Regra de Cramer :

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1-a) $\begin{cases} 2x - y = 2 \\ -x + 3y = -3 \end{cases}$ $\quad D = \begin{vmatrix} 2 & -1 \\ -1 & 3 \end{vmatrix} = 6 - 1 = \boxed{5}$

$D_x = \begin{vmatrix} 2 & -1 \\ -3 & 3 \end{vmatrix} = 6 - 3 = \boxed{3}$ $\quad D_y = \begin{vmatrix} 2 & 2 \\ -1 & -3 \end{vmatrix} = -6 + 2 = \boxed{-4}$

$x = \frac{3}{5}$ $\quad y = \frac{-4}{5}$ $\quad V = \left\{\left(\frac{3}{5}, \frac{-4}{5}\right)\right\}$

1-b) $\begin{cases} 3x - y + z = 1 \\ 2x + 3z = -1 \\ 4x + y - 2z = 7 \end{cases}$ $\quad D = \begin{vmatrix} 3 & -1 & 1 \\ 2 & 0 & 3 \\ 4 & 1 & -2 \end{vmatrix}$ $\begin{matrix} -10 - 13 \\ \boxed{-23} \end{matrix}$

$D_x = \begin{vmatrix} 1 & -1 & 1 \\ -1 & 0 & 3 \\ 7 & 1 & -2 \end{vmatrix}$ $\begin{matrix} -22 - 1 \\ \boxed{-23} \end{matrix}$ $\quad D_y = \begin{vmatrix} 3 & 1 & 1 \\ 2 & -1 & 3 \\ 4 & 7 & -2 \end{vmatrix}$ $\begin{matrix} 32 - 55 \\ \boxed{-23} \end{matrix}$

$D_z = \begin{vmatrix} 3 & -1 & 1 \\ 2 & 0 & -1 \\ 4 & 1 & 7 \end{vmatrix}$ $\begin{matrix} 0 + 17 \\ \boxed{23} \end{matrix}$

$x = \frac{-23}{-23} = \boxed{1}$ $\quad y = \frac{-23}{-23} = \boxed{1}$

$z = \frac{23}{-23} = \boxed{-1}$

$V = \{(1, 1, -1)\}$

2- $\begin{cases} 3x+4y-z=1 \\ 4x+5y+2z=12 \\ x-2y+3z=8 \end{cases}$ $D=\begin{vmatrix} 3 & 4 & -1 \\ 4 & 5 & 2 \\ 1 & -2 & 3 \end{vmatrix}$ $\begin{matrix} 61-31 \\ =\boxed{30} \end{matrix}$

$D_y=\begin{vmatrix} 3 & 1 & -1 \\ 4 & 12 & 2 \\ 1 & 8 & 3 \end{vmatrix}$ $\begin{matrix} (78)-(48) \\ =\boxed{30} \end{matrix}$ $y=\frac{D_y}{D}=\frac{30}{30}=1$ (A)

3- $\begin{cases} x+2y+z=1 \\ 3x+y+11z=-2 \\ 2x+3y+z=1 \end{cases}$ $D=\begin{vmatrix} 1 & 2 & 1 \\ 3 & 1 & -11 \\ 2 & 3 & -1 \end{vmatrix}$ $\begin{matrix} (-36)-(-37) \\ \boxed{=1} \end{matrix}$

$D_x=\begin{vmatrix} 1 & 2 & 1 \\ -2 & 1 & -11 \\ 1 & 3 & -1 \end{vmatrix}$ $\begin{matrix} (-29)-(-28) \\ -29+28 \\ \boxed{=-1} \end{matrix}$ $D_y\begin{vmatrix} 1 & 1 & 1 \\ 3 & -2 & -11 \\ 2 & 1 & -1 \end{vmatrix}$ $\begin{matrix} [redacted] \\ (-17)-(-18) \\ \boxed{=1} \end{matrix}$

$D_z\begin{vmatrix} 1 & 2 & 1 \\ 3 & 1 & -2 \\ 2 & 3 & 1 \end{vmatrix}$ $\begin{matrix} (2)-(2) \\ 2-2 \\ \boxed{=0} \end{matrix}$ $a+b+c=\frac{-1}{1}+\frac{1}{1}+\frac{0}{1}=0$ (C)

