NCERT Solutions for Class-XII Maths

Chapter-4.6

NCERT Math Class 12

Examine the consistency of the system of equations in Exercises 1 to 6.

1. x + 2y = 2
2x + 3y = 3

1. The given system of equations: $x+2y=2$
$2x+3y=3$

This system of equations can be written as AX = B, where

$A=\begin{bmatrix}1 & 2\\ 2 & 3\end{bmatrix}, X=\begin{bmatrix}x\\ y\end{bmatrix}$ and $B=\begin{bmatrix}2\\ 3\end{bmatrix}$

$|A| = 3 - 4 = -1 \neq 0$ $\Rightarrow$ A is non -singular and so A-1 exists.

Hence, the system of equations are consistent.

2. $2x - y = -5$
$x + y = 4$

2. The given system of equations is:
2x - y = 5
x + y = 4

The given system of equations can be written in the form of AX = B, where

$A=\begin{bmatrix}2 & -1\\ 1 & 1\end{bmatrix}; X=\begin{bmatrix}x\\ y\end{bmatrix}$ and $B=\begin{bmatrix}5\\ 4\end{bmatrix}$

Now |A| = 2(1)-1(-1) = 3 ≠ 0.

∴ A is a non-singular matrix and hence A^{-1} exists.

So the system of equations will be consistent.

3. $x + 3y = 5$
$2x + 6y = 8$

3. The given system of equations : $x + 3y = 5$
$2x + 6y = 8$

This system of equations can be written as AX = B, where

$A=\begin{bmatrix}1 & 3\\ 2 & 6\end{bmatrix}, X=\begin{bmatrix}x\\ y\end{bmatrix}$ and $B=\begin{bmatrix}5\\ 8\end{bmatrix}$

$|A| = 6 - 6 = 0$ $\Rightarrow$ A is a singular matrix and so A^{-1} does not exists . Now,

$$adj\ A = \begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix}$$

$$(adj\ A)B = \begin{bmatrix} 6 & -3 \\ -2 & 1 \end{bmatrix}\begin{bmatrix} 5 \\ 8 \end{bmatrix} = \begin{bmatrix} 30-24 \\ -10+8 \end{bmatrix} = \begin{bmatrix} 6 \\ -2 \end{bmatrix} \neq 0$$

So, there is no solutions of the given system of equations.
Hence, the system of equations are inconsistent.

4. x + y + z = 1
2x + 3y + 2z = 2
ax + ay + 2az = 4

4. The given system of equations is:
x + y + z = 1
2x + 3y + 2z = 2
ax + ay + 2az = 4
The given system of equations can be written in the form of AX = B, where

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ a & a & 2a \end{bmatrix};\ X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 \\ 2 \\ 4 \end{bmatrix}$$

Now $|A| = 1(6a-2a)-1(4a-2a)+1(2a-3a) = a \neq 0$
$\therefore$ A is a non-singular matrix and hence A^{-1} exists.
So the system of equations will be consistent.

5. 3x – y – 2z = 2
2y – z = –1
3x – 5y = 3

5. The given system of equations: 3x – y – 2z = 2
2y – z = –1
3x – 5y = 3
This system of equations can be written as AX = B, where

$$A = \begin{bmatrix} 3 & -1 & -2 \\ 0 & 2 & -1 \\ 3 & -5 & 0 \end{bmatrix}, x = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{and } B = \begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix}$$

$|A| = 3(0 - 5) + 1(0 + 3) - 2(0 - 6) = -15 + 3 + 12 = 0$
$\Rightarrow$ A is singular matrix and so A^{-1} does not exists. Now,
$A_{11} = -5$ $A_{12} = -3$ $A_{13} = -6$

$A_{21} = 10$ $A_{22} = 6$ $A_{23} = 12$

$A_{31} = 5$ $A_{32} = 3$ $A_{33} = 6$

$$adj\ A = \begin{bmatrix} -5 & 10 & 5 \\ -3 & 6 & 3 \\ -6 & 12 & 6 \end{bmatrix}$$

$$(adj\ A)B = \begin{bmatrix} -5 & 10 & 5 \\ -3 & 6 & 3 \\ -6 & 12 & 6 \end{bmatrix}\begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix} = \begin{bmatrix} -10-10+15 \\ -6-6+9 \\ -12-12+16 \end{bmatrix} = \begin{bmatrix} -5 \\ -3 \\ -6 \end{bmatrix} \neq 0$$

So, there is no solutions of the given system of equations.

Hence, the system of equations are inconsistent.

