Exercise 6.4

With the help of the given matrices answer the questions from 1 to 3.

$$A=\begin{bmatrix}2 & -2\\ -5 & 0\end{bmatrix},\ B=\begin{bmatrix}-3 & -2\\ 0 & 4\end{bmatrix},\ C=\begin{bmatrix}3\\ -1\\ 0\end{bmatrix},$$

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

1- What are the orders of matrices A, C and F?

2- What are the orders of matrices B, D and E?

3- What element is in the second row and third column of matrix D?

Answers:

1.(i) (R) Number of rows in matrix A = 2

(C) Number of columns in matrix B = 2

Order of matrix A (R × C) = 2-by-2

(ii) (R) Number of rows in matrix C = 3

(C) Number of columns in matrix C = 1

Order of matrix C(R × C) = 3-by-1

(iii) (R) Number of rows in matrix F = 3

(C) Number of columns in matrix F = 2

Order of matrix F(R × C) = 3-by-2

2.(i) (R) Number of rows in matrix B = 2

(C) Number of columns in matrix B = 2

Order of matrix B(R × C) = 2-by-2

(ii) (R) Number of rows in matrix D = 3

(C) Number of columns in matrix D = 3

Order of matrix D(R × C) = 3-by-3

(iii) (R) Number of rows in matrix E = 1

(C) Number of columns in matrix E = 3

Order of matrix E(R × C) = 1-by-3

3. The element is in the second row and third column of matrix D is 5.

Q.4. Which of the following matrices are equal and which of them are not?

$$A=\begin{bmatrix}4\end{bmatrix},\ B=\begin{bmatrix}1 & 2\end{bmatrix},\ C=\begin{bmatrix}6\\9\end{bmatrix},\ D=\begin{bmatrix}2+2\end{bmatrix},$$

$$E=\begin{bmatrix}3+3\\8+1\end{bmatrix},\ F=\begin{bmatrix}\frac{5}{5} & \frac{4}{2}\end{bmatrix},\ G=\begin{bmatrix}1 & 3\\6 & 8\end{bmatrix},$$

$$H=\begin{bmatrix}1 & 2 & 5\\0 & 3 & 4\\2 & 6 & 3\end{bmatrix},\ I=\begin{bmatrix}1 & 3\\6 & 7\end{bmatrix},\ J=\begin{bmatrix}1 & 3\\6 & \frac{16}{2}\end{bmatrix}$$

$$K = \begin{bmatrix} 1 & 2 & 3+2 \\ 0 & 3 & 4 \\ 2 & 4+2 & 3 \end{bmatrix}, L = \begin{bmatrix} 1 & 3 & 5 \\ 0 & 3 & 4 \\ 2 & 6 & 3 \end{bmatrix}$$

Answers:

(i) B = F, G = J, H = K, C = E, A = D

(ii) *I* and *L* are not equal to any matrix.

TYPES OF MATRICES

(i) Row Matrix:

A matrix with only one row is called a row matrix.

For example: B = [2 3 4] is of order 1 - by - 3.

(ii) Column Matrix:

A matrix with only one column is called a column matrix.

For example: $D = \begin{bmatrix} 3 \\ 2 \\ 7 \end{bmatrix}$ is of order 3 - by - 1.

(iii) Rectangular Matrix:

If in a matrix, the number of rows and the number of columns are not equal, then the matrix is called a rectangular matrix.

For example: $C = \begin{bmatrix} 1 & 2 & 7 \\ 3 & 4 & 5 \end{bmatrix}$

(iv) Square Matrix:

If a matrix has equal number of rows and columns, it is called a square matrix.

For example: $Q = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \\ 3 & 5 & 7 \end{bmatrix}$

(v) Zero or Null Matrix:

If all the elements in a matrix are zeros, it is called a zero matrix or null matrix. A null matrix is denoted by the letter O.

For example: $O = [0]$ is of order 1 - by - 1.

$O = [0 \quad 0]$ is of order 1 - by - 2.

(vi) ***Diagonal Matrix:***

A square matrix in which all the elements except at least the one element in the diagonal are zeros is called a diagonal matrix.

For example: $A = \begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 0 \\ 0 & 3 \end{bmatrix}$

(vii) ***Scalar Matrix:***

A diagonal matrix having equal elements is called a scalar matrix.

For example: $B = \begin{bmatrix} \sqrt{2} & 0 \\ 0 & \sqrt{2} \end{bmatrix}$

(viii) ***Unit Matrix or Identity Matrix:***

A scalar matrix having each element equal to 1 is called a unit or identity matrix. Identity or unit matrix is generally denoted by I.

For example: $I = [1]$ $\qquad$ $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(ix) ***Transpose of a Matrix:***

If A is a matrix of order (m - by - n), then a matrix (n - by - m) obtained by interchanging the rows and columns of A is called the transpose of A. It is denoted by A^t.

For example: $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, *then* $A^t = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$

(x) ***Symmetric Matrix:***

A square matrix A is called symmetric if $A' = A$

For example: $A = \begin{bmatrix} p & q \\ q & r \end{bmatrix}$, *and* $A' = \begin{bmatrix} p & q \\ q & r \end{bmatrix}$

(xi) ***Skew-Symmetric Matrix:***

A square matrix A is called skew symmetric (or anti-symmetric) if $A' = -A$

For example: $A = \begin{bmatrix} 0 & -2 & 3 \\ 2 & 0 & 4 \\ -3 & -4 & 0 \end{bmatrix}$

$$A' = \begin{bmatrix} 0 & 2 & -3 \\ -2 & 0 & -4 \\ 3 & 4 & 0 \end{bmatrix} = -\begin{bmatrix} 0 & -2 & 3 \\ 2 & 0 & 4 \\ -3 & -4 & 0 \end{bmatrix} = -A$$

$A' = -A$ Hence A is skew symmetric.

Exercise (6.2)

1- Identify row matrices, column matrices, square matrices, and rectangular matrices in the following matrices.

$$A = \begin{bmatrix} 3 & 1 & 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 5+2 & 4 \\ 2 & 6 \end{bmatrix}, C = \begin{bmatrix} a+x \\ b+y \end{bmatrix},$$

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

$$G = \begin{bmatrix} 1 & 2 & 4 \\ 5 & 7 & 8 \end{bmatrix}, H = \begin{bmatrix} 0 \end{bmatrix}$$

Solution: