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I.D :- 7449

Instructor :- SIR- SHAKEEL

Subject :- LINEAR ALGEBRA

Depertment :- Be. Civil

Student Sign :- ~~T~~Hussain

Semester :- 12th.

Date:

Question 1:-

$$x_1 - x_2 + x_3 = 0$$

$$2x_2 - 8x_3 = 8$$

$$5x_1 - 5x_2 = 10$$

Sol:-

To find $A = ?$

$$\begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -8 \\ -5 & 0 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -8 \\ 0 & -5 & 10 \end{bmatrix} \quad R_3 \to (-5R_1)$$

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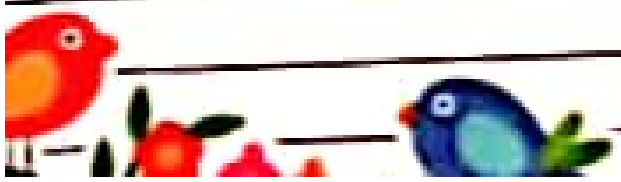
$$\begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -8 \\ 0 & 1 & -2 \end{bmatrix} \quad R_3/2$$

$$\begin{bmatrix} 1 & -1 & 1 \\ 0 & 1 & -4 \\ 0 & 1 & -2 \end{bmatrix} \quad \frac{R_2}{2}$$

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

Rank of $A = 3$



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Now Rank of AB

$$\left[\begin{array}{ccc|c} 1 & -1 & 1 & 0 \\ 0 & 2 & 8 & 8 \\ 2 & 0 & -2 & 10 \end{array}\right]$$

$$\left[\begin{array}{ccc|c} 1 & -1 & 1 & 0 \\ 0 & 2 & 8 & 8 \\ 0 & 2 & -10 & 10 \end{array}\right] \quad R_3 - 2R_1$$

$$\left[\begin{array}{ccc|c} 1 & -1 & 0 & 0 \\ 0 & 2 & 8 & 8 \\ 0 & 0 & -2 & 10 \end{array}\right] \quad R_3 + 2R_1$$

So Rank of AB = 3

So the Question is

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Question 2:-

Find the inverse of $A = \begin{bmatrix} 3 & 4 & 2 \\ 2 & -1 & 4 \\ 2 & -2 & 3 \end{bmatrix}$ by adjoint Method

Solve

To find $|A| = ?$

$$|A| = 3\begin{vmatrix} -1 & 3 \\ -2 & 3 \end{vmatrix} - 4\begin{vmatrix} 2 & 3 \\ 2 & 3 \end{vmatrix} + 2\begin{vmatrix} 2 & -1 \\ 2 & -2 \end{vmatrix}$$

$$|A| = 3(-3+6) - 4(6-6) + 2(-4+2)$$

$$= 3(3) - 4(0) - 4(-2) + 2$$

$$= 9 + 8 + 2$$

$$|A| = 19$$

Now to find adjoint of A:-

$$adj\ A = \begin{bmatrix} a_{11} & a_{21} & a_{31} \\ a_{12} & a_{22} & a_{32} \\ a_{13} & a_{23} & a_{33} \end{bmatrix}$$

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$a_{11} = (-1)^{1+1}(-7+14) = (-1)^2(7) = 7$

$a_{12} = (-1)^3(14-35) = (-1)(-21) = 21$

$a_{13} = (-1)^4(-4+5) = 1$

$a_{21} = (-1)^3(28+10) = -38$

$a_{22} = (-1)^4(21-25) = (1)(-4) = -4$

$a_{23} = (-1)^5(-6-20) = (-1)(-26) = 26$

$a_{31} = (-1)^4(28+5) = 33$

$a_{32} = (-1)^5(21+10) = -11$ (sic)

$a_{33} = (-1)^6(-3-8) = -11$

Now

$$A^{-1} = \frac{1}{|A|} \text{adj } A$$

$$A^{-1} = \frac{1}{110}\begin{bmatrix} 7 & -38 & 33 \\ 21 & -4 & -11 \\ 1 & 26 & -11 \end{bmatrix}$$

