

- 5) The cost of 4 kg onion, 3 kg wheat and 2 kg rice is Rs 60.
 The cost of 2 kg onion, 4 kg wheat and 6 kg rice is Rs 90.
 The cost of 6 kg onion 2 kg wheat and 3 kg rice is Rs 70.
 Find the cost of each item per kg by matrix method.

solution: Let the cost of onions, wheat and rice per kg be Rs x ,
 Rs y and Rs z respectively.

Then, the given situation can be represented by a system of equations as:

$$4x + 3y + 2z = 60$$

$$2x + 4y + 6z = 90$$

$$6x + 2y + 3z = 70$$

This system of equations can be written in the form of $AX=B$, where

$$A = \begin{bmatrix} 4 & 3 & 2 \\ 2 & 4 & 6 \\ 6 & 2 & 3 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \text{ and } B = \begin{bmatrix} 60 \\ 90 \\ 70 \end{bmatrix}$$

$$|A| = 4(12-12) - 3(6-36) + 2(4-24) = 50 \neq 0$$

$$\text{Now, } A_{11} = 0, A_{12} = 30, A_{13} = -20$$

$$A_{21} = -5, A_{22} = 0, A_{23} = 10$$

$$A_{31} = 10, A_{32} = -20, A_{33} = 10$$

$$\therefore \text{adj } A = \begin{bmatrix} 0 & -5 & 10 \\ 30 & 0 & -20 \\ -20 & 10 & 10 \end{bmatrix}$$

$$\therefore A^{-1} = \frac{1}{|A|} \text{adj } A = \frac{1}{50} \begin{bmatrix} 0 & -5 & 10 \\ 30 & 0 & -20 \\ -20 & 10 & 10 \end{bmatrix}$$

Now,

$$X = A^{-1}B$$

$$\Rightarrow X = \frac{1}{50} \begin{bmatrix} 0 & -5 & 10 \\ 30 & 0 & -20 \\ -20 & 10 & 10 \end{bmatrix} \begin{bmatrix} 60 \\ 90 \\ 70 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{50} \begin{bmatrix} 0 - 450 + 700 \\ 1800 + 0 - 1400 \\ -1200 + 900 + 700 \end{bmatrix}$$

$$= \frac{1}{50} \begin{bmatrix} 250 \\ 400 \\ 400 \end{bmatrix} = \begin{bmatrix} 5 \\ 8 \\ 8 \end{bmatrix} \therefore x=5, y=8 \text{ and } z=8$$

Hence, the cost of onions per kg is Rs 5 per kg, cost of wheat is Rs 8 per kg, the cost of rice is Rs 8 per kg.