6. 5x – y + 4z = 5

2x + 3y + 5z = 2

5x – 2y + 6z = –1

6. The given system of equations is:

5x - y + 4z = 5

2x + 3y + 5z = 2

5x - 2y + 6z = -1

The given system of equations can be written in the form of AX = B, where

$$A = \begin{bmatrix} 5 & -1 & 4 \\ 2 & 3 & 5 \\ 5 & -2 & 6 \end{bmatrix};\ X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{ and } B = \begin{bmatrix} 5 \\ 2 \\ -1 \end{bmatrix}$$

Now |A| = 5(18+10)+1(12-25) +4(-4-15) = 51 ≠ 0

∴ A is a non-singular matrix and hence A^{-1} exists.

So the system of equations will be consistent.

7. 5x + 2y = 4

7x + 3y = 5

7. The given system of equations: 7:5x + 2y = 4

7x + 3y = 5

This system of equations can be written as AX = B, where

$$A = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix} \text{and } B = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$$

|A| = 15 - 14 = 1 ≠ 0

⇒ A is non-singular and so A^{-1} exists.

Hence, the system of equations are consistent.

Now, $A_{11} = 3$ $A_{12} = -7$ $A_{21} = -2$ $A_{22} = 5$

$$A^{-1} = \frac{1}{|A|} adj\ A = \frac{1}{|A|}\begin{bmatrix} A_{11} & A_{21} \\ A_{12} & A_{22} \end{bmatrix} = \frac{1}{1}\begin{bmatrix} 3 & -2 \\ -7 & 5 \end{bmatrix}$$

$$X = A^{-1}B \qquad \Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 & -2 \\ -7 & 5 \end{bmatrix}\begin{bmatrix} 4 \\ 5 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 12-10 \\ -28+25 \end{bmatrix} \qquad \Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \end{bmatrix} \quad \Rightarrow x = 2, \qquad y = -3$$

8. 2x – y = – 2
3x + 4y = 3

8. The given system of equations is:
2x - y = -2
3x + 4y = 3
The given system of equations can be written in the form of AX = B, where

$$A=\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix};\ X=\begin{bmatrix} x \\ y \end{bmatrix} \text{ and } B=\begin{bmatrix} -2 \\ 3 \end{bmatrix}$$

Now |A| = 2(4)-3(-1) = 11 ≠ 0 .
∴ A is a non-singular matrix and hence A^{-1} exists.

Now $A^{-1} = \frac{1}{|A|}(AdjA)$

$$AdjA=\begin{bmatrix} 4 & 1 \\ -3 & 2 \end{bmatrix}$$

So $A^{-1} = \frac{1}{|A|}(AdjA) = \frac{1}{11}\begin{bmatrix} 4 & 1 \\ -3 & 2 \end{bmatrix} = \begin{bmatrix} \frac{4}{11} & \frac{1}{11} \\ -\frac{3}{11} & \frac{2}{11} \end{bmatrix}$

And $X = A^{-1}B = \begin{bmatrix} \frac{4}{11} & \frac{1}{11} \\ -\frac{3}{11} & \frac{2}{11} \end{bmatrix}\begin{bmatrix} -2 \\ 3 \end{bmatrix} = \begin{bmatrix} -\frac{5}{11} \\ \frac{12}{11} \end{bmatrix}$

So $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -\frac{5}{11} \\ \frac{12}{11} \end{bmatrix}$

Hence $x = -\frac{5}{11}$ and $y = \frac{12}{11}$

9. 9x – 3y = 3
3x – 5y = 7

9. This given system of equations : 9x – 3y = 3

3x – 5y = 7

This system of equation can be written as AX = B, where

$A=\begin{bmatrix}4 & -3\\ 3 & -5\end{bmatrix}, X=\begin{bmatrix}x\\ y\end{bmatrix}$ and $B=\begin{bmatrix}3\\ 7\end{bmatrix}$

|A| = –20 + 9 = –11 ≠ 0 ⇒ A is non-singular and so A^{-1} exists.

Hence, the system of equations are consistent.

Now, $A_{11} = -5$ $A_{12} = -3$ $A_{21} = 3$ $A_{22} = 4$

$$A^{-1}=\frac{1}{|A|}adj\ A=\frac{1}{|A|}\begin{bmatrix}A_{11} & A_{21}\\ A_{12} & A_{22}\end{bmatrix}=\frac{1}{-11}\begin{bmatrix}-5 & 3\\ -3 & 4\end{bmatrix}$$

$$X = A^{-1}B \quad \Rightarrow \begin{bmatrix}x\\ y\end{bmatrix}=-\frac{1}{11}\begin{bmatrix}-5 & 3\\ -3 & 4\end{bmatrix}\begin{bmatrix}3\\ 7\end{bmatrix}$$

$$\Rightarrow \begin{bmatrix}x\\ y\end{bmatrix}=-\frac{1}{11}\begin{bmatrix}-15+21\\ -9+28\end{bmatrix}\Rightarrow \begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}-\frac{6}{11}\\ -\frac{19}{11}\end{bmatrix}\Rightarrow x=-\frac{6}{11}, \qquad y=-\frac{19}{11}$$

