

1.

$$x_1 + 2x_2 - 3x_3 + 4x_4 = 2$$

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

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

The augmented Matrix.

$$\begin{bmatrix} 1 & 2 & -3 & 4 & 2 \\ 2 & 5 & -2 & 1 & 1 \\ 5 & 12 & -7 & 6 & 3 \end{bmatrix}$$

adding -2 ~~and~~ to the first row and obtain second row

adding -5 to the first row and obtain third.

$$\begin{bmatrix} 1 & 2 & -3 & 4 & 2 \\ 0 & 1 & 4 & -7 & -3 \\ 0 & 2 & 8 & -14 & -7 \end{bmatrix}$$

add -2 times to the 2nd row obtain 2nd row.

$$\begin{bmatrix} 1 & 2 & -3 & 4 & 2 \\ 0 & 1 & 4 & -7 & -3 \\ 0 & 0 & 0 & 0 & -1 \end{bmatrix}$$

multiply the third row by -1

$$\begin{bmatrix} 1 & 2 & -3 & 4 & 2 \\ 0 & 1 & 4 & -7 & -3 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

add 3 times to the third row and obtain 2nd

add -2 times to the 1st third row and obtain 1st

$$\begin{bmatrix} 1 & 2 & -3 & 4 & 0 \\ 0 & 1 & 4 & -7 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

add -2 times

$$\begin{bmatrix} 1 & 0 & 11 & 18 & 0 \\ 0 & 1 & 4 & -7 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

$$x_1 = -11x_3 - 18x_4$$

$$x_2 = 4x_3 - 7x_4$$

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$$\text{Let, } x_3 = \pi, x_4 = \delta$$

$$x_1 = -11\pi - 18\delta$$

$$x_2 = 4\pi - 7\delta$$

$$x_3 = \pi, x_4 = \delta$$

A

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

$$\text{Here } A^T = \begin{bmatrix} 10 & -14 & 2 \\ -14 & 16 & 4 \\ 2 & 4 & -8 \end{bmatrix}$$

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

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

$$\tilde{A} + 2A + A^T$$

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

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

$$= \begin{bmatrix} 25 & -35 & 5 \\ -35 & 40 & 10 \\ 5 & 10 & -12 \end{bmatrix}$$