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SECTION B
SUBJECT Differential Equations
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QUIZ

QUESTION :-

SOLUTION :-

Given that

$$A = 40$$

$$1:2:1$$

$$B = 50$$

$$2:1:1$$

$$C = 60$$

$$2:0:2$$

Sol let x, y, z be the cost of Pakistan
Egyptian and American cotton respectively
Then we get

$$\frac{1}{4}x + \frac{2}{4}y + \frac{1}{4}z = 40$$

$$\Rightarrow \frac{2}{4}x + \frac{1}{4}y + \frac{1}{4}z = 50$$

$$\frac{2}{4}x + \frac{2}{4}z = 60$$

$$1x + 2y + 1z = 40 \times 4$$

$$\Rightarrow 2x + 1y + 1z = 50 \times 4$$

$$1x + 1z = 60 \times 2$$

$$\Rightarrow 1x + 2y + 1z = 160$$

$$2x + 1y + 1z = 200$$

$$1x + 1z = 120$$

Now converting into matrix form.

We get

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

Let

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, B = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

②

Now

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

$$A_x = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix}$$

$$A_y = \begin{bmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{bmatrix}$$

$$A_z = \begin{bmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 2 & 0 & 1 \end{bmatrix}$$

$$|A| = 1 \cdot (1 \cdot 1 - 0 \cdot 1) - 2(2 \cdot 1 - 1 \cdot 1) + 1(2 \cdot 1 - 1 \cdot 1)$$

$$= 1(1-0) - 2(2-1) + 1(2-1)$$

$$= 1 - 2 - 1$$

$$\boxed{|A| = -2}$$

$$A_x = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix}$$

$$|A_x| = 160(1 \cdot 1 - 0 \cdot 1) - 2(200 \cdot 1 - 120 \cdot 1) + 1(200 \cdot 0 - 120 \cdot 1)$$

$$= 160(1-0) - 2(200-120) + 1(0-120)$$

(3)

$$|A_1| = \begin{vmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{vmatrix}$$

$$= 1(200 \times 1 - 120 \times 1) - 160(2 \times 1 - 1 \times 1) + 1(2 \times 120 - 1 \times 200)$$

$$= 1(200 - 120) - 160(2 - 1) + 1(240 - 200)$$

$$= 80 - 160 + 40$$

$$\boxed{|A_1| = -40}$$

$$|A_2| = \begin{vmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{vmatrix}$$

$$= 1(1 \times 200 - 0 \times 200) - 2(2 \times 120 - 1 \times 200) + 160(2 \times 0 - 1 \times 1)$$

$$= 1(200 - 0) - 2(240 - 200) + 160(0 - 1)$$

$$= 200 - 80 - 160$$

$$\boxed{|A_2| = -40}$$

Now $|A| = -2$

$$|A_x| = -120$$

$$|A_y| = -40$$

$$|A_z| = -120$$

Now

According to Cramer's Rule

$$x = \frac{|A_x|}{|A|} = \frac{-120}{-2} = 60$$

$$y = \frac{|A_y|}{|A|} = \frac{-40}{2} = 20$$

$$z = \frac{|A_z|}{|A|} = \frac{-120}{-2} = 60$$

So $x, y, z = (60, 20, 60)$

So

The cost/kg of cotton of Pakistan = 60

The cost/kg of cotton of Egyptian = 20

4 4 " " " American = 60

ANSWER