Exercise 1.2

Q. 1: From the following matrices, Identify unit matrices, row matrices, column matrices and null matrices.

$A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 3 & 4 \end{bmatrix}$, $C = \begin{bmatrix} 4 \\ 0 \\ 6 \end{bmatrix}$,

$D = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $E = [0]$, $F = \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$

Solution:

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

As all the elements in A are 0 so the matrix is a null matrix.

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

No of Rows in B = 1

No of Columns in B = 3

As the No. of Rows in B is 1 so the matrix is a row matrix.

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

No. of Rows in C = 3

No. of Columns in C = 1

As the No. of Columns in C is 1 so the matrix is a column matrix.

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

No. of Rows in D = 2

No. of Columns in D = 2

As all the elements of diagonal of D are 1 and other elements are 0

And No. of Rows = No. of Columns

So, D is a unit matrix.

$E = [0]$

As all the elements of the matrix are 0 so matrix E is a null matrix.

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

No. of Rows in F = 3

No. of Columns in F = 1

As the No. of columns in F is 1 so the matrix is a column matrix.

Q. 2: From the following matrices, identify

(a) Square matrices **(b) Rectangular matrices**

(c) Row matrices **(d) Column matrices**

(e) Identity matrices **(f) Null matrices**

(i) $\begin{bmatrix} -8 & 2 & 7 \\ 12 & 0 & 4 \end{bmatrix}$ (ii) $\begin{bmatrix} 3 \\ 0 \\ 1 \end{bmatrix}$ (iii) $\begin{bmatrix} 6 & -4 \\ 3 & -2 \end{bmatrix}$

(iv) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (v) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$ (vi) $\begin{bmatrix} 3 & 10 & -1 \end{bmatrix}$

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

Solution:

(i) No. of Rows = 2
No. of Columns = 3

As No. of Rows ≠ No. of Columns, So the given matrix is a Rectangular Matrix.

(ii) No. of Rows = 3
No. of Columns = 1

As No. of Columns = 1, So the given matrix is a Column matrix.

(iii) No. of Rows = 2
No. of Columns = 2

As No. of Rows = No. of Columns, So the given matrix is a Square Matrix.

(iv) No. of Rows = 2
No. of Columns = 2

As No. of Rows = No. of columns and only one diagonal is 1 and other elements are 0, So Identity Matrix.

(v) No. of Rows = 3
No. of Columns = 2

As No. of Rows ≠ No. of Columns, So the given matrix is a Rectangular Matrix.

(vi) No. of Rows = 1
No. of Columns = 3

As No. of Rows = 1, So the given matrix is a Row matrix.

(vii) No. of Rows = 3
No. of Columns = 1

As No. of Columns = 1, So the given matrix is a Column matrix.

(viii) No. of Rows = 3
No. of Columns = 3

As No. of Rows = No. of Columns, So the given matrix is a Square Matrix.

(ix) As all the elements of the matrix are 0, So the given matrix is a null matrix.

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

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

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

Solution:

Matrix A is a Scalar Matrix, diagonal Matrix.

Matrix B is a diagonal Matrix.

Matrix C is a Identity Matrix, diagonal Matrix.

Matrix D is a diagonal Matrix.

Matrix E is a Scalar Matrix.

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

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

$D = \begin{bmatrix} -3 & 2 \\ -4 & 5 \end{bmatrix}$, $E = \begin{bmatrix} 1 & -5 \\ 2 & 3 \end{bmatrix}$

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

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

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

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

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

Q. 5: Find the transpose of each of the following matrices:

$A = \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix}$, $B = [5 \quad 1 \quad -6]$, $C = \begin{bmatrix} 1 & 2 \\ 2 & -1 \\ 3 & 0 \end{bmatrix}$

$D = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix}$, $E = \begin{bmatrix} 2 & 3 \\ -4 & 5 \end{bmatrix}$, $F = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

Solution:

$A^t = [0 \quad 1 \quad -2]$ $B^t = \begin{bmatrix} 5 \\ 1 \\ -6 \end{bmatrix}$

$C^t = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 0 \end{bmatrix}$ $D^t = \begin{bmatrix} 2 & 0 \\ 3 & 5 \end{bmatrix}$

$E^t = \begin{bmatrix} 2 & -4 \\ 3 & 5 \end{bmatrix}$ $F^t = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$

Q. 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) $(B^t)^t = B$

(i) Solution

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

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

So, L.H.S = R.H.S

(ii) Solution

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

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

So, L.H.S = R.H.S