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Section

B

Dept

Civil

Sub

diff equation

Quiz

1)  
Quiz answer ✓

A Yarn merchants 3 brands

A, B and C of yarn,

each of which is blend of

Pakistan, Egyptian and American

cotton in ratios

$1:2:1$  ;  $2:1:1$  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, Egyptian and American cotton respectively. Then according to the given condition

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

$$\frac{2}{4}x + \frac{1}{4}y + \frac{1}{4}z = 50 \quad \text{--- (S)}$$

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

(3)

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

In matrix form we can write it as.

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

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

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

(4)

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

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

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

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

(5)

$$|A| = -2$$

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

$$|A_1| = -120$$

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

$$|A_2| = -40$$

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

$$|A_3| = -120$$

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

$$|A| = -2$$

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

According to Cramer's rule

$$\begin{cases} x = \frac{|A_1|}{|A|} = \frac{-120}{-2} = 60 \\ y = \frac{|A_2|}{|A|} = \frac{-40}{-2} = 20 \\ z = \frac{|A_3|}{|A|} = \frac{-120}{-2} = 60 \end{cases}$$

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