



Solution of Simultaneous Linear Equations Ex 8.1 Q19

$x$ ,  $y$  and  $z$  be prize amount per student for Tolerance, Kindness and Leadership respectively.

As per the data in the question, we get

$$3x + 2y + z = 2200$$

$$4x + y + 3z = 3100$$

$$x + y + z = 1200$$

The above three simultaneous equations can be written in matrix form as

$$\begin{bmatrix} 3 & 2 & 1 \\ 4 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2200 \\ 3100 \\ 1200 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 3 & 2 & 1 \\ 4 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 2200 \\ 3100 \\ 1200 \end{bmatrix} \dots (1)$$

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

$$|A| = 3(-2) - 2(1) + 1(3) = -5$$

$$\text{cof}A = \begin{bmatrix} -2 & -1 & 3 \\ -1 & 2 & -1 \\ 5 & -5 & -5 \end{bmatrix}$$

$$\text{adj}A = (\text{cof}A)^T = \begin{bmatrix} -2 & -1 & 5 \\ -1 & 2 & -5 \\ 3 & -1 & -5 \end{bmatrix}$$

$$A^{-1} = \frac{\text{adj}A}{|A|} = \frac{\begin{bmatrix} -2 & -1 & 5 \\ -1 & 2 & -5 \\ 3 & -1 & -5 \end{bmatrix}}{-5}$$

From (1)

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \frac{\begin{bmatrix} -2 & -1 & 5 \\ -1 & 2 & -5 \\ 3 & -1 & -5 \end{bmatrix}}{-5} \begin{bmatrix} 2200 \\ 3100 \\ 1200 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} -2 & -1 & 5 \\ -1 & 2 & -5 \\ 3 & -1 & -5 \end{bmatrix} \begin{bmatrix} -440 \\ -620 \\ -240 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 300 \\ 400 \\ 500 \end{bmatrix}$$

Solution of Simultaneous Linear Equations Ex 8.1 Q20

Let the amount deposited be x, y and z respectively.

As per the data in the question, we get

$$x + y + z = 7000$$

$$5\%x + 8\%y + 8.5\%z = 550$$

$$\Rightarrow 5x + 8y + 8.5z = 55000$$

$$x - y = 0$$

The above equations can be written in matrix form as

$$\begin{bmatrix} 1 & 1 & 1 \\ 5 & 8 & 8.5 \\ 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 7000 \\ 55000 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 \\ 5 & 8 & 8.5 \\ 1 & -1 & 0 \end{bmatrix}^{-1} \begin{bmatrix} 7000 \\ 55000 \\ 0 \end{bmatrix} \dots (1)$$

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 5 & 8 & 8.5 \\ 1 & -1 & 0 \end{bmatrix}$$

$$|A| = 1(8.5) - 1(-8.5) + 1(-13) = 4$$

$$\text{cof}A = \begin{bmatrix} 8.5 & 8.5 & -13 \\ -1 & -1 & 2 \\ 0.5 & -3.5 & 3 \end{bmatrix}$$

$$\text{adj}A = (\text{cof}A)^T = \begin{bmatrix} 8.5 & 8.5 & -13 \\ -1 & -1 & 2 \\ 0.5 & -3.5 & 3 \end{bmatrix}^T$$

$$\text{adj}A = (\text{cof}A)^T = \begin{bmatrix} 8.5 & 8.5 & -13 \\ -1 & -1 & 2 \\ 0.5 & -3.5 & 3 \end{bmatrix}^T$$

$$= \begin{bmatrix} 8.5 & -1 & 0.5 \\ 8.5 & -1 & -3.5 \\ -13 & 2 & 3 \end{bmatrix}$$

$$A^{-1} = \frac{\text{adj}A}{|A|} = \frac{1}{4} \begin{bmatrix} 8.5 & -1 & 0.5 \\ 8.5 & -1 & -3.5 \\ -13 & 2 & 3 \end{bmatrix}$$

From (1)

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{4} \begin{bmatrix} 8.5 & -1 & 0.5 \\ 8.5 & -1 & -3.5 \\ -13 & 2 & 3 \end{bmatrix} \begin{bmatrix} 7000 \\ 55000 \\ 0 \end{bmatrix}$$

$$= \frac{1}{4} \begin{bmatrix} 4500 \\ 4500 \\ 19000 \end{bmatrix} = \begin{bmatrix} 1125 \\ 1125 \\ 4750 \end{bmatrix}$$

Hence, the amounts deposited in the three accounts are 1125, 1125 and 4750 respectively.

\*\*\*\*\* END \*\*\*\*\*