4- $D=\begin{vmatrix} 1 & 2 & -3 \\ 1 & 3 & 2 \\ 1 & -1 & -2 \end{vmatrix}$ $\begin{matrix} (1)-(-15) \\ =\boxed{16} \end{matrix}$ $D_x\begin{vmatrix} 29 & 2 & -3 \\ 4 & 3 & 2 \\ 8 & -1 & -2 \end{vmatrix}$ $\begin{matrix} (-130)-(-146) \\ =\boxed{16} \end{matrix}$

$D_y\begin{vmatrix} 1 & 29 & -3 \\ 1 & 4 & 2 \\ 1 & 8 & -2 \end{vmatrix}$ $\begin{matrix} (26)-(-54) \\ =\boxed{80} \end{matrix}$ $D_z\begin{vmatrix} 1 & 2 & 29 \\ 1 & 3 & 4 \\ 1 & -1 & 8 \end{vmatrix}$ $(3)-(99)=\boxed{-96}$ [redacted]

$\frac{16}{16}+\frac{80}{16}+\frac{-96}{16}=\frac{96-96}{16}=\frac{0}{16}=0$ (A)

5- $\begin{cases} 2x+y = 5 \\ 2y+z = 3 \\ 3x+2y+z = 7 \end{cases}$ $D = \begin{vmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 3 & 2 & 1 \end{vmatrix}$ $(7)-(4)$ $7-4$ $= \boxed{3}$

$D_x = \begin{vmatrix} 5 & 1 & 0 \\ 3 & 2 & 1 \\ 7 & 2 & 1 \end{vmatrix}$ $(17)-(13)$ $17-13$ $\boxed{=4}$

$D_y = \begin{vmatrix} 2 & 5 & 0 \\ 0 & 3 & 1 \\ 3 & 7 & 1 \end{vmatrix}$ $(21)-(14)$ $21-14$ $\boxed{=7}$

$D_z = \begin{vmatrix} 2 & 1 & 5 \\ 0 & 2 & 3 \\ 3 & 2 & 7 \end{vmatrix}$ $(37)-(42)$ $37-42$ $\boxed{=-5}$

(D) $\frac{4}{3}; \frac{7}{3}; \frac{-5}{3}$

6- $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ -1 & 2 & 2 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 7 \\ -1 \end{bmatrix} \rightarrow \begin{cases} x = 3 \\ 2x+y = 7 \\ -x+2y+2z = -1 \end{cases}$

$D = \begin{vmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ -1 & 2 & 2 \end{vmatrix} \boxed{=2}$

$D_x = \begin{vmatrix} 3 & 0 & 0 \\ 7 & 1 & 0 \\ -1 & 2 & 2 \end{vmatrix} = \boxed{6}$

$\boxed{x = \frac{6}{2} = 3}$

$D_y = \begin{vmatrix} 1 & 3 & 0 \\ 2 & 7 & 0 \\ -1 & -1 & 2 \end{vmatrix}$ $(14)-(12)$ $14-12$ $= \boxed{2}$

$D_z = \begin{vmatrix} 1 & 0 & 3 \\ 2 & 1 & 7 \\ -1 & 2 & -1 \end{vmatrix}$ $(11)-(11)$ $11-11$ $= 0$

$\boxed{y = \frac{2}{2} = 1}$

$z = \frac{0}{2} = 0$ (E)

Escalonamento (Gauss) :

1- $S = \begin{cases} 2x - y - 3z = -5 \\ x + 3y - z = 11 \\ x - 5z = 3 \end{cases}$

-1/2

$$\begin{pmatrix} 2 & -1 & -3 & -5 \\ 1 & 3 & -1 & 11 \\ 1 & 0 & -5 & 3 \end{pmatrix} \sim \begin{pmatrix} 0 & 3{,}5 & 0{,}5 & 13{,}5 \\ 0 & 0{,}5 & -3{,}5 & 5{,}5 \end{pmatrix} \cdot 7 \sim \begin{pmatrix} & & & \\ 0 & 25 & 0 & 100 \end{pmatrix}$$

$25y = 100 \rightarrow y = 100/25 = \boxed{4}$

$3{,}5y + 0{,}5z = 13{,}5 \rightarrow 14 + 0{,}5z = 13{,}5 \rightarrow z = -0{,}5/0{,}5 = \boxed{-1}$

