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Exercise 1.2

Q.1 Identify the following matrices.

$A=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$ **(U.B)**

It's all members are 0. So, it's a null matrix.

$B = \begin{bmatrix}2 & 3 & 4\end{bmatrix}$ **(U.B)**

It has only 1 row. So, it's a row matrix.

$C = \begin{bmatrix}4\\ 0\\ 6\end{bmatrix}$ **(U.B)**

It has only 1 column. So, it's a column matrix.

$D = \begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ **(U.B)**

Its an identity matrix because its diagonal entries are 1 and non-diagonal enteries are zero.

$E = \begin{bmatrix}0\end{bmatrix}$ **(U.B)**

It has only 0. So, it's a null matrix.

$F = \begin{bmatrix}5\\ 6\\ 7\end{bmatrix}$ **(U.B)**

It has only 1 column. So, it's a column matrix.

Q.2 Identify the following matrices.

(i) $\begin{bmatrix}-8 & 2 & 7\\ 12 & 0 & 4\end{bmatrix}$ **(U.B)**

Its number of rows & columns are not equal. So, it's a rectangular matrix.

(ii) $\begin{bmatrix}3\\ 0\\ 1\end{bmatrix}$ **(U.B)**

It has only one column. So, it's a column matrix.

(iii) $\begin{bmatrix}6 & -4\\ 3 & -2\end{bmatrix}$ **(U.B)**

The number of rows & columns are equal. So, it's a square matrix.

$\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$

Identity matrix – Because Diagonal entries are 1 and non-diagonal entries are 0.

(iv) $\begin{bmatrix}1 & 2\\ 3 & 4\\ 5 & 6\end{bmatrix}$ **(U.B)**

Number of rows & columns are not equal. So, it's a rectangular matrix.

(v) $\begin{bmatrix}3 & 10 & -1\end{bmatrix}$ **(U.B)**

It's a row matrix because it has only 1 row.

(vi) $\begin{bmatrix}1\\ 0\\ 0\end{bmatrix}$ **(U.B)**

It's a column matrix because it has only one column.

(vii) $\begin{bmatrix}1 & 2 & 3\\ -1 & 2 & 0\\ 0 & 0 & 1\end{bmatrix}$ **(U.B)**

It's a square matrix because number of rows & columns are equal.

(viii) $\begin{bmatrix}0 & 0\\ 0 & 0\\ 0 & 0\end{bmatrix}$ **(U.B)**

It's a null matrix because all elements are 0.

Q.3 Identify the matrices.

(1) $A=\begin{bmatrix}4 & 0\\ 0 & 4\end{bmatrix}$ **(U.B)**

It's a scalar-matrix because it non-diagonal entries are 0 & diagonal entries are same.

(2) $B=\begin{bmatrix}2 & 0\\ 0 & -1\end{bmatrix}$ **(U.B)**

It's a diagonal matrix because its non-diagonal entries are 0.

(3) $C=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ **(U.B)**

It's a unit matrix because diagonal-entries are 1.

(4) $D=\begin{bmatrix}3 & 0\\ 0 & 0\end{bmatrix}$ **(U.B)**

It's a diagonal matrix because non-diagonal entries are 0.

(5) $E=\begin{bmatrix}5-3 & 0\\ 0 & 1+1\end{bmatrix}=\begin{bmatrix}2 & 0\\ 0 & 2\end{bmatrix}$ **(U.B)**

It's a scalar matrix because diagonal entries are same.

Q.4 Find the negative of matrices.

(1) $A=\begin{bmatrix}1\\ 0\\ -1\end{bmatrix}$ **(A.B)**

$$-A=-\begin{bmatrix}1\\ 0\\ -1\end{bmatrix}=\begin{bmatrix}-1\\ 0\\ 1\end{bmatrix}$$

(2) $B=\begin{bmatrix}3 & -1\\ 2 & 1\end{bmatrix}$ **(A.B)**

$$-B=-\begin{bmatrix}3 & -1\\ 2 & 1\end{bmatrix}$$

$$-B=\begin{bmatrix}-3 & +1\\ -2 & -1\end{bmatrix}$$

(3) $C=\begin{bmatrix}2 & 6\\ 3 & 2\end{bmatrix}$ **(A.B)**

$$-C=-\begin{bmatrix}2 & 6\\ 3 & 2\end{bmatrix}$$

$$=\begin{bmatrix}-2 & -6\\ -3 & -2\end{bmatrix}$$

(4) $D=\begin{bmatrix}-3 & 2\\ -4 & 5\end{bmatrix}$ **(A.B)**

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

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

(5) $E=\begin{bmatrix}1 & -5\\ 2 & 3\end{bmatrix}$ **(A.B)**

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

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

Q.5 Find the transpose.

(1) $A=\begin{bmatrix}0\\ 1\\ -2\end{bmatrix}$ **(A.B)**

$$A^t=\begin{bmatrix}0\\ 1\\ -2\end{bmatrix}^t$$

$$A^t=\begin{bmatrix}0 & 1 & -2\end{bmatrix}$$

(2) $B=\begin{bmatrix}5 & 1 & -6\end{bmatrix}$ **(LHR 2019)** **(A.B)**

$$B^t=\begin{bmatrix}5 & 1 & -6\end{bmatrix}^t$$

$$B^t=\begin{bmatrix}5\\ 1\\ -6\end{bmatrix}$$

(3) $C = \begin{bmatrix} 1 & 2 \\ 2 & -1 \\ 3 & 0 \end{bmatrix}$ **(FSD 2016)** **(A.B)**

$$C^t = \begin{bmatrix} 1 & 2 \\ 2 & -1 \\ 3 & 0 \end{bmatrix}^t$$

$$C^t = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 0 \end{bmatrix}$$

(4) $D = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix}$ **(A.B)**

$$D^t = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix}^t$$

$$D^t = \begin{bmatrix} 2 & 0 \\ 3 & 5 \end{bmatrix}$$

(5) $E = \begin{bmatrix} 2 & 3 \\ -4 & 5 \end{bmatrix}$ **(A.B)**

$$E^t = \begin{bmatrix} 2 & 3 \\ -4 & 5 \end{bmatrix}^t$$

$$E^t = \begin{bmatrix} 2 & -4 \\ 3 & 5 \end{bmatrix}$$

(6) $F = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ **(A.B)**

$$F^t = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}^t$$

$$F^t = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

Q.6 Verify that if $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ **and**

$B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$ **then**

(i) $(A^t)^t = A$ **(SWL 2018, SGD 2015, 17)** **(A.B)**

Verification:

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

$$A^t = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}^t$$

$$A^t = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$$

$$\left(A^t\right)^t = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}^t$$

$$\left(A^t\right)^t = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

$$\left(A^t\right)^t = A$$

Hence Proved.

(ii) $\left(B^t\right)^t = B$ **(A.B)**

(SWL 2016, D.G.K 2016, 18)

Verification:

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

$$B^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}^t$$

$$B^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$$

$$\left(B^t\right)^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}^t$$

$$\left(B^t\right)^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$$

$$\left(B^t\right)^t = B$$

Hence proved