = 95$

$\frac{-81y}{-81} = \frac{243}{-81}$

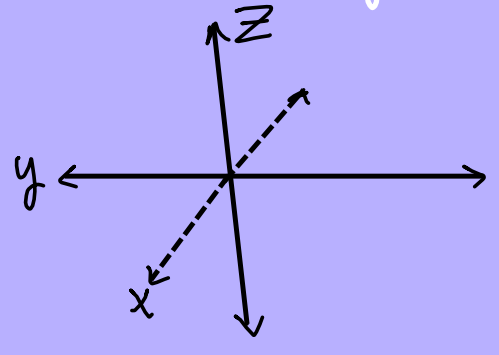
$y = -3$

④ $-23(-3) + z = 74$
$69 + z = 74$
-69
$z = 5$

⑤ $x + 8(-3) + 2(5) = -12$
$x + -24 + 10 = -12$
$x - 14 = -12$
$+14 \quad +14$
$x = 2$

$(2, -3, 5)$

Where 3 planes intersect



Elimination

1) Group 2 equations & eliminate a variable.
2) Group a different pair of equations & eliminate the SAME variable.
3) Group the 2 resulting equations (with 2 variables) & eliminate a variable.
4) Sub answer in a 2-variable equation to find a 2nd variable.
5) Sub both answers in a 3-variable equation to get 3rd variable.

Cramer's Rule

$$4x + 2y - z = 15$$
$$2x - y + 5z = 9$$
$$3x + 2y - z = 12$$

$$z = \frac{\begin{vmatrix} \textcircled{4} & \textcircled{2} & \textcircled{15} \\ 2 & -1 & 9 \\ 3 & 2 & 12 \end{vmatrix}}{\begin{vmatrix} \textcircled{4} & \textcircled{2} & -1 \\ 2 & -1 & 5 \\ 3 & 2 & -1 \end{vmatrix}} = \frac{-9}{-9} = 1$$

$$4\begin{vmatrix} -1 & 9 \\ 2 & 12 \end{vmatrix} - 2\begin{vmatrix} 2 & 9 \\ 3 & 12 \end{vmatrix} + 15\begin{vmatrix} 2 & -1 \\ 3 & 2 \end{vmatrix}$$

$$4(-12 - 18) - 2(24 - 27) + 15(4 + 3)$$

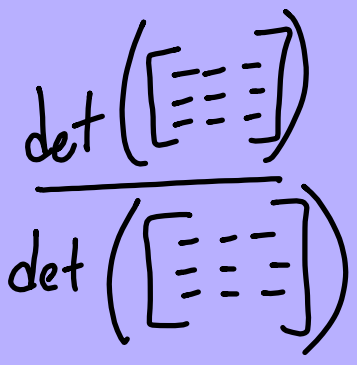
$$-120 + 6 + 105 = -9$$

$$4\begin{vmatrix} -1 & 5 \\ 2 & -1 \end{vmatrix} - 2\begin{vmatrix} 2 & 5 \\ 3 & -1 \end{vmatrix} + -1\begin{vmatrix} 2 & -1 \\ 3 & 2 \end{vmatrix}$$

$$4(1 - 10) - 2(-2 - 15) + -1(4 + 3)$$

$$-36 + 34 - 7 = -9$$

By Calculator



Determinant on Calculator:

Menu - 7 - 3

#18. Look at picture:

1st equation: x + y = 1300

2nd equation: x + 2z = 1400

x = # of sofas

y = # of love seats

z = # of chairs

You figure out 3rd equation. Then set up Cramer's Rule to solve for all 3 variables.

Use you calculator to work out the determinants. Enter missing variables as 0.