

Lista de exercícios - Danilo Correia (xirme)

1) a) $\begin{cases} 1x + 0y = 2 \\ 0x + y = 1 \end{cases} \Rightarrow \begin{cases} x = 2 \\ y = 1 \end{cases} \quad S = \{(2, 1)\}$

b) $\begin{cases} 1x_1 + 0x_2 + 0x_3 + 0x_4 = 6 \Rightarrow x_1 = 6 \\ 0x_1 + 1x_2 + 0x_3 + 0x_4 = 3 \Rightarrow x_2 = 3 \\ 0x_1 + 0x_2 + 1x_3 + 1x_4 = 2 \\ 2x_3 + 2x_4 = 2 \\ x_3 + x_4 = \frac{2}{2} \Rightarrow 1 \end{cases}$

b) $\begin{cases} 1x_1 + 0x_2 + 0x_3 + 0x_4 = 4 \\ 0x_1 + 1x_2 + 0x_3 + 0x_4 = 3 \\ 0x_1 + 0x_2 + 1x_3 + 0x_4 = 2 \\ 0x_1 + 0x_2 + 0x_3 + 1x_4 = 1 \end{cases} \quad \left\{ \begin{array}{l} x_1 = 4 \\ x_2 = 3 \\ x_3 = 2 \\ x_4 = 1 \end{array} \right.$

1) $\begin{cases} 1x + 0y + 3z = 1 \\ 0x + y - z = 2 \end{cases} \quad \begin{aligned} x &= 1 - 3z \\ y &= 2 + z \end{aligned}$ *(re z for livre)*

1) $\begin{cases} 1x + 0y + 0z - 7w = 8 \Rightarrow x - 7w = 8 \Rightarrow x = 8 + 7w \\ 0x + 1y + 0z + 3w = 2 \Rightarrow y + 3w = 2 \Rightarrow y = 2 - 3w \\ 0x + 0y + z + w = -5 \Rightarrow z + w = -5 \Rightarrow z = -5 - w \end{cases}$

(re w for livre)

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2) a) $\begin{cases} 3x - 4y = 1 \\ x + 3y = 9 \end{cases}$ (1-3)

$$\begin{array}{l} x + 3y = 9 \\ 3x - 4y = 1 \\ \hline x + 3(1-2) = 9 \end{array}$$

$S = \{(15, -2)\}$ $\begin{cases} x + 3y = 9 \\ 0 - 13y = 26 \end{cases}$ $x = 9 + 6 > 15$

(SPD) $-13y = 26$ $y = \frac{26}{-13} \Rightarrow -2$

b) $\begin{cases} 5x + 8y = 34 \\ 10x + 16y = 50 \end{cases}$ (1-2)

$$\begin{array}{l} 5x + 8y = 34 \\ 0 + 0 = -18 \end{array} \Rightarrow \boxed{(5)}$$

c) $\begin{cases} x + 2y = 5 \\ 2x - 3y = -4 \end{cases}$ (1-2)

$$\begin{array}{l} x + 2y = 5 \\ 0 - 7y = -14 \end{array} \Rightarrow \begin{array}{l} -7y = -14 \\ y = \frac{-14}{-7} \Rightarrow +2 \end{array}$$

$S = \{(1, 2)\}$ $x + 2 \cdot 2 = 5$ $x = 1$

(SPD)

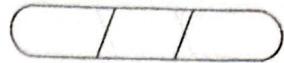
d) $\begin{cases} x - 2y - 3z = -4 \\ 2x - 4y - 2z = -4 \\ 3x + 2y - 5z = 8 \end{cases}$ (1-2)(1-3)

$$\begin{array}{l} x - 2y - 3z = -4 \\ 0 + 0 + 4z = -8 \\ 0 + 8y + 4z = 20 \end{array} \Rightarrow \begin{array}{l} 4z = -8 \Rightarrow z = 2 \\ 0 + 0 + 4z = -8 \\ 8y + 4 \cdot 2 = 20 \end{array}$$
$$8y = 20 - 8 \Rightarrow y = \frac{12}{8} \Rightarrow \frac{3}{2}$$
$$\begin{array}{l} x - 2 \left(\frac{3}{2} \right) - 3 \cdot 2 = -4 \\ x - 3 - 6 = -4 \\ x = -4 + 9 \end{array}$$

