M. Faizan

ID # 16046

Department BE(E)

subject linear Algebera

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Q1 (a) Let $A = \begin{bmatrix} 1 & -2 & 3 \\ 4 & 2 & 1 \\ 0 & 1 & -2 \end{bmatrix}$ & $B = \begin{bmatrix} 1 & 4 \\ 3 & -1 \\ 2 & 2 \end{bmatrix}$

Identify the (3,2) entry of AB.

Solution:- Identify (3,2) = ?

$Row_3(A) \cdot coloumn_2(B)$

$\Rightarrow [0 \ 1 \ -2] \cdot \begin{bmatrix} 4 \\ -1 \\ 2 \end{bmatrix}$.

~~$\Rightarrow (0)(4)$~~ $\Rightarrow (0)(4) + (1)(-1) + (-2)(2)$

$\Rightarrow 0 + (-1) + (-4)$

$\Rightarrow -1 - 4$

$\Rightarrow \boxed{-5}$ Ans

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Q1 Label the quadric polynomial
(b) that interpolate the points
(1,3) . (2,4) (3,7)

Solution:-

As $a_2 x_1^2 + a_1 x_1 + a_0 = y_1$
$a_2 x_2^2 + a_1 x_2 + a_0 = y_2$
$a_2 x_3^2 + a_1 x_3 + a_0 = y_3$

Now $(x_1, y_1) = (1,3)$, $(x_2, y_2) = (2,4)$
$(x_3, y_3) = (3,7)$ Put in above

$$a_2 + a_1 + a_0 = 3$$
$$4a_2 + 2a_1 + a_0 = 4$$
$$9a_2 + 3a_1 + a_0 = 7$$

$$A_b = \left[\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 4 & 2 & 1 & 4 \\ 9 & 3 & 1 & 7 \end{array}\right]$$

$$R_1 \left[\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & -2 & -3 & -8 \\ 0 & -6 & -8 & -20 \end{array}\right] \quad \begin{array}{l} R_2 - 4R_1 \\ R_3 - 9R_1 \end{array}$$

$$R_1 \left[\begin{array}{ccc|c} 1 & 1 & 1 & 3 \\ 0 & -2 & -3 & -8 \\ 0 & 0 & 1 & 4 \end{array}\right] \quad R_3 - 3R_2$$

So $a_2 + a_1 + a_0 = 3$ — (1)
$-2a_1 - 3a_0 = -8$ — (2)
$\boxed{a_0 = 4}$ Put in (2)

$-2a_1 - 12 = -8 \Rightarrow a_1 = \frac{4}{-2} = -2$
Put in (1)
$a_2 - 2 + 4 = 3 \Rightarrow \boxed{a_2 = 1}$

Q2 IF A & B are non matrics
(a) where $|A| = 2$ and $|B| = -3$
calculate $|A^{-1} B^{t}|$

Soloution:-

$$|A^{-1} B^{t}|$$

$$= |A^{-1}| \; |B^{t}|$$

$$= \frac{1}{|A|} |B|$$

$$|B^{t}| = |B|$$

so $|A^{-1} B^{t}| = \frac{1}{|A|} |B|$

$$= \frac{1}{2} \cdot 3$$

$$\boxed{= \frac{3}{2}}$$ Ans

Q2 Estimate the linear system of
(b) equation

$$x + y + 2z = 1$$
$$x - 2y + z = -5$$
$$3x + y + z = 3$$

Solution:-

$$x + y + 2z = 1$$
$$x - 2y + z = -5$$
$$3x + y + z = 3$$

$$\left[\begin{array}{ccc:c} 1 & 1 & 2 & 1 \\ 1 & -2 & 1 & -5 \\ 3 & 1 & 1 & 3 \end{array}\right] \quad \cancel{R_2 - R_1} \quad \cancel{R_3 - 3R_1}$$

$$\left[\begin{array}{ccc:c} 1 & 1 & 2 & 1 \\ 0 & -3 & -1 & -6 \\ 0 & -2 & -5 & 0 \end{array}\right] \quad \begin{array}{l} R - R_1 \\ R_3 - 3R_1 \end{array}$$

$$\left[\begin{array}{ccc:c} 1 & 1 & 2 & 1 \\ 0 & 1 & 7/3 & 2 \\ 0 & -2 & -5 & 0 \end{array}\right] \quad \frac{R_2}{-3}$$

$$\left[\begin{array}{ccc:c} 1 & 1 & 2 & 1 \\ 0 & 1 & 7/3 & 2 \\ 0 & 0 & -\frac{13}{2} & 4 \end{array}\right] \quad R_3 + 2R_2$$

$$\left[\begin{array}{ccc:c} 1 & 1 & 2 & 1 \\ 0 & 1 & 1/3 & 2 \\ 0 & 0 & 1 & -8/13 \end{array}\right] \quad R_3 \times \frac{2}{-13}$$

