

LA

BSSE23058

Junaidi Abdul Aziz

A.

Q) Let  $Ax=b$  be the linear system

$$\begin{bmatrix} -1 & 3 & 2 \\ 1 & 2 & -3 \\ 2 & 1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ -9 \\ -3 \end{bmatrix}$$

02

Show that  $b$  is in the column space of  $A$  and express  $b$  as a linear combination of column vectors of  $A$ .

$$\left[ \begin{array}{ccc|c} -1 & 3 & 2 & 1 \\ 1 & 2 & -3 & -9 \\ 2 & 1 & -1 & -3 \end{array} \right] R1 \leftrightarrow \frac{R1}{-1}$$

$$\left[ \begin{array}{ccc|c} 1 & -3 & -2 & -1 \\ 1 & 2 & -3 & -9 \\ 2 & 1 & -1 & -3 \end{array} \right]$$

$$R2 \leftarrow R2 + (-1)R1$$

$$R3 \leftarrow R3 + (-2)R1$$

$$-3 - 2$$

$$-2(-2) - 12 \quad 4 - 1 = 3$$

$$\left[ \begin{array}{ccc|c} 1 & -3 & -2 & -1 \\ 0 & 5 & -1 & -8 \\ 0 & 7 & 1 & -1 \end{array} \right]$$

$$R2 \leftarrow \frac{R2}{5}$$

$$1 + (-2 \times -3)$$

$$1 + 6$$

$$-1 + (-1 \times -2) = -1 + 2 = 1$$

$$-3 + (-1 \times -2) = -3 + 2 = -1$$

$$\left[ \begin{array}{ccc|c} 1 & -3 & -2 & -1 \\ 0 & 1 & -1/5 & -8/5 \\ 0 & 7 & 1 & -1 \end{array} \right]$$

$$R3 \leftarrow R3 + (-7)R2$$

$$1 + (-7 \times -1/5) = 5 + 7/5 = 12/5$$

$$-1 + (-7 \times -8/5) = -1 + 56/5 = 51/5$$

$$4 \frac{1}{4} = \frac{17}{4}$$

$$-1 + \frac{51}{5} = \frac{51}{5}$$

$$\frac{12}{5}$$

$$\frac{12}{5}$$

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$$\frac{12}{5}$$

$$\frac{12}{5}$$

$$\frac{12}{5}$$

$$\frac{12}{5}$$

$$\frac{12}{5}$$

$$\frac{12}{5}$$

$$\left[ \begin{array}{ccc|c} 1 & -3 & -2 & -1 \\ 0 & 1 & -1/5 & -8/5 \\ 0 & 0 & 12/5 & 51/5 \end{array} \right]$$

$$\begin{cases} x_1 - 3x_2 - 2x_3 = -1 \\ 12x_1 + 9x_2 - 10x_3 = -1 \end{cases}$$

$$\Rightarrow x_1 - 3x_2 - 2x_3 = -1$$

$$x_2 - \frac{1}{5}x_3 = -8/5$$

$$\frac{12}{5}x_3 = \frac{51}{5}$$

$$x_1 = \frac{63}{12}$$

$$x_2 = \frac{51}{12}$$

$$x_3 = \frac{17}{4}$$

$$\begin{bmatrix} 1 \\ -4 \\ 2 \end{bmatrix}$$