$\left(\frac{-2 \cdot 3}{2}, \frac{-6}{2} \right)$ $x - 2 \left(\frac{3}{2} \right) - 3 \cdot 2 = -4$ $8y + 4 \cdot 2 = 20$

$$8y = 20 - 8$$

$x = 5$ $S = \left\{ \left(5, \frac{3}{2}, 2 \right) \right\}$



$$3(4) + 0 + 2 = 3$$

e) 5)

$$\begin{array}{l} \text{b)} \begin{cases} x + 2y - z = 2 & (-2) \\ 2x - y + 3z = 9 & (-3) \\ 3x + 3y - 2z = 3 \end{cases} \quad \begin{cases} x + 2y - z = 2 \\ 0 - 5y + 6z = 5 \\ 0 - 3y + 2z = 3 \end{cases} \quad \begin{array}{l} -5y + 5(3+3y) = 5 \\ -5y + 15 + 15y = 5 \\ 10y = -10 \\ y = -1 \end{array} \\ S = \{4, 0, -1\} \end{array}$$

$$\begin{array}{l} x + 2(-1) - 0 = 2 \\ x - 2 = 2 \\ x = 4 \end{array} \quad \begin{array}{l} z = 3 + 3y \\ z = 3 - 3 > 0 \end{array}$$

$$\begin{array}{l} \text{g)} \begin{cases} x + 0y + 3z = -8 & (-2) \\ 2x - 4y + 0z = -4 & (-3) \\ 3x - 2y - 5z = 26 \end{cases} \quad \begin{cases} x + 0y + 3z = -8 \\ 0 - 4y - 6z = 12 \\ 0 - 2y - 14z = 50 \end{cases} \end{array}$$

$$\begin{array}{l} \text{3) a)} \left(\begin{array}{ccccc|c} 1 & 2 & 3 & 1 & 8 \\ 1 & 3 & 0 & 1 & 7 \\ 1 & 0 & 2 & 1 & 3 \end{array} \right) \quad L_2 - L_1 \rightarrow L_2 \quad \left(\begin{array}{ccccc|c} 1 & 2 & 3 & 1 & 8 \\ 0 & 1 & -3 & 0 & -1 \\ 1 & 0 & 2 & 1 & 3 \end{array} \right) \\ L_3 - L_1 \rightarrow L_3 \quad \left(\begin{array}{ccccc|c} 1 & 2 & 3 & 1 & 8 \\ 0 & 1 & -3 & 0 & -1 \\ 0 & 0 & -1 & 0 & -9 \end{array} \right) \end{array}$$

$$\begin{array}{l} L_3 + 2L_2 \rightarrow L_3 \quad \left(\begin{array}{ccccc|c} 1 & 2 & 3 & 1 & 8 \\ 0 & 1 & -3 & 0 & -1 \\ 0 & 0 & -1 & 0 & -9 \end{array} \right) \quad L_3 - (-7) \rightarrow L_3 \quad \left(\begin{array}{ccccc|c} 1 & 2 & 3 & 1 & 8 \\ 0 & 1 & -3 & 0 & -1 \\ 0 & 0 & 1 & 0 & 1 \end{array} \right) \end{array}$$

$$\begin{array}{l} L_1 - 3L_3 \rightarrow L_1 \quad \left(\begin{array}{ccccc|c} 1 & 2 & 0 & 1 & 5 \\ 0 & 1 & 0 & 0 & 2 \\ 0 & 0 & 1 & 0 & 1 \end{array} \right) \quad L_1 - 2L_2 \rightarrow L_1 \quad \left(\begin{array}{ccccc|c} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 2 \\ 0 & 0 & 1 & 0 & 1 \end{array} \right) \end{array}$$

$$x = 1 - w$$

$$y = 2$$

$$z = 1$$

$$w = \text{Inver}$$

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b) $\left| \begin{array}{cccc|c} 1 & 1 & 3 & -3 & 0 \\ 0 & 2 & 1 & -3 & 3 \\ 1 & 0 & 2 & -1 & -1 \end{array} \right|$ $L_3 - L_1 \Rightarrow L_3$ $\left| \begin{array}{cccc|c} 1 & 1 & 3 & -3 & 0 \\ 0 & 2 & 1 & -3 & 3 \\ 0 & -1 & -1 & 2 & -1 \end{array} \right|$

