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Section - "B"

Semester - 2nd

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Date: __/__/__

QUESTION NO:-(1)

Determine if the following System is Consistent or not

$$x_1 - (3rd - 1D)x_2 + x_3 = 0$$
$$2x_2 - 8x_3 = 8$$
$$5x_1 - 5x_3 = 10$$

$$x_1 - 3x_2 + x_3 = 0$$
$$0x_1 + 2x_2 - 8x_3 = 8$$
$$5x_1 + 0x_2 - 5x_3 = 10$$

$$\begin{bmatrix} 1 & -3 & 1 \\ 0 & 2 & -8 \\ 5 & 0 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \begin{bmatrix} 0 \\ 8 \\ 10 \end{bmatrix}$$

$$Ax = B$$
$$x = A^{-1}B$$

Find $|A|$

IF $|A| \neq 0$ then equation will be consistent.

$$|A| = \begin{vmatrix} 1 & -3 & 1 \\ 0 & 2 & -8 \\ 5 & 0 & -5 \end{vmatrix} \quad C_3 + C_1$$

$$= \begin{bmatrix} 1 & -3 & 1 \\ 0 & 2 & -8 \\ 5 & 0 & 0 \end{bmatrix} = 5 \begin{bmatrix} -3 & 2 \\ 2 & -8 \end{bmatrix}$$

$$|A| = 5(24-4) = 5(20) = 100$$

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The equation are consistant

QUESTION No:- (2)

Find the inverse of $A = \begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & \text{4th-ID} \\ 5 & -2 & 7 \end{bmatrix}$ by the adjoint method.

$$\begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & \text{4th ID} \\ 5 & -2 & 7 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 4 & 5 \\ 2 & -1 & 7 \\ 5 & -2 & 7 \end{bmatrix}$$

$$A^{-1} = \frac{1}{|A|} Adj(A)$$

$$|A| = \begin{vmatrix} 3 & 4 & 5 \\ 2 & -1 & 7 \\ 5 & -2 & 7 \end{vmatrix}$$

$$3(-7-(-14)) - 4(14-35) + 5(-4+(-5))$$

$$3(-7+14) - 4(14-35) + 5(-4+5)$$

$$3(7) - 4(-21) + 5(1)$$

$$21 - (-84) + 5$$

$$21 + 84 + 5 = 110$$

$Adj(A) =$

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$A_{11} = (-1)^{1+1} \times \begin{vmatrix} 1 & 7 \\ -2 & 7 \end{vmatrix} = (-1)^2 = -7 - (-14) = -7 + 14 = 7$

$A_{12} = (-1)^{1+2} \times \begin{vmatrix} 2 & 7 \\ 5 & 7 \end{vmatrix} = (-1)^3 \times (14 + 35) = +21$

$A_{13} = (-1)^{1+3} \begin{vmatrix} 2 & -1 \\ 5 & -2 \end{vmatrix} = (-1)^4 \times (-4 + 5) = 1$

$A_{21} = (-1)^{2+1} \begin{vmatrix} 4 & 5 \\ -2 & 7 \end{vmatrix} = (-1)^3 \times 28 + 10 = 38$

$A_{22} = (-1)^{2+2} \begin{vmatrix} 3 & 5 \\ 5 & 7 \end{vmatrix} = (1)(21 - 25) = -4$

$A_{23} = (-1)^{2+3} = \begin{vmatrix} 3 & 4 \\ 5 & -2 \end{vmatrix} = (-1)(-6 - 20) = -26$

$A_{31} = (-1)^{3+1} = \begin{vmatrix} 4 & 5 \\ -1 & 7 \end{vmatrix} = (+1)(28 + 5) = 33$

$A_{32} = (-1)^{3+2} = \begin{vmatrix} 3 & 5 \\ 2 & 7 \end{vmatrix} = (-1)(21 - 10) = (-1)(11) = -11$

$A_{33} = (-1)^{3+3} \times \begin{vmatrix} 3 & 4 \\ 2 & -1 \end{vmatrix} = (1)(-3 - 8)(1)(-11) = -11$

$$\operatorname{adj}(A) = \begin{bmatrix} 7 & 21 & 1 \\ 38 & -4 & -26 \\ 33 & -11 & -11 \end{bmatrix}$$

$$\operatorname{adj}(A) = \begin{bmatrix} 7 & 38 & 33 \\ 21 & -4 & -11 \\ 1 & -26 & -11 \end{bmatrix}$$

$$A^{-1} = \frac{1}{|A|} \operatorname{adj}(A)$$

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

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

QUESTION No:- (3)

Solve the following systems of linear equations by Guass-jordan Method.

