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# MATRICES

$[15]$ $\begin{bmatrix} 10 & 8 & 6 \\ 7 & 5 & 6 \end{bmatrix}$

It is an array of numbers.

It is a combination of rows or columns.

It is a rectangular arrangement of numbers.

$\begin{bmatrix} 5 & 4 \\ 3 & 2 \end{bmatrix}$ rows $\Rightarrow m$, columns $\Rightarrow n$

$\begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \end{bmatrix}$

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order of matrix = no. of rows × no. of columns

$2\times2$ $\begin{bmatrix} 5 & 4 & 3 \\ 2 & 1 & 3 \end{bmatrix}$ $2\times3$ $\begin{bmatrix} 5 & 4 & 3 \\ 2 & 1 & 6 \\ 7 & 2 & 3 \end{bmatrix}$ $3\times3$

Q A matrix has 12 elements. find the no. of possible order

$12\times1$, $1\times12$, $3\times4$, $4\times3$, $6\times2$, $2\times6$

Q. ⟶ 7 elements $\Rightarrow 7\times1$, $1\times7$

$\begin{bmatrix} 5 & 4 \\ 3 & 2 \\ a_{21} & a_{22} \end{bmatrix}$ $a_{11}$, $a_{12}$

$a_{ij}$ = $i^{th}$ row and $j^{th}$ column element

i j

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Construct a $3 \times 2$ matrix where $a_{ij}$

$$a_{ij} = \frac{1}{2}|i-3j|$$

$$A_{3\times 2} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{bmatrix}$$

$$a_{11} = \frac{1}{2}|1-3\times 1| \qquad a_{12} = \frac{1}{2}|1-3\times 2|$$

$$= \frac{1}{2}|2| = 1 \qquad = \frac{1}{2}|-5| = 5/2$$

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$$a_{21} = \frac{1}{2}|2-3\times 1| = \frac{1}{2}|-1| = 1/2, \qquad a_{22} = 2$$

$$a_{31} = 0, \qquad a_{32} = 3/2$$

$$\begin{bmatrix} 1 & 5/2 \\ 1/2 & 2 \\ 0 & 3/2 \end{bmatrix}$$

Types of matrix

Row matrix $\Rightarrow$ It has one row & n columns

$$[1 \; 5 \; 6 \; 7 \; \cdots]$$

Column matrix It has one column & n rows

$$\begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \\ \vdots \\ a_{1m} \end{bmatrix}$$

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**Square matrix** no of rows = no of columns

$[1]$ $1\times1$, $\begin{bmatrix}2&2\\3&2\end{bmatrix}$ $2\times2$, $\begin{bmatrix}3&2&3\\4&5&6\\7&1&2\end{bmatrix}$ $3\times3$

**Diagonal matrix** A square matrix in which the main diagonal elements are non zero and other elements are zero. $\begin{bmatrix}1&0\\0&3\end{bmatrix}$ $\begin{bmatrix}5&0&0\\0&7&0\\0&3&4\end{bmatrix}$

**Unit matrix = Identity matrix.**

⇒ It is a diagonal matrix whose main diagonal elements are one

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$[1]$ $I_1$, $\begin{bmatrix}1&0\\0&1\end{bmatrix}$ $I_2$, $\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$ $I_3$

**Null matrix** All elements are zero

$[0]$ $\begin{bmatrix}0&0\\0&0\end{bmatrix}$ $\begin{bmatrix}0&0&0\\0&0&0\\0&0&0\end{bmatrix}$

**Q** If type $\begin{bmatrix}a&b\\c&d\end{bmatrix}=\begin{bmatrix}3&4\\5&6\end{bmatrix}$.

$a=3,\ b=4,\ c=5,\ d=6$

**Q** $\begin{bmatrix}x-3&y\\z&2w+2\end{bmatrix}=\begin{bmatrix}5&0\\4&6\end{bmatrix}$

$x-3=5,\ y=0,\ z=4,\ 2w+2=6$

$x=8,$

$2w+4=6$

$2w=6-4$

$2w=2$

$w=1$

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$$\begin{bmatrix} 2a+3 & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$$

find a, b, c, d

addition of matrix $\begin{bmatrix} 2 & 4 \\ 7 & 2 \end{bmatrix} + \begin{bmatrix} 8 & 4 \\ 9 & 3 \end{bmatrix}$

2×2 2×2

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$$\begin{bmatrix} 13 & 8 \\ 16 & 5 \end{bmatrix}$$

Subtraction matrix $= \begin{bmatrix} -3 & 0 \\ -2 & -1 \end{bmatrix}$

$$A = \begin{bmatrix} 3 & 4 & 2 \\ 1 & 3 & 2 \\ 5 & 4 & 6 \end{bmatrix}$$

addition & subtraction of two matrices is possible if order of two matrices is same

$$3A = \begin{bmatrix} 9 & 12 & 6 \\ 3 & 9 & 6 \\ 15 & 12 & 18 \end{bmatrix}$$

Negative of A $= \begin{bmatrix} -3 & -4 & -2 \\ -1 & -3 & -2 \\ -5 & -4 & -6 \end{bmatrix}$

$$\begin{bmatrix} 3 & 6 \\ 7 & 5 \end{bmatrix} + \begin{bmatrix} 4 & 2 \\ 8 & 6 \end{bmatrix} - \begin{bmatrix} 7 & 8 \\ 15 & 10 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$$

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$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix}$$

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

$$x + y = \begin{bmatrix} 5 & 2 \\ 0 & 5 \end{bmatrix} \quad \text{(I)}$$

$$x - y = \begin{bmatrix} 3 & 6 \\ 6 & -1 \end{bmatrix} \quad \text{(II)}$$

$$x+y+x-y = \begin{bmatrix} 8 & 8 \\ 0 & 8 \end{bmatrix}$$

$$2x$$

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$$x = \begin{bmatrix} 4 & 4 \\ 0 & 4 \end{bmatrix}$$

Subs (II) in (I)

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

~~x+y-x+y~~

$$2y = \begin{bmatrix} 2 & -4 \\ 0 & 10 \end{bmatrix}$$

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