10. 5x + 2y = 3

3x + 2y = 5

10. The given system of equations is:

5x + 2y = 3

3x + 2y = 5

The given system of equations can be written in the form of AX = B, where

$A=\begin{bmatrix}5 & 2\\ 3 & 2\end{bmatrix}; X=\begin{bmatrix}x\\ y\end{bmatrix}$ and $B=\begin{bmatrix}3\\ 5\end{bmatrix}$

Now |A| = 5(2)-2(3) = 4 ≠ 0

∴ A is a non-singular matrix and hence A^{-1} exists.

Now $A^{-1}=\frac{1}{|A|}(\text{AdjA})$

$\text{AdjA}=\begin{bmatrix}2 & -2\\ -3 & 5\end{bmatrix}$

So $A^{-1}=\frac{1}{|A|}(\text{AdjA})=\frac{1}{4}\begin{bmatrix}2 & -2\\ -3 & 5\end{bmatrix}=\begin{bmatrix}\frac{2}{4} & \frac{-2}{4}\\ \frac{-3}{4} & \frac{5}{4}\end{bmatrix}$

And $X = A^{-1}B=\begin{bmatrix}\frac{1}{2} & \frac{-1}{2}\\ \frac{-3}{4} & \frac{5}{4}\end{bmatrix}\begin{bmatrix}3\\ 5\end{bmatrix}=\begin{bmatrix}-1\\ 4\end{bmatrix}$

So $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 4 \end{bmatrix}$

Hence x=-1 and y=4

11. $2x + y + z = 1$

$x - 2y - z = \frac{3}{2}$

$3y - 5z = 9$

11. The given system of equations: $2x + y + z = 1$

$$x - 2y - z = \frac{3}{2}$$

$$3y - 5z = 9$$

This system of equations can be written as AX = b, where

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & -2 & -1 \\ 0 & 3 & -5 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{and } B = \begin{bmatrix} 1 \\ 3/2 \\ 9 \end{bmatrix}$$

$|A| = 2(10 + 3) - 1(-5 - 0) + 1(3 - 0) = 26 + 5 + 3 = 34 \neq 0$

$\Rightarrow$ A is non-singular and so A^{-1} exists. Now,

$A_{11} = 13$	$A_{12} = 5$	$A_{13} = 3$
$A_{21} = 8$	$A_{22} = -10$	$A_{23} = -6$
$A_{31} = 1$	$A_{32} = 3$	$A_{33} = -5$

$$A^{-1} = \frac{1}{|A|} adj\ A = \frac{1}{34}\begin{bmatrix} 13 & 8 & 1 \\ 5 & -10 & 3 \\ 3 & -6 & -5 \end{bmatrix}$$

$$X = A^{-1}B \quad \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{34}\begin{bmatrix} 13 & 8 & 1 \\ 5 & -10 & 3 \\ 3 & -6 & -5 \end{bmatrix}\begin{bmatrix} 1 \\ 3/2 \\ 9 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{34}\begin{bmatrix} 13+12+9 \\ 5-15+27 \\ 3-9-45 \end{bmatrix} \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{34}\begin{bmatrix} 34 \\ 17 \\ -51 \end{bmatrix} = \begin{bmatrix} 1 \\ 1/2 \\ -3/2 \end{bmatrix} \Rightarrow x = 1, y = \frac{1}{2}, z = -\frac{3}{2}$$

12. $x - y + z = 4$

$2x + y - 3z = 0$

$x + y + z = 2$

12. The given system of equations is:

$x - y + z = 4$

$2x + y - 3z = 0$

$x + y + z = 2$

The given system of equations can be written in the form of AX = B, where

$$A=\begin{bmatrix}1 & -1 & 1\\ 2 & 1 & -3\\ 1 & 1 & 1\end{bmatrix};\ X=\begin{bmatrix}x\\ y\\ z\end{bmatrix}\ \text{and}\ B=\begin{bmatrix}4\\ 0\\ 2\end{bmatrix}$$

Now $|A| = 1(1+3)+1(5)+1(1) = 10 \neq 0$

$\therefore$ A is a non-singular matrix and hence A^{-1} exists.

