Exercise 1.2

1. From the following matrices, identify unit matrices, row matrices, column matrices and null matrices.

Ans. $A=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$, Null matrix

$B=\begin{bmatrix}2 & 3 & 4\end{bmatrix}$, Row matrix

$C=\begin{bmatrix}4\\ 0\\ 6\end{bmatrix}$, Column matrix

$D=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, Unit matrix

$E=\begin{bmatrix}0\end{bmatrix}$, Null matrix

$F=\begin{bmatrix}5\\ 6\\ 7\end{bmatrix}$ Column matrix

2. From the following matrices, identify

(a) Square matrices
(b) Rectangular matrices
(c) Row matrices
(d) Column matrices
(e) Identity matrices
(f) Null matrices

Ans. (a) Square Matrices:

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

(iv) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$

(viii) $\begin{bmatrix}1 & 2 & 3\\ -1 & 2 & 0\\ 0 & 0 & 1\end{bmatrix}$

Ans. (b) Rectangular Matrices:

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

(ii) $\begin{bmatrix}3\\ 0\\ 1\end{bmatrix}$

(v) $\begin{bmatrix}1 & 2\\ 3 & 4\\ 5 & 6\end{bmatrix}$

Ans. (c) Row Matrices:

(vi) $\begin{bmatrix}3 & 10 & -1\end{bmatrix}$

Ans. (d) Column Matrices:

(ii) $\begin{bmatrix}3\\ 0\\ 1\end{bmatrix}$

(vii) $\begin{bmatrix}1\\ 0\\ 0\end{bmatrix}$

Ans. (e) Identity Matrices:

(iv) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$

Ans. (f) Null matrices:

(ix) $\begin{bmatrix}0 & 0\\ 0 & 0\\ 0 & 0\end{bmatrix}$

3. From the following matrices, identify diagonal, scalar and unit (identity) matrices.

$$A=\begin{bmatrix}4 & 0\\ 0 & 4\end{bmatrix},$$

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

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

$$D=\begin{bmatrix}3 & 0\\ 0 & 0\end{bmatrix},$$

$$E=\begin{bmatrix}5-3 & 0\\ 0 & 1+1\end{bmatrix}$$

Ans. Scalar matrices:

$$A=\begin{bmatrix}4 & 0\\ 0 & 4\end{bmatrix},\ E=\begin{bmatrix}5-3 & 0\\ 0 & 1+1\end{bmatrix}$$

Unit Matrices:

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

Diagonal Matrices:

$$A=\begin{bmatrix}4 & 0\\ 0 & 4\end{bmatrix},\ B=\begin{bmatrix}2 & 0\\ 0 & -1\end{bmatrix},$$

$$C=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix},D=\begin{bmatrix}3 & 0\\ 0 & 0\end{bmatrix}$$

$$E=\begin{bmatrix}5-3 & 0\\ 0 & 1+1\end{bmatrix}$$

4. Find negative of matrices A, B, C, D and E when:

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

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

$$C=\begin{bmatrix}2 & 6\\ 3 & 2\end{bmatrix},\quad D=\begin{bmatrix}-3 & 2\\ -4 & 5\end{bmatrix},$$

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

Negative of matrices

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

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

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

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

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

5. Find the transpose of each of following matrices:

Ans. (i)

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

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

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

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

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

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

6. Verify that if $A=\begin{bmatrix}1 & 2\\0 & 1\end{bmatrix}$, $B=\begin{bmatrix}1 & 1\\2 & 0\end{bmatrix}$, **then**

(i) $(A^t)^t = A$

(ii) $(B^t)^t = B$

Ans. (i) $\mathbf{(A^t)^t = A}$

L.H.S $= (A^t)^t$

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

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

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

$$(A^t)^t = A = \text{R.H.S.}$$

Hence L.H.S = R.H.S.

Ans. (ii) $\mathbf{(B^t)^t = B}$

L.H.S $= (B^t)^t$

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

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

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

$$(B^t)^t = B$$
$$= \text{R.H.S}$$

Hence L.H.S = R.H.S.