

40. If  $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$ , then find  $A^2 - 5A - 14I$ . Hence, obtain  $A^3$ .

Sol. We have,  $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$  ... (i)

$$\therefore A^2 = A \cdot A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix} = \begin{bmatrix} 29 & -25 \\ -20 & 24 \end{bmatrix}$$

$$\therefore A^2 - 5A - 14I = \begin{bmatrix} 29 & -25 \\ -20 & 24 \end{bmatrix} - \begin{bmatrix} 15 & -25 \\ -20 & 10 \end{bmatrix} - \begin{bmatrix} 14 & 0 \\ 0 & 14 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

Now,  $A^2 - 5A - 14I = O$

$$\Rightarrow A \cdot A^2 - 5A \cdot A = 14AI = O$$

$$\Rightarrow A^3 - 5A^2 - 14A = O$$

$$\Rightarrow A^3 = 5A^2 + 14A$$

$$= 5 \begin{bmatrix} 29 & -25 \\ -20 & 24 \end{bmatrix} + 14 \begin{bmatrix} 3 & -5 \\ -4 & -2 \end{bmatrix}$$

$$= \begin{bmatrix} 145 & -125 \\ -100 & 120 \end{bmatrix} + \begin{bmatrix} 42 & -70 \\ -56 & 28 \end{bmatrix} = \begin{bmatrix} 187 & -195 \\ -156 & 148 \end{bmatrix}$$

NOTE: for topics covered in this lecture, there is very few problems in ncert. to practice concepts covered here, please solve problems from similar and past year ques pdfs.