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Where Minds Pollinate

Class 11
Mathematics

Chapter 2

Exercise 2.1

Notes

National Book Foundation

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Unit 2 Matrices & Determinants

Matrix:

$$A = \begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix} \begin{matrix} R_1 \\ R_2 \end{matrix}$$

$C_1 \quad C_2 \quad C_3$

Order: 2-by-3 , 2x3

Row matrix / (row vector): row - $m \times n$ - colu

In general if a row matrix A having n number of column is: $\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{1n} \end{bmatrix}_{1 \times n}$

column vector:

$$\begin{bmatrix} a_{11} \\ a_{12} \\ a_{21} \\ \vdots \\ a_{m1} \end{bmatrix}_{m \times 1}$$

Square matrix: $m = n$

Rectangular: $m \neq n$

Null:

Types of Square matrix:- 10 types

Diagonal matrix: A square matrix is called diag matrix if $a_{iJ} = 0 \quad \forall i \neq J$

At least one a_{iJ} isn't zero $\forall i = J$

e.g:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ 1 & 0 & 0 \\ a_{21} & a_{22} & a_{23} \\ 0 & 2 & 0 \\ a_{31} & a_{32} & a_{33} \\ 0 & 0 & 0 \end{bmatrix}$$ Diagonal

$A = \begin{bmatrix} 1 \end{bmatrix}$ ✓ $\qquad A = \begin{bmatrix} 0 \end{bmatrix}$ x

$$C = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$ x

Scalar matrix: A diagonal matrix is called scalar matrix if

→ $a_{ij} = 0 \quad \forall i \neq j$

→ $a_{ij} = M \quad \forall i = j$ * M is any constant number but

e.g:	3	0	0	$M \neq \{0, 1\}$
	0	3	0	If M reduces to 1 than it is: Identity matrix (unit)
	0	0	3	If M = 0 , Null matrix.

Upper Triangular matrix: A square matrix is called upper triangular matrix if $a_{ij} = 0 \quad \forall i > j$

zero: $\begin{bmatrix} 1 & 6 & 7 \\ & 3 & 3 \\ 0 & 0 & 5 \end{bmatrix}$

Lower Triangular matrix: If $a_{ij} = 0 \quad \forall i < j$

Triangular matrix:- either upper/lower

Note: Sum/Dif/Prod of Upper/lower triangular matrix

→ Every scalar and identity matrix is diagonal matrix

→ But every diagonal matrix may or maynt be scalar and

→ Identity matrix.

→ Diagonal matrix is both upper and lower-Triangular matrix

Examples:

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$ Diagonal

$$D = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 5 \\ 0 & 0 & 6 \end{bmatrix}$$ Upper T.M

$$H = \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$$ Upper TM

$$B = \begin{bmatrix} -4 & 0 & 0 \\ 0 & -4 & 0 \\ 0 & 0 & -4 \end{bmatrix}$$ Scalar

$$E = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 5 & 0 \\ 3 & 4 & 6 \end{bmatrix}$$ Lower T.M

$$C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ Identity

$F = [1]$ Diagonal

$9 = [0]$ Null

Exercise : 2.1

QNo.1: Find the order of following matrixes

(1) $A = \begin{bmatrix} 1 & 3 & 0 \\ 2 & 0 & 1 \end{bmatrix}$

2-by-3

(2) $B = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ 3 & 4 \end{bmatrix}$

3-by-2

(3) $C = \begin{bmatrix} \frac{1}{6} \\ 9 \end{bmatrix}$

3 by 1

(4) $D = \begin{bmatrix} 2 & 1 & 6 & 8 \end{bmatrix}$

1 by 4

(5) $E = \begin{bmatrix} 3 \end{bmatrix}$

1 by 1

(6) $F = \begin{bmatrix} 3 & 6 \\ 9 & 2 \end{bmatrix}$

2 by 2

QNo.2: Identify the following matrices are square, rectangular, row or column matrix.