$\frac{1}{2}L_2 \rightarrow L_2$ $\left| \begin{array}{cccc|c} 1 & 1 & 3 & -3 & 0 \\ 0 & 1 & 0,5 & -1,5 & 1,5 \\ 0 & -1 & -1 & 2 & -1 \end{array} \right|$ $L_1 - L_2 \rightarrow L_1$ $\left| \begin{array}{cccc|c} 1 & 0 & 2,5 & -1,5 & 0 \\ 0 & 1 & 0,5 & -1,5 & 1,5 \\ 0 & 0 & -0,5 & 0,5 & 0,5 \end{array} \right|$

$-2 \cdot L_3 \rightarrow L_3$ $\left| \begin{array}{cccc|c} 1 & 0 & 2,5 & -1,5 & -1,5 \\ 0 & 1 & 0,5 & -1,5 & 1,5 \\ 0 & 0 & 1 & -1 & -1 \end{array} \right|$ $L_1 - 2 \cdot L_3 \rightarrow L_1$
 $L_2 - 0,5 \cdot L_3 \rightarrow L_2$

$\left| \begin{array}{cccc|c} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & -1 & 2 \\ 0 & 0 & 1 & -1 & -1 \end{array} \right|$ $x = 1 - w$ $w = \text{arbitrary}$
 $y = 2 + w$
 $z = -1 + w$ (d) 8

c) $\left| \begin{array}{cccc|c} 1 & 2 & 3 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 2 & 0 & 0 & 0 \\ 1 & 3 & 3 & 0 & 0 \end{array} \right|$ $L_2 - L_1 \rightarrow L_2$ $\left| \begin{array}{cccc|c} 1 & 2 & 3 & 0 & 0 \\ 0 & -1 & -2 & 0 & 0 \\ 0 & 0 & -3 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{array} \right|$
 $L_3 - L_1 \rightarrow L_3$
 $L_4 - L_1 \rightarrow L_4$

$\left| \begin{array}{cccc|c} 1 & 2 & 3 & 0 & 0 \\ 0 & 1 & 2 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{array} \right|$ $L_1 - 3 \cdot L_3 \rightarrow L_1$ $\left| \begin{array}{cccc|c} 1 & 0 & -4 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{array} \right|$
 $L_1 - 2 \cdot L_2 \rightarrow L_1$
 $L_2 - 2 \cdot L_3 \rightarrow L_2$

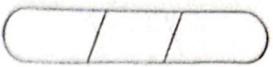
$x = 0$

$y = 0$

$z = 0$

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a = b



u) a) $\left| \begin{array}{ccccc} 1 & -2 & 1 & 1 & 2 \\ 2 & -5 & 1 & -2 & -1 \\ 3 & -7 & 2 & -1 & 2 \end{array} \right| L_2 - 2L_1 \rightarrow L_2 \quad \left| \begin{array}{ccccc} 1 & -2 & 1 & 1 & 2 \\ 0 & -1 & -1 & -4 & -5 \\ 0 & -1 & -1 & -4 & -4 \end{array} \right|$

b) $\left| \begin{array}{ccccc} 1 & -2 & 1 & 1 & 2 \\ 0 & 1 & 1 & 4 & 5 \\ 0 & -1 & -1 & -4 & -4 \end{array} \right| L_3 + L_2 \rightarrow L_3 \quad \left| \begin{array}{ccccc} 1 & -2 & 1 & 1 & 2 \\ 0 & 1 & 1 & 4 & 5 \\ 0 & 0 & 0 & 0 & 1 \end{array} \right|$

$-1 \cdot L_2 \rightarrow L_2 \quad \left| \begin{array}{ccccc} 1 & -2 & 1 & 1 & 2 \\ 0 & 1 & 1 & 4 & 5 \\ 0 & -1 & -1 & -4 & -4 \end{array} \right| L_3 + L_2 \rightarrow L_3 \quad \left| \begin{array}{ccccc} 1 & -2 & 1 & 1 & 2 \\ 0 & 1 & 1 & 4 & 5 \\ 0 & 0 & 0 & 0 & 1 \end{array} \right|$

$$x + 2y + z = 1 \quad x - 2(4 - 3) + z = 1 \Rightarrow x - 8 + 2z + z = 1$$
$$x = 9 - 3z$$

5) a) $A + 4I \Rightarrow \left| \begin{array}{ccc|cc} 1 & 0 & 0 & 4 & 0 & 0 \\ 0 & 1 & 0 & 0 & 4 & 0 \\ 0 & 0 & 1 & 0 & 0 & 4 \end{array} \right| + \left| \begin{array}{ccc|cc} 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & -4 & 0 & 0 & 1 \end{array} \right|$