Now $A_{11}=4$, $A_{12}=-5$, $A_{13}=1$, $A_{21}=2$, $A_{22}=0$, $A_{23}=-2$, $A_{31}=1$, $A_{32}=-2$, $A_{33}=3$

$$\text{So AdjA}=\begin{bmatrix}4 & 2 & 2\\ -5 & 0 & 5\\ 1 & -2 & 3\end{bmatrix}$$

$$\therefore\ A^{-1}=\frac{1}{|A|}(\text{AdjA})=\frac{1}{10}\begin{bmatrix}4 & 2 & 2\\ -5 & 0 & 5\\ 1 & -2 & 3\end{bmatrix}$$

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

$$\text{So}\ X=A^{-1}B=\frac{1}{10}\begin{bmatrix}4 & 2 & 2\\ -5 & 0 & 5\\ 1 & -2 & 3\end{bmatrix}\begin{bmatrix}4\\ 0\\ 2\end{bmatrix}=\frac{1}{10}\begin{bmatrix}20\\ -10\\ 10\end{bmatrix}=\begin{bmatrix}\frac{20}{10}\\ \frac{-10}{10}\\ \frac{10}{10}\end{bmatrix}=\begin{bmatrix}2\\ -1\\ 1\end{bmatrix}$$

Hence x=2,y=-1 and z=1.

13. $2x + 3y + 3z = 5$

$x - 2y + z = -4$

$3x - y - 2z = 3$

13. The given system of equations: $2x + 3y + 3z = 5$

$x - 2y + z = -4$

$3x - y - 2z = 3$

This system of equations can be written as AX = B, where

$$A=\begin{bmatrix}2 & 3 & 3\\ 1 & -2 & 1\\ 3 & -1 & -2\end{bmatrix}, X=\begin{bmatrix}x\\ y\\ z\end{bmatrix}\ \text{and}\ B=\begin{bmatrix}5\\ -4\\ 3\end{bmatrix}$$

$|A| = 2(4 + 1) - 3(-2 - 3) + 3(-1 + 6) = 10 + 15 + 15 = 40 \neq 0$

$\Rightarrow$ A is non-singular and so A^{-1} exists. Now,

$A_{11} = 5$ $\quad A_{12} = 5$ $\quad A_{13} = 5$

$A_{21} = 3$ $\quad A_{22} = -13$ $\quad A_{23} = 11$

$A_{31} = 9$ $\quad A_{32} = 1$ $\quad A_{33} = -7$

$$A^{-1} = \frac{1}{|A|} adj\ A = \frac{1}{40}\begin{bmatrix} 5 & 3 & 9 \\ 5 & -13 & 1 \\ 5 & 11 & -7 \end{bmatrix}$$

$$X = A^{-1}B \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{40}\begin{bmatrix} 5 & 3 & 9 \\ 5 & -13 & 1 \\ 5 & 11 & -7 \end{bmatrix}\begin{bmatrix} 5 \\ -4 \\ 3 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{40}\begin{bmatrix} 25-12+27 \\ 25+52+3 \\ 25-44-21 \end{bmatrix} \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{40}\begin{bmatrix} 40 \\ 80 \\ -40 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} \Rightarrow x = 1, y = 2, z = -1$$

14. x – y + 2z = 7
3x + 4y – 5z = -5
2x – y + 3z = 12

14. The given system of equations is:
x - y + 2z = 7
3x + 4y - 5z = -5
2x – y + 3z = 12
The given system of equations can be written in the form of AX = B, where

$$A=\begin{bmatrix} 1 & -1 & 2 \\ 3 & 4 & -5 \\ 2 & -1 & 3 \end{bmatrix};\ X=\begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{ and } B=\begin{bmatrix} 7 \\ -5 \\ 12 \end{bmatrix}$$

Now |A| = 1(12-5) + 1(9+10) + 2(-3-8) = 4 ≠ 0
∴ A is a non-singular matrix and hence A^{-1} exists.
Now A_{11} =7, A_{12}=-19, A_{13}=-11, A_{21}=1, A_{22}=-1, A_{23}=-1, A_{31}=-3, A_{32}=11, A_{33}=7

$$\text{So AdjA}=\begin{bmatrix} 7 & 1 & -3 \\ -19 & -1 & 11 \\ -11 & -1 & 7 \end{bmatrix}$$

$$\therefore\ A^{-1} = \frac{1}{|A|}(\text{AdjA}) = \frac{1}{4}\begin{bmatrix} 7 & 1 & -3 \\ -19 & -1 & 11 \\ -11 & -1 & 7 \end{bmatrix}$$

$$\text{So } X = A^{-1}B = \frac{1}{4}\begin{bmatrix} 7 & 1 & -3 \\ -19 & -1 & 11 \\ -11 & -1 & 7 \end{bmatrix}\begin{bmatrix} 7 \\ -5 \\ 12 \end{bmatrix} = \frac{1}{4}\begin{bmatrix} 8 \\ 4 \\ 12 \end{bmatrix} = \begin{bmatrix} \frac{8}{4} \\ \frac{4}{4} \\ \frac{12}{4} \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$$