(1) $A = \begin{bmatrix} 3 & 6 & 2 \\ 2 & 1 & 9 \end{bmatrix}$

Rectangular matrix

(2) $B = \begin{bmatrix} 1/3 & 1 \\ 2 & 6 \end{bmatrix}$

Square matrix

(3) $C = \begin{bmatrix} 3 \\ 2 \\ 8 \end{bmatrix}$

Column matrix

(4) $D = \begin{bmatrix} 1 & 6 & 9 \\ 2 & 0 & 1 \\ 3 & 1 & 2 \end{bmatrix}$

Square matrix

(5) $E = \begin{bmatrix} 2 & 0 & 1 \end{bmatrix}$

Row matrix

(6) $F = \begin{bmatrix} 16 \end{bmatrix}$

Square matrix

QNo.3: Identify the diagonal matrix, identity, lower and upper triangular matrix.

(1) $A = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 1 & 0 \\ 2 & 6 & 0 \end{bmatrix}$

lower triangular

(2) $B = \begin{bmatrix} -6 & 0 & 0 \\ 0 & -6 & 0 \\ 0 & 0 & -6 \end{bmatrix}$

Scalar

(3) $C = \begin{bmatrix} 1 & 0 \\ 2 & 0 \end{bmatrix}$ lower triangular matrix

(4) $D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Identity Matrix

(5) $E = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ Diagonal

(6) $F = \begin{bmatrix} \sqrt{3} & 1 & 2 \\ 0 & 0 & 6 \\ 0 & 0 & 1 \end{bmatrix}$ Upper TM

(7) $G = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ Lower T.

(8) $H = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ scalar

QNo.4. Find transpose of following matrices and identify symmetric or skew symmetric

(1) $A = \begin{bmatrix} 2 & 0 \\ \sqrt{5} & 6 \\ 1 & 9 \end{bmatrix}$ $A^t = \begin{bmatrix} 2 & \sqrt{5} & 1 \\ 0 & 6 & 9 \end{bmatrix}$ $A^t \neq A$ Not symmetric or skew

(2) $B = \begin{bmatrix} 1 & 6 & 2 & 0 \end{bmatrix}$ $A^t = \begin{bmatrix} 1 \\ 6 \\ 2 \\ 0 \end{bmatrix}$ $Bt \neq B$ B is not Symmetric or skew

(3) $C = \begin{bmatrix} 2 & 6 \\ 9 & 2 \end{bmatrix}$ $C^t = \begin{bmatrix} 2 & 9 \\ 6 & 2 \end{bmatrix}$ $C^t \neq C$. Not symmetric or skew

(4) $D = \begin{bmatrix} 0 & 1 & 9 \\ -1 & 0 & 5 \\ 9 & -5 & 0 \end{bmatrix}$ $D^t = \begin{bmatrix} 0 & -1 & 9 \\ 1 & 0 & -5 \\ 9 & 5 & 0 \end{bmatrix}$ $D^t = -D$ skew Symmetric

(5) $E = \begin{bmatrix} 3 & -6 & 9 \\ -6 & 2 & 0 \\ 9 & 0 & 0 \end{bmatrix}$ $E^t = \begin{bmatrix} 3 & -6 & 9 \\ -6 & 2 & 0 \\ 9 & 0 & 0 \end{bmatrix}$ $E^t = E$ Symmetric

(6) $F = \begin{bmatrix} 9 & 0 & 1 \\ 0 & 6 & 3 \\ 0 & 0 & 1 \end{bmatrix}$ $F^t = \begin{bmatrix} 9 & 0 & 0 \\ 0 & 6 & 0 \\ 1 & 3 & 1 \end{bmatrix}$ Not symmetric or skew symmetric

Entry Test:

(1) $A^t - A$ = Null Matrix $\rightarrow$ Symmetric

(2) $A^t + A = 0$ $\rightarrow$ Skew symmetric