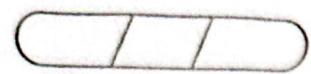
$$A + 4I = \begin{pmatrix} 5 & 0 & 5 \\ 1 & 5 & 1 \\ 0 & 1 & 0 \end{pmatrix} \cdot X = 0 \Rightarrow \begin{pmatrix} 5 & 0 & 5 \\ 1 & 5 & 1 \\ 0 & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} x_{11} \\ x_{21} \\ x_{31} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

$$\left| \begin{array}{ccc|c} 5 & 0 & 5 & 0 \\ 1 & 5 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{array} \right| L_1 \leftrightarrow L_1 \quad \left| \begin{array}{ccc|c} 1 & 5 & 1 & 0 \\ 5 & 0 & 5 & 0 \\ 0 & 1 & 0 & 0 \end{array} \right| L_2 - 5 \cdot L_1 \rightarrow L_2$$

$$\left| \begin{array}{ccc|c} 1 & 5 & 1 & 0 \\ 0 & -25 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{array} \right| \frac{1}{-25} \cdot L_2 \rightarrow L_2 \quad \left| \begin{array}{ccc|c} 1 & 5 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{array} \right| L_3 - L_2 \rightarrow L_3$$

$$\left| \begin{array}{ccc|c} 1 & 5 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \right| x_1 + 5x_2 + x_3 = 0 \quad x_1 + x_3 = 0$$
$$x_2 = 0 \quad x_1 = -x_3$$

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b) $A - 2I = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 1 & 0 & 5 \end{pmatrix} \Rightarrow \begin{pmatrix} -1 & 0 & 5 \\ 1 & -1 & 1 \\ 0 & 1 & -6 \end{pmatrix}$

$$\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & -4 \end{pmatrix} \xrightarrow{\begin{array}{c} L_1 - L_2 \\ L_3 + L_1 \end{array}} \begin{pmatrix} -1 & 0 & 5 \\ 1 & 1 & 1 \\ 0 & 1 & -6 \end{pmatrix} \xrightarrow{\begin{array}{c} -L_1 \Rightarrow L_1 \\ L_3 - L_2 \Rightarrow L_3 \end{array}} \begin{pmatrix} 1 & 0 & 5 \\ 1 & 1 & 1 \\ 0 & 1 & -6 \end{pmatrix}$$

$$L_2 - L_1 \Rightarrow L_2 \quad \begin{pmatrix} 1 & 0 & 5 & | & 0 \\ 0 & -1 & 6 & | & 0 \\ 0 & 1 & -6 & | & 0 \end{pmatrix} \xrightarrow{-1 \cdot L_2 \Rightarrow L_2} \begin{pmatrix} 1 & 0 & 5 & | & 0 \\ 0 & 1 & -6 & | & 0 \\ 0 & 0 & 0 & | & 0 \end{pmatrix}$$

$$x_1 - 5x_3 = 0 \Rightarrow x_1 = 5x_3 \quad \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 5x_3 \\ 6x_3 \\ x_3 \end{pmatrix} \quad x \in \mathbb{R}$$

6) a) $\begin{pmatrix} 1 & 1 & 1 & | & 2 \\ 2 & 3 & 2 & | & 5 \\ 2 & 3 & a^2-1 & | & a+1 \end{pmatrix} \xrightarrow{L_2 - 2L_1 \Rightarrow L_2} \begin{pmatrix} 1 & 1 & 1 & | & 2 \\ 0 & 1 & 0 & | & 1 \\ 0 & 1 & a^2-3 & | & a-3 \end{pmatrix}$

$$L_3 - L_2 \Rightarrow L_3 \quad \begin{pmatrix} 1 & 1 & 1 & | & 2 \\ 0 & 1 & 0 & | & 1 \\ 0 & 0 & a^2-3 & | & a-4 \end{pmatrix} \quad a^2 - 3 \neq 0$$

$$a^2 - 3 = 0 \Rightarrow a = \pm\sqrt{3}$$

sem solução: $a = \pm\sqrt{3}$

solução única $a \neq \pm\sqrt{3}$

infinitas = nunca ocorre

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$$\textcircled{1} \text{ a) } \left(\begin{array}{cc|cc} 2 & -2 & 1 & 0 \\ 3 & 1 & 0 & 1 \end{array} \right) \xrightarrow{\frac{1}{2}L_1} \left(\begin{array}{cc|cc} 1 & -1 & 0,5 & 0 \\ 3 & 1 & 0 & 1 \end{array} \right) \xrightarrow{L_2 - 3L_1} \left(\begin{array}{cc|cc} 1 & -1 & 0,5 & 0 \\ 0 & 4 & -1,5 & 1 \end{array} \right)$$