Hence $x = 2, y = 1\ and\ z = 3$

15. If $A=\begin{bmatrix}2 & -2 & 5\\ 3 & 2 & -4\\ 1 & 1 & -2\end{bmatrix}$, find A^{-1}. Using A^{-1} solve the system of equations

2x – 3 y + 5z = 11
3x + 2y – 4z = -5
X + y – 2z = -3

15. $A=\begin{bmatrix}2 & -2 & 5\\ 3 & 2 & -4\\ 1 & 1 & -2\end{bmatrix}$

$|A| = 2(-4 + 4) + 3(-6 + 4) + 5(3 - 2) = 0 - 6 + 5 = -1 \neq 0$

$\Rightarrow$ A is non-singular and so A^{-1} exists. Now,

$A_{11} = 0$ $\quad A_{12} = 2$ $\quad A_{13} = 1$
$A_{21} = -1$ $\quad A_{22} = -9$ $\quad A_{23} = -5$
$A_{31} = 2$ $\quad A_{32} = 23$ $\quad A_{33} = 13$

$$A^{-1}=\frac{1}{|A|}adj\ A=\frac{1}{-1}\begin{bmatrix}0 & -1 & 2\\ 2 & -9 & 23\\ 1 & -5 & 13\end{bmatrix}=\begin{bmatrix}0 & 1 & -2\\ -2 & 9 & -23\\ -1 & 5 & -13\end{bmatrix}$$

This given system of equations: 2x – 3 y + 5z = 11
3x + 2y – 4z = -5
x + y – 2z = -3

This system of equations can be written as AX = B, where

$$A=\begin{bmatrix}2 & -2 & 5\\ 3 & 2 & -4\\ 1 & 1 & -2\end{bmatrix}, X=\begin{bmatrix}x\\ y\\ z\end{bmatrix} \text{ and } B=\begin{bmatrix}11\\ -5\\ -3\end{bmatrix}$$

$$X=A^{-1}B\Rightarrow\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\begin{bmatrix}0 & 1 & -2\\ -2 & 9 & -23\\ -1 & 5 & -13\end{bmatrix}\begin{bmatrix}11\\ -5\\ -3\end{bmatrix}$$

$$\Rightarrow\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\begin{bmatrix}0-5+6\\ -22-45+69\\ -11-25+39\end{bmatrix}\Rightarrow\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\begin{bmatrix}1\\ 2\\ -1\end{bmatrix}\Rightarrow x=1, y=2, z=3$$

16. The cost of 4 kg onion, 3 kg wheat and 2 kg rice is ₹ 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is ₹ 90. The cost of 6 kg onion 2 kg wheat and 3 kg rice is ₹ 70. Find cost of each item per kg by matrix method.

16. Let the cost of onions, wheat and rice per kg be Rs x, Rs y and Rs z respectively.
Then according to the giving situation, it can be represented by a system of equations as-

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

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

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

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

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

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

Hence A^{-1} will exist.

Now, $A_{11} = 0$, $A_{12} = 30$, $A_{13} = -20$, $A_{21} = -5$, $A_{22} = 0$, $A_{23} = 10$, $A_{31} = 10$, $A_{32} = -20$, $A_{33} = 10$

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

$$\text{So } A^{-1} = \frac{1}{|A|}(\text{Adj}A) = \frac{1}{50}\begin{bmatrix} 0 & -5 & 10 \\ 30 & 0 & -20 \\ -20 & 10 & 10 \end{bmatrix} = \begin{bmatrix} 0 & -\frac{5}{50} & \frac{10}{50} \\ \frac{30}{50} & 0 & -\frac{20}{50} \\ -\frac{20}{50} & \frac{10}{50} & \frac{10}{50} \end{bmatrix}$$

$$\text{So } X = A^{-1}B = \begin{bmatrix} 0 & -\frac{1}{10} & \frac{1}{5} \\ \frac{3}{5} & 0 & -\frac{2}{5} \\ -\frac{2}{5} & \frac{1}{5} & \frac{1}{5} \end{bmatrix}\begin{bmatrix} 60 \\ 90 \\ 70 \end{bmatrix} = \begin{bmatrix} 5 \\ 8 \\ 8 \end{bmatrix}$$

Hence x=5, y=8 & z=8.

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