

ID: 7313 : Ahmad Faraz Khan.

Quiz : Differential Equation.

Q:- A yarn merchant .....  
..... of each country.

Solution:-

$$x = A, y = B, z = x.$$

Let  $x, y$  and  $z$  be the cost/kg of  
Palcisani Egyptian and American cotton  
respectively.

According to the condition.

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

Sum of Ratio = 4.

$$\frac{2}{4}x + \frac{1}{4}y + \frac{1}{4}z = 50 \rightarrow \textcircled{2}.$$

$$\frac{2}{4}x + \frac{2}{4}z = 60 \rightarrow \textcircled{3}.$$

Multiplying "4" both sides on equation ①, ②, and ③  
we get:

$$\textcircled{1} \Rightarrow x + 2y + z = 160$$

$$\textcircled{2} \Rightarrow 2x + y + z = 200$$

$$\textcircled{3} \Rightarrow 2x + 0y + z = 120.$$

Now we use these equations.  
in matrix form.

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

So.

$$A_1 = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 2 & 0 & 1 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, \quad B_1 = \begin{bmatrix} 160 \\ 200 \\ 120 \end{bmatrix}$$

$$\Rightarrow A_1 X = B_1$$

Now using Cramer's Rule.

$$A_1 x = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix} \quad \text{we just replace } B_1 \\ \text{in 1st column of } A_1.$$

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

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

$$= 160 - 2(80) - 120 = 160 - 160 - 120$$

$$|A_1 x| = -120$$

Now.

$$x = \frac{|A_1 x|}{|A_1|} \rightarrow (4)$$

Now find  $|A_1|$

$$|A_2| = \begin{vmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} = 1(1-0) - 2(2-1) + 1(0-1).$$

$$= 1 - 2 - 1 = -2.$$

Now,

$$\textcircled{4} \Rightarrow x = \frac{|A_2 x|}{|A_2|} = \frac{-120}{-2} = 60.$$

$$x = A = 60.$$

Also.

$$y = \frac{|A_1 y|}{|A_1|} \rightarrow \textcircled{5}.$$

$$|A_1 y| = \begin{vmatrix} 1 & 160 & 1 \\ 2 & 200 & 1 \\ 1 & 120 & 1 \end{vmatrix} \quad \text{Just replace } B_1 \text{ in} \\ \text{2nd column of } A_1.$$

$$|A_1 y| = 1(200 - 120) - 160(2 - 1) + 1(240 - 200).$$

$$= 80 - 160 + 40$$

$$|A_1 y| = -40.$$

$$\textcircled{5} \Rightarrow y = \frac{|A_1 y|}{|A_1|} = \frac{-40}{-2} = 20.$$

$$y = B = 20.$$

Again.

$$z = \frac{|A_1 z|}{|A_1|} \rightarrow \textcircled{6}.$$

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

$$|A_1 Z| = 1(120 \cdot 0) - 2(240 - 200) + 160(0 - 1).$$

$$= 120 - 80 - 160$$

$$= -120.$$

$$\Rightarrow Z = \frac{|A_1 Z|}{|A_1|} = \frac{-120}{-2} = 60.$$

$$Z = C = 60.$$

Hence

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

OR.

$$(A, B, C) = (60, 20, 60)$$

Its mean that.

Pakistani blend cost/kg of cotton = 60.

Egyptian blend cost/kg of cotton = 20.

American blend cost/kg of cotton = 60.

~~~~~