$2x - y - 3z = -5 \rightarrow 2x - 4 + 3 = -5 \rightarrow x = -4/2 = \boxed{-2}$

$x = -2 ; y = 4 ; z = -1$

2- $\begin{cases} x = 2y \\ 2y = 3z \\ x + y + z = 11 \end{cases} \rightarrow \begin{cases} x - 2y = 0 \\ 2y - 3z = 0 \\ x + y + z = 11 \end{cases}$

-1

$$\begin{pmatrix} 1 & -2 & 0 & 0 \\ 0 & 2 & -3 & 0 \\ 1 & 1 & 1 & 11 \end{pmatrix} \sim \begin{pmatrix} 0 & 2 & -3 & 0 \\ 0 & 3 & 1 & 11 \end{pmatrix} \cdot 3 \cdot 2 + \sim \begin{pmatrix} & & & \\ 0 & 0 & 11 & 22 \end{pmatrix}$$

$11z = 22 \rightarrow z = 22/11 = \boxed{2}$

$2y - 6 = 0 \rightarrow y = 6/2 = \boxed{3}$

$x - 2 \cdot (3) = 0 \rightarrow x - 6 = 0 \rightarrow x = \boxed{6}$

$x + 2y + 3z$

$6 + 2 \cdot 3 + 3 \cdot 2$

$6 + 6 + 6$

$= 18$ (B)

3- $\begin{cases} x+y+z=0 \\ 2x-y-2z=1 \\ 6y+3z=-12 \end{cases}$

$$\begin{pmatrix} 1 & 1 & 1 & 0 \\ 2 & -1 & -2 & 1 \\ 0 & 6 & 3 & -12 \end{pmatrix} \xrightarrow{-2} N \begin{pmatrix} 0 & -3 & -4 & 1 \\ 0 & 6 & 3 & -12 \end{pmatrix} \xrightarrow{2} N \begin{pmatrix} & & & \\ 0 & 0 & -5 & -10 \end{pmatrix}$$

$-5z = -10 \rightarrow z = -10/-5 = 2$ (D)

4- $\begin{cases} a+b+c=68 \\ b+1/5 \cdot c = a \\ 1/5 \cdot a + c = 3b \end{cases} \rightarrow \begin{cases} a+b+c=68 \\ a-b-1/5 \cdot c = 0 \\ 1/5\,a - 3b + c = 0 \end{cases}$

$$\begin{pmatrix} 1 & 1 & 1 & 68 \\ 1 & -1 & -1/5 & 0 \\ 1/5 & -3 & 1 & 0 \end{pmatrix} \xrightarrow{-1} \xrightarrow{1/5} N \begin{pmatrix} 0 & -2 & -6/5 & -68 \\ 0 & -16/5 & 4/5 & -68/5 \end{pmatrix} \xrightarrow{-8/5}$$

$$\begin{pmatrix} & & & \\ 0 & 0 & 68/25 & 476/5 \end{pmatrix}$$

$68/25\,c = 476/5 \rightarrow 68c = 25 \cdot \frac{476}{5}$

$c = 2380/68 = \boxed{35}$

$-2b - 42 = -68 \rightarrow b = \frac{-26}{-2} = \boxed{13}$

$a+b+c = 68 \rightarrow a + 13 + 35 = 68 \rightarrow a = \boxed{20}$

Ali = 20 reais
Bia = 13 reais
Caco = 35 reais

Ali - Caco = 20 - 35
= -15 (A)

5- A = $3y + 4z = 134$

B = $x + 5z = 115$

C = $2x + y = 48$

-3

$$\begin{pmatrix} 0 & 3 & 4 & 134 \\ 1 & 0 & 5 & 115 \\ 2 & 1 & 0 & 48 \end{pmatrix} \sim \begin{pmatrix} -6 & 0 & 4 & -10 \\ 1 & 0 & 5 & 115 \end{pmatrix} \cdot (-6) \sim \begin{pmatrix} 0 & 0 & 34 & 680 \\ & & & \end{pmatrix}$$

$34z = 680 \rightarrow z = 680/34 = \boxed{20}$

$x + 5z = 115 \rightarrow x + 100 = 115 \rightarrow x = \boxed{15}$

$2x + y = 48 \rightarrow 30 + y = 48 \rightarrow y = \boxed{18}$

$x + y + z = 15 + 18 + 20 = 53$ (A)