21(a)

$$\left[\begin{array}{ccc|c} 0 & 0 & 1 & 2 \\ 0 & 1 & 0 & 3 \\ 1 & 0 & 0 & 4 \end{array}\right] L_3 \leftrightarrow L_1 \quad \left[\begin{array}{ccc|c} 1 & 0 & 0 & 4 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 2 \end{array}\right]$$

$z = 2 \quad y = 3 \quad x = 4$

$$X = \begin{bmatrix} 4 \\ 3 \\ 2 \end{bmatrix}$$

2|b| Com PIVOTEAMENTO

$$(A + \varepsilon E)\, x_\varepsilon = V$$

$$\left[\begin{array}{ccc|c} \varepsilon & \varepsilon & 1+\varepsilon & 2 \\ \varepsilon & 1+\varepsilon & \varepsilon & 3 \\ 1+\varepsilon & \varepsilon & \varepsilon & 4 \end{array}\right] \quad L_1 \leftrightarrow L_3$$

$$\left[\begin{array}{ccc|c} 1+\varepsilon & \varepsilon & \varepsilon & 4 \\ \varepsilon & 1+\varepsilon & \varepsilon & 3 \\ \varepsilon & \varepsilon & 1+\varepsilon & 2 \end{array}\right] \begin{array}{l} L_2 \to L_2 - \left(\frac{\varepsilon}{1+\varepsilon} \cdot L_1\right) \\ L_3 \to L_3 - \left(\frac{\varepsilon}{1+\varepsilon} \cdot L_1\right) \end{array}$$

$$\left[\begin{array}{ccc|c} 1+\varepsilon & \varepsilon & \varepsilon & 4 \\ 0 & \frac{1+2\varepsilon}{1+\varepsilon} & \frac{\varepsilon}{1+\varepsilon} & \frac{3-\varepsilon}{1+\varepsilon} \\ 0 & \frac{\varepsilon}{1+\varepsilon} & \frac{1+2\varepsilon}{1+\varepsilon} & \frac{2-2\varepsilon}{1+\varepsilon} \end{array}\right] \quad L_3 \to L_3 - \left(\frac{\varepsilon}{1+2\varepsilon} \cdot L_2\right)$$

$$\left[\begin{array}{ccc|c} 1+\varepsilon & \varepsilon & \varepsilon & 4 \\ 0 & \frac{1+2\varepsilon}{1+\varepsilon} & \frac{\varepsilon}{1+\varepsilon} & \frac{3-\varepsilon}{1+\varepsilon} \\ 0 & 0 & \frac{1+4\varepsilon+3\varepsilon^2}{(1+\varepsilon)(1+2\varepsilon)} & \frac{-3\varepsilon^2-\varepsilon+2}{(1+\varepsilon)(1+2\varepsilon)} \end{array}\right]$$

$$\left(\frac{1+4\varepsilon+3\varepsilon^2}{(1+\varepsilon)(1+2\varepsilon)}\right)z = \frac{-3\varepsilon^2-\varepsilon+2}{(1+\varepsilon)(1+2\varepsilon}$$

$$(1+4\varepsilon+3\varepsilon^2)z = -3\varepsilon^2-\varepsilon+2$$

$$z = \frac{-3\varepsilon^2-\varepsilon+2}{3\varepsilon^2+4\varepsilon+1}$$

$$\frac{1+2\varepsilon}{1+\varepsilon}y + \frac{\varepsilon}{1+\varepsilon}z = \frac{3-\varepsilon}{1+\varepsilon}$$

$$\frac{1+2\varepsilon}{1+\varepsilon}y = \frac{3-\varepsilon-\varepsilon z}{1+\varepsilon} \rightarrow y = \frac{3-\varepsilon-\varepsilon z}{1+2\varepsilon}$$

$$(1+\varepsilon)x + \varepsilon y + \varepsilon z = 4$$

$$x = \frac{4-\varepsilon y-\varepsilon z}{1+\varepsilon}$$

$$x_\varepsilon = \begin{bmatrix} \frac{4-\varepsilon y-\varepsilon z}{1+\varepsilon} \\ \frac{3-\varepsilon-\varepsilon z}{1+2\varepsilon} \\ \frac{-3\varepsilon^2-\varepsilon+2}{3\varepsilon^2+4\varepsilon+1} \end{bmatrix}$$

c1

$$\lim_{\varepsilon \to 0} x_\varepsilon$$

$$x_\varepsilon = \begin{bmatrix} \frac{4-\varepsilon_2-\varepsilon_3}{1+\varepsilon} \\ \frac{3-\varepsilon-\varepsilon_3}{1+2\varepsilon} \\ \frac{-3\varepsilon^2-\varepsilon+2}{3\varepsilon^2+4\varepsilon+1} \end{bmatrix}$$

$$\lim_{\varepsilon \to 0} \frac{4-\varepsilon_2-\varepsilon_3}{1+\varepsilon} = 4$$

$$\lim_{\varepsilon \to 0} \frac{3-\varepsilon-\varepsilon_3}{1+2\varepsilon} = 3$$

$$\lim_{\varepsilon \to 0} \frac{-3\varepsilon^2-8+2}{3\varepsilon^2+4\varepsilon+1} = 2$$

$$\lim_{\varepsilon \to 0} x_\varepsilon = \begin{bmatrix} 4 \\ 3 \\ 2 \end{bmatrix}$$