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Section "A"

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Dept Civil enjineering

Subject Differential equation

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Quiz

Ans :-

A yarn merchants 3 brands A, B and C of yarn, each of which is blend pakistan, Egyption and american cotton in ratio,

1 : 2 : 1 , 2 : 1 : 1 and 2 : 0 : 2.

If cost / Kg of A, B and C is Rs 40, 50 and 60 respectively.

find the cost / Kg of cotton of each country

40

P	E
A	E

A

50

P	P
A	E

B

60

P	P
A	A

C

Let x, y and z be the cost / Kg of pakistan . Egyption and american cotton respectively. Then according to the given condition

$$\left.\begin{aligned} \tfrac{1}{4}x + \tfrac{2}{4}y + \tfrac{1}{4}z &= 40 \\ \tfrac{2}{4}x + \tfrac{1}{4}y + \tfrac{1}{4}z &= 50 \\ \tfrac{2}{4}x + \tfrac{2}{4}z &= 60 \end{aligned}\right] \rightarrow (5)$$

$$\left.\begin{aligned} 1x + 2y + 1z &= 160 \\ 2x + 1y + 1z &= 200 \\ 1x + 1z &= 120 \end{aligned}\right] \rightarrow (5)$$

In matrix form we can write it as.

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

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

$$A\underline{x} = \underline{b}$$

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

$$A_1 = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{bmatrix}$$

$$A_3 = \begin{bmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{bmatrix}$$

$|A| = -2$

$|A_1| = -120$

$|A_2| = -40$

$|A_3| = -120$

$$|A| = \begin{vmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} = 1(1\times1-0\times1)-2(2\times1-1\times1) + 1(2\times1-1\times1)$$

$$|A_1| = \begin{vmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{vmatrix} = 160(1\times1-0\times1)-2(200\times1 - 120\times1)+(200\times1-120\times1)$$

$$|A_2| = \begin{vmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{vmatrix} = 1(200\times1-120\times1)-160(2\times1 - 1\times1)+1(2\times1-1\times200)$$

$$|A_3| = \begin{vmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 120 \end{vmatrix} = 1(1\times120-0\times200)-2(2\times120-1\times200)+160(2\times120-1\times1)$$

$|A| = -2$

$|A_1| = -120$, $|A_2| = -40$, $|A_3| = -120$

According to Cramer rule

$x = \dfrac{|A_1|}{|A|} = \dfrac{-120}{2} = 60$

$y = \dfrac{|A_2|}{|A|} = \dfrac{-40}{-2} = 20$

$z = \dfrac{|A_3|}{|A|} = \dfrac{-120}{-2} = 60$

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