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Section: 11

① Augmented matrix =

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

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

$$= \left[\begin{array}{ccccc} 1 & 2 & -3 & 4 & 2 \\ 0 & 1 & 4 & 7 & -3 \\ 5 & 12 & -7 & 6 & 3 \end{array}\right] \quad [R_2' = (R_1 \times -2) + R_2]$$

$$= \left[\begin{array}{ccccc} 1 & 2 & -3 & 4 & 2 \\ 0 & 1 & 4 & 7 & -3 \\ 0 & 12 & -28 & 42 & -9 \end{array}\right] \quad [R_3' = R_2 \times R_3]$$

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

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

$= \begin{bmatrix} 75 & -89 & -13 \\ -89 & 117 & 1 \\ -13 & 1 & 21 \end{bmatrix}$

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

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

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

~~$\text{tr}(A^T) = 9$~~

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

$$= \begin{bmatrix} 75 & -89 & -13 \\ -89 & 117 & 1 \\ -13 & 1 & 21 \end{bmatrix} + \begin{bmatrix} 10 & -14 & 2 \\ -14 & 16 & 4 \\ 2 & 4 & -8 \end{bmatrix} +$$

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

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