$$\left(\begin{array}{cc|cc} 1 & -1 & 0,5 & 0 \\ 0 & 4 & -1,5 & 1 \end{array} \right) \xrightarrow{\frac{1}{4}L_2} L_2 \left(\begin{array}{cc|cc} 1 & -1 & 0,5 & 0 \\ 0 & 1 & -0,375 & 0,25 \end{array} \right) \xrightarrow{L_1 + L_2} L_1$$

$$A^{-1} = \begin{pmatrix} 0,125 & 0,125 \\ -0,375 & 0,25 \end{pmatrix}$$

$$\text{b) } \left(\begin{array}{ccc|ccc} 2 & -2 & 0 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 & 1 & 0 \\ 0 & 1 & -1 & 0 & 0 & 1 \end{array} \right) \xrightarrow{\frac{1}{2}L_2} \left(\begin{array}{ccc|ccc} 1 & -1 & 0 & 0,5 & 0 & 0 \\ 1 & 2 & 1 & 0 & 1 & 0 \\ 0 & 1 & -1 & 0 & 0 & 1 \end{array} \right)$$

$$L_2 - L_1 \Rightarrow L_2 \left(\begin{array}{ccc|ccc} 1 & -1 & 0 & 0,5 & 0 & 0 \\ 0 & 3 & 1 & -0,5 & 1 & 0 \\ 0 & 1 & -1 & 0 & 0 & 1 \end{array} \right) \xrightarrow{L_3 - \frac{1}{3}L_2} L_3 \left(\begin{array}{ccc|ccc} 1 & -1 & 0 & 0,5 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 0 & -\frac{2}{3} & 0 & 0 & 1 \end{array} \right)$$

$$B^{-1} = \begin{pmatrix} \frac{3}{8} & \frac{1}{4} & \frac{1}{4} \\ -\frac{1}{8} & \frac{1}{4} & \frac{1}{4} \\ -\frac{1}{8} & \frac{1}{4} & -\frac{3}{4} \end{pmatrix}$$

$$\text{c) } \left(\begin{array}{cc|cc} 3 & 5 & 1 & 0 \\ 1 & 2 & 0 & 1 \end{array} \right) \xrightarrow{\frac{1}{3}L_1} \left(\begin{array}{cc|cc} 1 & \frac{5}{3} & \frac{1}{3} & 0 \\ 1 & 2 & 0 & 1 \end{array} \right) \xrightarrow{L_2 - L_1} \left(\begin{array}{cc|cc} 1 & \frac{2}{3} & \frac{1}{3} & 0 \\ 0 & 1 & -\frac{1}{3} & 1 \end{array} \right)$$

$$3 \cdot L_2 \left(\begin{array}{cc|cc} 1 & \frac{2}{3} & \frac{1}{3} & 0 \\ 0 & 1 & -\frac{1}{3} & 1 \end{array} \right) \xrightarrow{L_1 - \frac{2}{3} \cdot L_2} \left(\begin{array}{cc|cc} 1 & 0 & 2 & -\frac{5}{3} \\ 0 & 1 & -1 & 3 \end{array} \right)$$

$$C^{-1} = \begin{pmatrix} 2 & -\frac{5}{3} \\ -1 & 3 \end{pmatrix}$$

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$$\text{d) } \left(\begin{array}{ccc|ccc} 0 & -1 & 1 & 1 & 0 & 0 \\ 2 & 0 & -1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{array} \right) \xrightarrow{L_2+L_1} \left(\begin{array}{ccc|ccc} 1 & 0 & -\frac{1}{2} & 1 & 0 & 0 \\ 0 & -1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 1 \end{array} \right)$$

$$\xrightarrow{L_3-L_1} \left(\begin{array}{ccc|ccc} 1 & 0 & -\frac{1}{2} & 0 & \frac{1}{2} & 0 \\ 0 & -1 & 1 & 1 & 0 & 0 \\ 0 & 1 & \frac{1}{2} & 0 & -\frac{1}{2} & 1 \end{array} \right) \xrightarrow{-1 \cdot L_2} \left(\begin{array}{ccc|ccc} 1 & 0 & -\frac{1}{2} & 0 & \frac{1}{2} & 0 \\ 0 & 1 & -1 & -1 & 0 & 0 \\ 0 & 1 & \frac{1}{2} & 0 & -\frac{1}{2} & 1 \end{array} \right)$$

