

Name

Waseem Khan

ID

7337

Quiz

differential equation

date

18-06-2020

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Ans

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

Let x, y & z be the cost/kg of Pakistan, Egypt & America respectively

according to condition

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

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

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

Multiplying 4 b/s on equation (1), (2) and (3) we get

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

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

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

Now we use the equation as matrix form

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

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

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

Now using cramer's rule

$$A_{1x} = \begin{pmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{pmatrix} \text{ we just replace } \underline{b}_1 \text{ is column of } A$$

$$|A_{1x}| = 160 \begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} - 2 \begin{vmatrix} 200 & 1 \\ 1200 & 1 \end{vmatrix} + \begin{vmatrix} 200 & 1 \\ 1200 \end{vmatrix}$$

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

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

$$|A_{1x}| = -120$$

Now $x = \frac{|A_{1x}|}{|A|} \quad \text{--- (4)}$

Now find $|A|$

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

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

Now (4) $\Rightarrow x = \frac{|A_1 x|}{|A_1|} = \frac{-120}{-2} = 60$

$$x = A = 60$$

Also

$$y = \frac{|A_1 y|}{|A_1|} = (5)$$

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

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

$$= 80 - 160 + 40$$

$$|A_1 y| = -40$$

$$(5) = y = \frac{|A_1 y|}{|A_1|} = \frac{-40}{-2} = 20$$

$$y = B = 20$$

again

$$z = \frac{|A_1 z|}{|A_1|} = 6$$

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

$$|A_1 z| = \frac{1(120 - 0) - 2(240 - 200) - 160}{(0 - 1)}$$

$$= 120 - 80 - 160 = 120$$

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

$$z = c = 60$$

Hence

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

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

H mean that

Pakistani blend cost/kg of cotton
= 60

Egyptian blend cost/kg of cotton
= 20

America blend cost/kg of cotton
= 60