$x + y + 2z = 7$ — (i)

$y + 7/3\, z = 2$ — (ii)

$z = \frac{-8}{13}$ (iii)

Now put eq (iii) in eq (i)

$y + 7/3 \times \frac{-8}{13} = 2$

$y - \frac{8}{39} = 2$

$y = 2 + \frac{8}{39}$

$y = \frac{78+8}{39} = \frac{86}{39}$

Now put value of y in (i)

$x + \frac{86}{39} + 2\left(\frac{-8}{13}\right) = 1$

$x + \frac{86}{39} - \frac{16}{13} = 1$

$x + \frac{38}{39} = 1$

$x = 1 - \frac{38}{39}$

$\boxed{x = \frac{1}{39}}$

Q3 Find A^{-1} where $A = \begin{bmatrix} 3 & -2 & 1 \\ 5 & 6 & 2 \\ 1 & 0 & -3 \end{bmatrix}$

Soloution:-

$$A = \begin{bmatrix} 3 & -2 & 1 \\ 5 & 6 & 2 \\ 1 & 0 & -3 \end{bmatrix}$$

$$|A| = \begin{vmatrix} 3 & -2 & 1 \\ 5 & 6 & 2 \\ 1 & 0 & -3 \end{vmatrix}$$

Expand by Row,

$$= 3 \begin{vmatrix} 6 & 2 \\ 0 & -3 \end{vmatrix} - (-2) \begin{vmatrix} 5 & 2 \\ 1 & -3 \end{vmatrix} + 1 \begin{vmatrix} 5 & 6 \\ 1 & 0 \end{vmatrix}$$

$$= 3 \begin{vmatrix} 6 & 2 \\ 0 & -3 \end{vmatrix} + 2 \begin{vmatrix} 5 & 2 \\ 1 & -3 \end{vmatrix} + 1 \begin{vmatrix} 5 & 6 \\ 1 & 0 \end{vmatrix}$$

$\Rightarrow 3(-18-0) + 2(-15-2) + 1(0-6)$

$\Rightarrow 3(-18) + 2(-17) + 1(-6)$

$\Rightarrow -54 - 34 - 6$

$\Rightarrow -94$

$\Rightarrow$

$$|A| = -94$$

$$A_{11} = (-1)^{1+1} \begin{vmatrix} 6 & 2 \\ 0 & -3 \end{vmatrix} = -18$$

$$A_{12} = (-1)^{1+2} \begin{vmatrix} 5 & 2 \\ 1 & -3 \end{vmatrix} = 17$$

$$A_{13} = (-1)^{1+3} \begin{vmatrix} 5 & 6 \\ 1 & 0 \end{vmatrix} = -6$$

$$A_{21} = (-1)^{2+1} \begin{vmatrix} -2 & 1 \\ 0 & -3 \end{vmatrix} = -6$$

$$A_{22} = (-1)^{2+2} \begin{vmatrix} 3 & 1 \\ 1 & -3 \end{vmatrix} = -10$$

$$A_{23} = (-1)^{2+3} \begin{vmatrix} 3 & -2 \\ 1 & 0 \end{vmatrix} = 2$$

$$A_{31} = (-1)^{3+1} \begin{vmatrix} -2 & 1 \\ 6 & 2 \end{vmatrix} = -10$$

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

$$A_{33} = (-1)^{3+3} \begin{vmatrix} 3 & -2 \\ 5 & 6 \end{vmatrix} = 28$$

$$\operatorname{adj} A = \begin{vmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{vmatrix}^{t}$$

$$\Rightarrow \begin{vmatrix} A_{11} & A_{21} & A_{31} \\ A_{12} & A_{22} & A_{32} \\ A_{13} & A_{23} & A_{33} \end{vmatrix}$$