$$\xrightarrow{L_3-L_2} \left(\begin{array}{ccc|ccc} 1 & 0 & -\frac{1}{2} & 0 & \frac{1}{2} & 0 \\ 0 & 1 & -1 & -1 & 0 & 0 \\ 0 & 0 & \frac{3}{2} & 1 & -\frac{1}{2} & 1 \end{array} \right) \xrightarrow{\frac{2}{3} \cdot L_3} \left(\begin{array}{ccc|ccc} 1 & 0 & -\frac{1}{2} & 0 & \frac{1}{2} & 0 \\ 0 & 1 & -1 & -1 & 0 & 0 \\ 0 & 0 & 1 & \frac{2}{3} & -\frac{1}{3} & \frac{2}{3} \end{array} \right)$$

$$\left(\begin{array}{ccc|ccc} 1 & 1 & 0 & \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ 0 & 1 & 0 & -\frac{1}{3} & -\frac{1}{3} & \frac{2}{3} \\ 0 & 0 & 1 & \frac{2}{3} & -\frac{1}{3} & \frac{2}{3} \end{array} \right) \xrightarrow{D = \begin{pmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ -\frac{1}{3} & -\frac{1}{3} & \frac{2}{3} \\ \frac{2}{3} & -\frac{1}{3} & \frac{2}{3} \end{pmatrix}}$$

$$\begin{aligned} 8) \quad & \begin{cases} x + 2y + 3z = 26 \quad (1) \\ 2x + 5y + 6z = 60 \\ 2x + 3y + 4z = 40 \end{cases} \quad 2x + 4y + 6z - (2x + 5y + 6z) = 52 - 60 \\ & \quad y = 8 \\ & \quad x = 10 - 3z \quad (10-6) \end{aligned}$$

$$\begin{aligned} & x + 2(8) + 3z = 26 \quad x = 4 \\ & x + 16 + 3z = 26 \Rightarrow x + 3z = 10 \quad 2(10-3z) + 4z = 16 \\ & \quad 20 - 6z + 4z = 16 \end{aligned}$$

$$\begin{aligned} & 2x + 3(8) + 4z = 40 \quad -2z = -4 \\ & 2x + 24 + 4z = 40 \Rightarrow 2x + 4z = 16 \quad z = 2 \end{aligned}$$

$$x = 4, 00$$

$$y = 8$$

$$z = 2$$

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Banana

$$9) \quad 3x = x + y \quad 3x = 300$$

$$3x = x + y \Rightarrow y = 2x \quad y = 200$$

$$6x + 6x + 10x = 2200 \Rightarrow 22x = 2200 \Rightarrow x = 100$$

Banana: 100 unidades

Carrinho: 300 unidades

Mundae: 200 unidades

$$10) \quad 40x + 30y + 10z = 7000 \quad \text{simplificar} \quad x + 2y + 4z = 5000$$
$$20x + 40y + 30z = 6000 \quad 13x + 6y - 8z = 1300$$
$$10x + 20y + 40z = 5000 \quad x = 2z - 20$$
$$y = 260 - 3z$$
$$4x + 3y + z = 700 \Rightarrow 4(2z - 20) + 3(260 - 3z) + z = 700$$

$$8z - 80 + 780 - 9z + z = 700 \Rightarrow (8z - 9z + z) + (780 - 80) = 700$$

$$0z + 700 = 700$$

$$x = 2(100) - 20 \Rightarrow 180 \quad x = 2(80) - 20 \Rightarrow 140$$

$$z = 260 - 3(100) = 40 \quad y = 260 - 240 = 20$$

Pizza = 80,00

Torta = 140,00

Ralada = 20,00

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11)

$$\begin{array}{l} x \\ y \\ z \end{array} \left\{ \begin{array}{l} 2x + 3y + z = 8420 \quad (1) \\ x + 2y + 2z = 7940 \\ 4x + 3y = 8110 \end{array} \right. \quad \left\{ \begin{array}{l} 4x + 6y + 2z = 16840 \\ 3x + 3y = 8110 \end{array} \right.$$

$$7y = 11270 \quad y = 1610$$

$$4x + 3(1610) = 8110 \quad x = 820$$

$$z = 8420 - 2(820) - 3(1610) = 1950$$

$$z - x = 1950 - 820 \Rightarrow 1130 //$$