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IES/GATE/PSU
MATHEMATICS
BY-Umamashwer SIR

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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Linear Algebra;

Determinant value of a square matrix:

The sum of the products of the elements of a row (column) with their coeresponding cofactoes is known as determinant value of square motors.

$$3x^{3}$$
 | 3 1 | 2 -1 5 | = $\pm(-3-10)$ - $\pm(6+5)$ + $\pm(4-1)$ -1 2 3 | = $-13-33+3$ = -43 .

$$(lo+x)x_{s}$$

A square matrix A is said to be

* Every square motorix can be expressed as the sum of symmetric matrices..

$$\int_{0}^{\infty} e_{3} A = \left(\frac{A + A^{T}}{2}\right) + \left(\frac{A - A^{T}}{2}\right)$$

Symmetric Skew Symmetric

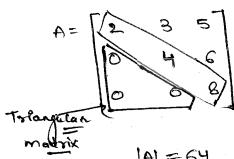
$$A = \begin{bmatrix} 2 & 5 \\ 9 & 7 \end{bmatrix} \quad A^{T} = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix} \quad \frac{A - A^{T}}{2} = \begin{bmatrix} 2 & 3 \\ 9 & 7 \end{bmatrix}$$

$$\frac{A-A^{T}}{2} = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$$

Skew Symmetric

Always leading diagonal elements will be zero...

* The det. value of a triangular or a diagonal motive is the broduct of its leading diagonal elements.



$$|A| = 64$$

= 2x4x8
= 64.

* In a square matrix if each element of a row (column) is zero then the value of its determinant is zero.

* In a square motrix of two rows (columns) are proportional/ Identical then the value of its determinant is zero.

$$(A) = 2(72-72) - 3(48-48) + 5(54-54)$$
=0

* The determinant value of skew symmetric matrix of odd order is always zero.

$$A = \begin{bmatrix} 0 & 1 & 2 \\ -1 & 0 & 3 \\ -2 & -3 & 0 \end{bmatrix}_{3\times3}$$

$$(A) = 0 - 1(0+6) + 2(3-6)$$

$$AAT = I$$

$$|AAT| = |II|$$

$$|A||AT| = 1 \longrightarrow : |A| = |A|$$

$$|A||A| = 1$$

$$|A|^2 = 1$$

$$|A|^2 = 1$$

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}_{2 \times 2}$$

$$KA = \begin{bmatrix} Ka_{11} & Ka_{12} \\ Ka_{21} & Ka_{22} \end{bmatrix}$$

$$|KA| = |Ka_{11}| |Ka_{12}| |Ka_{21}| |Ka_{22}|$$

* If A is non-singular matrix of order n then

ii)
$$A^{-1} = AdjA$$

[A]

Cofactor =
$$\begin{bmatrix} 3 & -2 \\ -7 & 5 \end{bmatrix}$$

Matrix
$$\begin{bmatrix} -7 & 5 \\ -2 & 5 \end{bmatrix}$$

Adj A = $\begin{bmatrix} 3 & -7 \\ -2 & 5 \end{bmatrix}$

$$A^{-1} = \underbrace{AdjA}_{1A)}$$

$$= \underbrace{1}_{1} \begin{bmatrix} 3 & -7 \\ -2 & 5 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} 3 & -7 \\ -2 & 5 \end{bmatrix}$$

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

$$|A| = -1(1-4) + 2(2+4) - 2(-4-2)$$

$$= 3 + 12 + 12$$

$$= 27.$$

$$M \qquad \downarrow \qquad \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \qquad \qquad \downarrow \qquad \qquad \qquad$$

$$Adj A = \begin{bmatrix} -3 & 6 & 6 \\ -6 & 3 & -6 \\ -6 & -6 & 3 \end{bmatrix}$$

$$A^{-1} = Adi = 1$$
 $A^{-1} = Adi = 1$
 $A^{-1} = Ad$

If Amen and Boxp are multiplied then the total number of multiplicative and additive operations are needed to get motion AB.

e) mp(n-1), mpn d) mpn, mpn-1

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} & b_{n1} \\ \vdots & \vdots & \ddots & \vdots \\ b_{n1} & b_{n1} & a_{1n} & b_{n1} \end{bmatrix}$$

$$AB = \begin{bmatrix} a_{11} & a_{12} & b_{21} & \cdots & a_{1n} & b_{n1} \\ \vdots & \vdots & \ddots & \vdots \\ a_{1n} & b_{n1} & \cdots & a_{1n} & b_{n1} \end{bmatrix}$$

MPN mp(m-1)

for mp elements m thmes multiplied (m-1) times added...