

4

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$$\textcircled{1} \quad x_1 + 2x_2 - 3x_3 + 4x_4 = 2$$

$$2x_1 + 5x_2 - 2x_3 + x_4 = 1$$

$$5x_1 + 12x_2 - 7x_3 + 6x_4 = 3$$

Augmented matrix,

$$\left[\begin{array}{cccc|c} 1 & 2 & -3 & 4 & 2 \\ 2 & 5 & -2 & 1 & 1 \\ 5 & 12 & -7 & 6 & 3 \end{array} \right]$$

$$\begin{array}{l} \pi'_2 = \pi_2 - 2\pi_1 \\ \pi'_3 = \pi_3 - 5\pi_1 \end{array} \rightarrow \left[\begin{array}{cccc|c} 1 & 2 & -3 & 4 & 2 \\ 0 & 1 & 4 & -7 & -3 \\ 0 & 2 & 8 & -14 & -7 \end{array} \right]$$

$$\begin{array}{l} \pi'_1 = \pi_1 - 2\pi_2 \\ \pi'_3 = \pi_3 - 2\pi_2 \end{array} \rightarrow \left[\begin{array}{cccc|c} 1 & 0 & -11 & 18 & 8 \\ 0 & 1 & 4 & -7 & -3 \\ 0 & 0 & 0 & 0 & -1 \end{array} \right]$$

\therefore The augmented matrix is inconsistent (An)

$$\textcircled{2} A^2 + 2A + \text{tr}(A)A^T$$

$$A = \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix}$$

Now,

$$A^2 = \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix} \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 25 & -89 & -13 \\ -89 & 117 & 1 \\ -13 & 1 & 21 \end{bmatrix}$$

$$2A = 2 \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 10 & -14 & 2 \\ -14 & 16 & 4 \\ 2 & 4 & -8 \end{bmatrix}$$

Ans: $A^2 + 2A + \text{tr}(A)A^T$

The value of $\text{tr}(A)$ is 4.

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$$A^T = \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix}$$

$$\therefore \text{tr}(A^T) = \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix}$$

$$\therefore A^2 + 2A + \text{tr}(A^T) = \begin{bmatrix} 25 & -89 & -13 \\ -89 & 112 & 1 \\ -13 & 1 & 21 \end{bmatrix} + \begin{bmatrix} 10 & -14 & 2 \\ -14 & 16 & 4 \\ 2 & 4 & -8 \end{bmatrix}$$

$$+ \begin{bmatrix} 5 & -7 & 1 \\ -7 & 8 & 2 \\ 1 & 2 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 90 & -110 & -10 \\ -110 & 141 & 7 \\ -10 & 7 & 9 \end{bmatrix}$$

(A)