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Question 5:-

$$2x + 2y + 4z = 18$$
$$x + 3y + 2z = 13$$
$$3x + 2y - 3z = 14$$

Write in Matrix form

$$\begin{bmatrix} 2 & 2 & 4 & | & 18 \\ 1 & 3 & 2 & | & 13 \\ 3 & 2 & -3 & | & 14 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 2 & | & 9 \\ 1 & 3 & 2 & | & 13 \\ 3 & 2 & -3 & | & 14 \end{bmatrix} \quad R_1 \div 2$$

$$\begin{bmatrix} 1 & 1 & 2 & | & 9 \\ 0 & 2 & 0 & | & 4 \\ 0 & -1 & -9 & | & 13 \end{bmatrix} \quad R_2 - R_1, \quad R_3 - 3R_1$$

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$$\left[\begin{array}{ccc|c} 1 & 1 & 2 & 9 \\ 2 & 1 & 0 & \\ & & & 2 \\ 0 & -1 & -9 & 13 \end{array}\right] \quad R_1/2$$

$$\left[\begin{array}{ccc|c} 1 & 0 & 2 & 7 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & -9 & 11 \end{array}\right] \quad R_1 - R_2 \quad R_3 + R_2$$

$$\left[\begin{array}{ccc|c} 1 & 0 & 2 & 7 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & -11/9 \end{array}\right] \quad R_3 / -9$$

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 31/3 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & -11/9 \end{array}\right] \quad R_1 + (2R_3)$$

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Ans by Gauss Jacobi Method

R.

$x = 8/3$

$y = 2$

$z = -5/3$

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Question 5:

$$\begin{cases} 3x_1 + 5x_2 - 4x_3 = 0 \\ -3x_1 - 25x_2 + 4x_3 = 0 \\ 6x_1 + x_2 - 8x_3 = 0 \end{cases}$$

Sol:

To find $|A|$

$$\begin{vmatrix} 3 & 5 & -4 \\ -3 & -25 & 4 \\ 6 & 1 & -8 \end{vmatrix} = 3(200 - 4) - \text{[illegible]}$$

So the $|A| = 0$

it's mean it is non trivial Sol

$$A = \begin{bmatrix} 3 & 5 & -4 \\ -3 & -25 & 4 \\ 6 & 1 & 8 \end{bmatrix}$$

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$$\begin{bmatrix} 1 & 5/3 & -4/3 \\ -3 & -25 & 4 \\ 6 & 1 & -8 \end{bmatrix} \quad R_2 \to 5R_2$$

$$\begin{bmatrix} 1 & 5/3 & -4/3 \\ 0 & -20 & 0 \\ 0 & -49 & 0 \end{bmatrix} \quad \begin{matrix} R_2 \to 3R_1 \\ R_3 \to 2R_1 \end{matrix}$$

$$\begin{bmatrix} 1 & 5/3 & -4/3 \\ 0 & -20 & 0 \\ 0 & 1 & 0 \end{bmatrix} \quad \begin{matrix} R_2 \\ \hline -49 \\ 1 \end{matrix}$$

$$\begin{bmatrix} 1 & 5/3 & -4/3 \\ 0 & 1 & 0 \\ 0 & -20 & 0 \end{bmatrix} \quad R_2 \leftrightarrow R_3$$

$$\begin{bmatrix} 1 & 5/3 & -4/3 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad R_3 \to 3R_3$$

Let

$x_3 = t$

$x_2 = t$

$x_1 + \frac{5}{3}x_2 - \frac{4}{3}x_3 = 0$

$x_1 + \frac{5}{3}t - \frac{4}{3}t = 0$

$x_1 + t\left(\frac{5-4}{3}\right) = 0$

$x_1 + \frac{1}{3}t = 0$

$\boxed{x_1 = -\frac{1}{3}t}$

$\therefore \quad x_1 = -\frac{1}{3}t$

$x_2 = t$

$x_3 = t$

Question: Reduce the matrix to normal form and its find rank?

$$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 0 \end{bmatrix}$$

Sol:-

$$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -3 \end{bmatrix} \quad R_2 + (-3R_1), \; R_3 - R_1$$

$$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 0 & 0 & 0 & -3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad R_2 \leftrightarrow R_3$$

$$\begin{bmatrix} 1 & 3 & 4 & 0 \\ 0 & 0 & 0 & -3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad R_1 + R_2$$

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1	3	4	0	R_0
0	0	0	1	-3
0	0	0	0	

So the rank is

R = 3

Ans.