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QUIZ 1: —

SUBMITTED TO: —

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Quiz :- DIFFERENTIATION EQUATION ^{Date:}

Q A yarn merchant sell cotton of each country
SOLUTION :-

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

Let x, y, z be the cost/kg of Pakistani, Egyptian & American cotton

$$\frac{1}{4}x + \frac{2}{4}y + \frac{1}{4}z = 40 \quad \text{--- (1)}$$

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

$$\frac{2}{4}x + \frac{2}{4}z = 60 \quad \text{--- (3)}$$

multiply 4 both sides on eq (1)
(2) & (3), we get

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

$$(2) \Rightarrow 2x + y + z = 200$$

$$(3) \Rightarrow 2x + 2z = 120$$

No we use the equation
In matrix

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

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

$$\Rightarrow A_1 x = B_1$$

Now using Cramer's rule

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

we just replace B_1 in first column of A_1

$$\begin{aligned} [A_1 x] &= 160 \begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} - 2 \begin{vmatrix} 200 & 1 \\ 120 & 1 \end{vmatrix} \\ &= \begin{vmatrix} 200 & 1 \\ 120 & 0 \end{vmatrix} \end{aligned}$$

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

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

$$[A_1 x] = 120$$

$$\frac{[A_1 x]}{|A_1|} \rightarrow \textcircled{4}$$

Now find $|A_1|$

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

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

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Now

$$\textcircled{4} \Rightarrow x = \frac{|A_{1x}|}{|A_{11}|} = \frac{-120}{-2} = 60$$

$$x = A = 60$$

also

$$y = \frac{|A_{1y}|}{|A_{11}|} \Rightarrow \textcircled{5}$$

$$|A_{1y}| = 1 \begin{vmatrix} 1 & 1 \\ 200 & -120 \end{vmatrix} - 160(2-1) + 1(240-200)$$
$$= 80 - 160 - 40$$

$$|A_{1y}| = -40$$

$$\textcircled{5} \Rightarrow y = \frac{|A_{1y}|}{|A_{11}|} = \frac{-40}{-2} = 20$$

$$y = B = 20$$

again

$$z = \frac{|A_{1z}|}{|A_{11}|} \rightarrow \textcircled{6}$$

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

$$|A_{1z}| = 1(120-0) - 2(240-200) - 160(0+0)$$

$$= 120 - 80 - 160$$

$$= -120$$

$$\textcircled{6} \Rightarrow z = \frac{|A_{1z}|}{|A_{11}|} = \frac{-120}{-2} = 60$$

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$$z = c = 60$$

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

or
 $(A, B, c) = (60, 20, 60)$

It means that

- Pakistan blend cost/kg of cotton = 60.
- Egyptian blend cost/kg of cotton = 20.
- American blend cost/kg of cotton = 60.