Name: M. Kamran

IDNo : 7888

BE civil

Section B

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Q No 1 A Yarn - . - - - -

$x + 2y + z = 160$

$2x + y + z = 200$

$2x + 0y + 2z = 240$

Ratios = $1:2:1$, $2:1:1$, $2:0:2$

SOLUTION:

Since Ratio are

$1:2:1$, $2:1:1$ & $2:0:2$

of Pak, Egypt & America

let

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

$$\Rightarrow \cancel{4}\ x + 2y + c = 160 \quad \text{—} \quad (i)$$

also

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

$$2x + y + z = 200 \quad \text{—} \quad (ii)$$

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Now

$$\frac{2}{4}x + \frac{0y}{4} + \frac{2z}{4} = 60$$

$$2x + 2y = 240 \quad —(3)$$

$$x + 0y + z = 120 \quad —(4)$$

Now from i, ii & iv

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 140 \\ 200 \\ 120 \end{bmatrix}$$

$$Ax = b$$

By Cramer's Rule

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

$$|A| = 1 - 2(2-1) + 1(0-1) \qquad |A| = -2$$

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$$x = \frac{|A_x|}{|A|}$$

$$A_x = \begin{bmatrix} 160 & 2 & 1 \\ 200 & 1 & 1 \\ 120 & 0 & 1 \end{bmatrix} \quad |A_x| =$$

$$|A_x| = -120 \qquad x = \frac{-120}{-2} = 60$$

$$y = \frac{|A_y|}{|A|}$$

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

$$|A_y| = -40$$

$$y = \frac{-40}{-2} = 20$$

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$$z = \frac{|A_2|}{|A|}$$

$$A_2 = \begin{bmatrix} 1 & 2 & 160 \\ 2 & 1 & 200 \\ 1 & 0 & 720 \end{bmatrix}$$

$$|A_2| = -120$$

$$z = \frac{|A_2|}{|A|} = \frac{-1\cancel{2}0}{-\cancel{2}} = 60$$

Value of x, y, z = (60, 20, 60) and there are value of cotton in Pakistan, Egypt and America respectively

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Q No 2 (i)

$$\frac{dy}{dx} = \frac{x^3+y^3}{x^2y+xy^2}$$

SOLUTION:

$$= \frac{x^3+y^3}{x^2y+xy^2} \rightarrow ① \quad \text{homogenous}$$

let

$$y = vx \qquad y/x = v$$

Diff w.r.t x

$$\frac{dy}{dx} = v \cdot 1 + x\frac{dv}{dx}$$

$$= v + x\frac{dv}{dx}$$

$$v + x\frac{dv}{dx} = \frac{x^3+v^3x^3}{x^2vx+xv^2x^2}$$

$$= \frac{x^3+v^3x^3}{x^3v+x^3v^2} = \frac{\cancel{x^3}(1+v^3)}{\cancel{x^3}(v+v^2)}$$

$$V + u\frac{dv}{du} = \frac{1+v^3}{v+v^2}$$

$$u\frac{dv}{du} = \frac{1+v^3}{v+v^2} - v$$

$$= \frac{1+v^3 - v(v+v^2)}{v+v^2}$$

$$= \frac{1+\cancel{v^3} - v^2 - \cancel{v^3}}{v+v^2}$$

$$= \frac{1-v^2}{v+v^2} = \frac{(1-v)\cancel{(1+v)}}{v\cancel{(1+v)}}$$

$$u\frac{dv}{du} = \frac{1-v}{v}$$

Superating variable

$$\frac{v}{1-v}\,dv = \frac{du}{u}$$

$$-\frac{v}{v-1}dv = \frac{dx}{x}$$

$$\frac{v}{v-1} = -\frac{dx}{x}$$

integrating b.s

$$\int\frac{v}{v-1} = -\int\frac{dx}{x}$$

$$\int\left(\frac{v-1+1}{v-1} + \frac{1}{v-1}\right)dx = -\ln x + \ln c$$

$$\Rightarrow \int\left(1+\frac{1}{v-1}\right. dv = \ln c - \ln x$$

$$\int 1dv + \int\frac{1}{v-1}dv = \ln c - \ln x$$

$$v + \ln(v-1) = \ln c - \ln x$$

$$y/x + \ln|y/x - 1| = \ln c - \ln x$$

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$$y/x + \ln|y/x - 1|^{(4)} = \ln c/x$$

Q No 2(b)

$$(y - x + 5)\,dy = (y - x + 1)\,dx$$

SOLUTION:

$$\frac{dy}{dx} = \frac{y - x + 1}{y - x + 5}$$

$$= \frac{-x + y + 1}{-x + y + 5} \quad \text{——} \; (1)$$

$$\frac{a_1}{a_2} = \frac{-1}{-1} = 1, \quad \frac{b_1}{b_2} = 1/1 = 1$$

Put $z = -x + y$

Diff w.r.t x

$$\frac{dz}{dx} = -1 + \frac{dy}{dx}$$

(5)

$$\frac{dz}{du}+1=\frac{z+1}{z+5}$$

(i) $\Rightarrow$

$$\frac{dz}{du}+1=\frac{z+1}{z+5}$$

$$\frac{dz}{du}=\frac{z+1}{z+5}-1$$

$$=\frac{z+1-(z+5)}{z+5}$$

$$\frac{\cancel{z}+1-\cancel{z}-5}{z+5}$$

$$\frac{dz}{du}=\frac{-4}{z+5}$$

Saperatiy variable

$$(z+5)\,dz = -4\,dx$$

integrating bs

$$\int (z+5)\,dz = -4\int dx$$

$$\int z\,dz + 5\int dz = -4x + c$$

$$\frac{z^2}{2} + 5z = -4x + c$$

$$\frac{(-x+y)^2}{2} + 5(-x+y) = -4x + c$$

$$\frac{(y-x)^2}{2} - 5x + 5y + 4x = c$$

$$\frac{y^2 + x^2 - 2xy}{2} - \frac{x}{1} + \frac{5y}{1} = c$$

$$\frac{x^2 + y^2 - 2xy - 2x - 10y}{2} = c$$

$$x^2 + y^2 - 2xy - 2x + 10y = 2c$$

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