

Subjective part

Q.2

$$2x_1 + 2x_2 + 2x_3 = 0$$

$$-2x_1 + 5x_2 + 2x_3 = 1$$

$$8x_1 + x_2 + 4x_3 = -1$$

The Augment of the matrix

$$= \left[\begin{array}{ccc|c} 2 & 2 & 2 & 0 \\ -2 & 5 & 2 & 1 \\ 8 & 1 & 4 & -1 \end{array} \right]$$

$$R_1/2 \rightarrow R_1$$

$$= \left[\begin{array}{ccc|c} 1 & 1 & 1 & 0 \\ -2 & 5 & 2 & 1 \\ 8 & 1 & 4 & -1 \end{array} \right]$$

$$2R_1 + R_2 \rightarrow R_2$$

$$= \left[\begin{array}{ccc|c} 1 & 1 & 1 & 0 \\ 0 & 7 & 4 & 1 \\ 8 & 1 & 4 & -1 \end{array} \right]$$

$$R_3 - 8R_1 \rightarrow R_3$$

$$\begin{bmatrix} 1 & 1 & 1 & | & 0 \\ 0 & 7 & 4 & | & 1 \\ 0 & -7 & -4 & | & -1 \end{bmatrix}$$

$$R_2 \leftrightarrow R_1 \rightarrow R_2 \quad R_2 \times \frac{1}{7}$$

$$\begin{bmatrix} 1 & 1 & 1 & | & 0 \\ 0 & 1 & 4/7 & | & 1/7 \\ 0 & -7 & -4 & | & -1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 & | & 0 \\ 0 & 1 & 4/7 & | & 1/7 \\ 0 & -7 & -4 & | & -1 \end{bmatrix}$$

$$R_1 - R_2 \rightarrow R_1$$

$$\begin{bmatrix} 1 & 0 & 3/7 & | & -1/7 \\ 0 & 1 & 4/7 & | & 1/7 \\ 0 & -7 & -4 & | & -1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 3/7 & | & -1/7 \\ 0 & 1 & 4/7 & | & 1/7 \\ 0 & -7 & -4 & | & -1 \end{bmatrix}$$

$$R_3 \rightarrow R_3$$

$$R_3 + 7R_2 \rightarrow R_3$$

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$$= \left[\begin{array}{ccc|c} 1 & 0 & 3/7 & 0 \\ 0 & 1 & 4/7 & 1/7 \\ 0 & 0 & 4-4 & -1 + 7(1/7) \end{array} \right]$$

$$= \left[\begin{array}{ccc|c} 1 & 0 & 3/7 & 0 \\ 0 & 1 & 4/7 & 1/7 \\ 0 & 0 & 0 & 0 \end{array} \right]$$

Q.7 $A = \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix}$ $A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
Find a and b .

$$A \times A = \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ a & b \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 1+2a & 2+2b \\ a+ab & 2a+b^2 \end{bmatrix}$$

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

$$\begin{bmatrix} 1+2a & 2+2b \\ a+ab & 2a+b^2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$1+2a=0 \Rightarrow \boxed{a=-1/2}$$

$$2+2b=0 \Rightarrow \boxed{b=-1}$$

Q.6
USin

21

-3

-21

21:

Q.6
Using Crammer's rules

$$x_1 + 0x_2 + 2x_3 = 6$$

$$-3x_1 + 4x_2 + 6x_3 = 30$$

$$-x_1 - 2x_2 + 3x_3 = 8$$

$$\begin{bmatrix} 1 & 0 & 2 \\ -3 & 4 & 6 \\ -1 & -2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 30 \\ 8 \end{bmatrix}$$

\Downarrow
 \Downarrow
 \Downarrow
 A
 $X = B$

$$AX = B$$

$$X = A^{-1}B$$

\longleftrightarrow
 Crammer's rules

$$\begin{array}{r} 184 \\ 144 \\ \hline 40 \end{array}$$

$$x_1 = \frac{A_1}{|A|} = \frac{\begin{vmatrix} 6 & 0 & 2 \\ 30 & 4 & 6 \\ 8 & -2 & 3 \end{vmatrix}}{44}$$

$$\begin{vmatrix} 6 & 0 & 2 \\ 30 & 4 & 6 \\ 8 & -2 & 3 \end{vmatrix} = 6 \begin{vmatrix} 4 & 6 \\ -2 & 3 \end{vmatrix} + 0 + 2 \begin{vmatrix} 30 & 4 \\ 8 & -2 \end{vmatrix}$$

$$= 6(12 + 12) + 2(-60 - 32)$$

$$144 - 184 = -40$$

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$$x_1 = \frac{-46}{44} = -\frac{10}{11}$$

$$x_2 = \frac{\begin{vmatrix} 1 & 6 & 2 \\ -3 & 30 & 6 \\ -1 & 8 & 3 \end{vmatrix}}{44} = \frac{|A_2|}{|A|}$$

$$\begin{vmatrix} 1 & 6 & 2 \\ -3 & 30 & 6 \\ -1 & 8 & 3 \end{vmatrix} = 1 \begin{vmatrix} 30 & 6 \\ 8 & 3 \end{vmatrix} - 6 \begin{vmatrix} -3 & 6 \\ -1 & 3 \end{vmatrix} + 2 \begin{vmatrix} -3 & 30 \\ -1 & 8 \end{vmatrix}$$

$$= (90 - 48) - 6(-9 + 6) + 2(-24 + 30)$$

$$42 + 18 + 12 = 72$$

$$x_2 = \frac{72}{44} = \frac{18}{11}$$

$$x_2 = \frac{18}{11}$$

$$x_3 = \frac{|A_3|}{|A|} = \frac{\begin{vmatrix} 1 & 0 & 6 \\ -3 & 4 & 30 \\ -1 & -2 & 8 \end{vmatrix}}{44}$$

$$1 \begin{vmatrix} 4 & 30 \\ -2 & 8 \end{vmatrix} - 0 \begin{vmatrix} -3 & 30 \\ -1 & 8 \end{vmatrix} + 6 \begin{vmatrix} -3 & 9 \\ -1 & -2 \end{vmatrix}$$

$$(32 + 60 + 0) + 6(6 + 9)$$

$$92 + 110 = 202$$

$$r(3) = \frac{|A_3|}{|A|} = \frac{101}{22}$$

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4 Using Row reduction

$$A = \begin{bmatrix} 2 & 3 & 3 & 1 \\ 0 & 4 & 3 & -3 \\ 2 & -1 & -1 & -3 \\ 0 & -4 & -3 & 2 \end{bmatrix} \quad R_3 - R_1 \rightarrow R_3$$

Finding Determinants

$$= \begin{bmatrix} 2 & 3 & 3 & 1 \\ 0 & 4 & 3 & -3 \\ 0 & -4 & -4 & -4 \\ 0 & -4 & -3 & 2 \end{bmatrix} \quad R_3 + R_2 \rightarrow R_3$$

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$$\begin{bmatrix} 2 & 3 & 3 & 1 \\ 0 & 4 & 3 & -3 \\ 0 & 0 & -1 & -7 \\ 0 & -4 & -3 & 2 \end{bmatrix}$$

 $R_4 + R_2 \rightarrow R_4$

$$\begin{bmatrix} 2 & 3 & 3 & 1 \\ 0 & 4 & 3 & -3 \\ 0 & 0 & -1 & -7 \\ 0 & 0 & 0 & 3 \end{bmatrix}$$

Determinant of the matrix
is. This is triangle matrix
 $= (2)(4)(-1)(3)$
 $= (8)(-1)(3) = -24 \text{ Ans.}$