$$2x + 2y + 4z = 18$$

$$x + 3y + 2z = 13$$

$$3x + 2y - 3z = 14$$

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

$R_1 = \frac{1}{2} R_1$

$$\begin{bmatrix} 1 & 1 & 2 & 9 \\ 1 & 3 & 2 & 13 \\ 3 & 2 & -3 & 14 \end{bmatrix} \quad R_2 - R_1$$

$$\begin{bmatrix} 1 & 1 & 2 & 9 \\ 0 & 2 & 0 & 4 \\ 3 & 2 & -3 & 14 \end{bmatrix} \quad R_3 - 3R_1$$

$$\begin{bmatrix} 1 & 1 & 2 & 9 \\ 0 & 2 & 0 & 4 \\ 0 & -1 & -9 & -13 \end{bmatrix} \quad \frac{1}{2} R_2$$

$$\begin{bmatrix} 1 & 1 & 2 & 9 \\ 0 & 1 & 0 & 2 \\ 0 & -1 & -9 & -13 \end{bmatrix} \quad \begin{matrix} \cancel{R_1} + R_3 \\ R_2 + R_3 \end{matrix}$$

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$$\begin{bmatrix} 1 & 1 & 2 & 9 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & -9 & -11 \end{bmatrix} \quad R_1 \Rightarrow R_1 - R_2$$

$$\begin{bmatrix} 1 & 0 & 2 & 7 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & -9 & -11 \end{bmatrix} \quad -\frac{1}{9} R_3$$

$$\begin{bmatrix} 1 & 0 & 2 & 7 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & \frac{11}{9} \end{bmatrix} \quad R_1 - 2R_3$$

$$\begin{bmatrix} 1 & 0 & 0 & 41/9 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & \frac{11}{9} \end{bmatrix}$$

$x = 41/9$

$z = 11/9$

$y = 2$

QUESTION No:- (4)

Show that this matrix is Diagonisable.

$$\begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$$

$\det(A - \lambda I) = 0$

$$\begin{bmatrix} 4-\lambda & 2 & -2 \\ -5 & 3-\lambda & 2 \\ -2 & 4 & 1-\lambda \end{bmatrix} = \cancel{2-\lambda}$$

$$4-\lambda \begin{vmatrix} 3-\lambda & 2 \\ 4 & 1-\lambda \end{vmatrix} - 2 \begin{vmatrix} -5 & 2 \\ -2 & 1-\lambda \end{vmatrix} + (-2) \begin{vmatrix} -5 & 3-\lambda \\ -2 & 4 \end{vmatrix}$$

$4-\lambda((3-\lambda)(1-\lambda)-(8)) - 2((-5)(1-\lambda)+4) - 2(-20+6-2\lambda$

$4-\lambda(3-3\lambda-\lambda+\lambda^2-8) - 2(-5+5\lambda+4) - 2(-20+6-2\lambda)$

$(\lambda^3+8\lambda^2-11\lambda-20)+(10-10\lambda-8)+40-12+4\lambda$

$\lambda^3+8\lambda^2-11\lambda-20+10-10\lambda-8+40-12+4\lambda$

$\lambda^3+8\lambda^2-17\lambda+10$

QUESTION No:- (5)

Determine if the following homogeneous System has a non-trivial Solution. then describe the solution set.

$$3x_1 + 5x_2 - 4x_3 = 0$$
$$-3x_1 - 25x_2 + 4x_3 = 0$$
$$6x_1 + x_2 - 8x_3 = 0$$

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

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

$$|A| \quad 3\begin{vmatrix} -25 & 4 \\ 1 & -8 \end{vmatrix} - 5\begin{vmatrix} -3 & 4 \\ 6 & -8 \end{vmatrix} + (-4)\begin{vmatrix} -3 & -25 \\ 6 & 1 \end{vmatrix}$$

$$|A| = 3(200-4) - 5(24+24) - 4(-3-(-150))$$

$$3(196) - 5(0) - 4(-3+150)$$

$$3(196) - 4(147)$$

$$588 - 588 = 0$$

yes this is
non-trivial solution.

QUESTION No (6)

Reduce the matrix to normal Form and Find its rank.

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

$R_2 - 3R_1$

$$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 0 & 0 & 0 & -6 \\ 1 & 3 & 4 & 0 \end{bmatrix}$$

$R_3 = R_1$

$$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 0 & 0 & 0 & -6 \\ 0 & 0 & 0 & -3 \end{bmatrix} \rightarrow R_2 \longleftrightarrow R_3$$

$$\begin{bmatrix} 1 & 3 & 4 & 3 \\ 0 & 0 & 0 & -3 \\ 0 & 0 & 0 & -6 \end{bmatrix} \quad \begin{matrix} \cancel{R_3}+R_2 \\ R_3+R_2 \end{matrix}$$

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

This is Normal Form

so the non-zero Row are two

so the rank is also 2

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