1. Classify the following matrices:

(i)

$$\begin{bmatrix} 2 & 1 \\ 0 & 6 \\ 8 & 7 \end{bmatrix}$$

Solution:-

The order of the given matrix is, 3 × 2.

Therefore, the given matrix is a rectangular matrix of 3 × 2.

(ii) $\begin{bmatrix} 7 & 0 \end{bmatrix}$

Solution:-

The order of the given matrix is, 1 × 2.

Therefore, the given matrix is a rectangular matrix of 1 × 2.

(iii)

$$\begin{bmatrix} 8 & 0 & 0 \\ 5 & 2 & 1 \end{bmatrix}$$

Solution:-

The order of the given matrix is, 2 × 3.

Therefore, the given matrix is a rectangular matrix of 2 × 3.

(iv)

$$\begin{bmatrix} 1 & 1 \\ 0 & 9 \end{bmatrix}$$

Solution:-

The order of the given matrix is, 2 × 2.

Therefore, the given matrix is a square matrix of 2 × 2.

(v)

$$\begin{bmatrix} 1 & 1 & 3 & 0 \\ 2 & 1 & 8 & 4 \\ 1 & 5 & 5 & 2 \end{bmatrix}$$

Solution:-

The order of the given matrix is, 3 × 4.

Therefore, the given matrix is a rectangular matrix of 3 × 4.

2. Find the values of a and b, if [2a + 3b a - b] = [19 2]

Solution:-

From the question,

2a + 3b = 19 … [equation (i)]

a – b = 2 … [equation (ii)]

a = 2 + b

Now, substitute the value of a in equation (i),

2(2 + b) + 3b = 19

4 + 2b + 3b = 19

5b = 19 – 4

5b = 15

b = 15/5

b = 3

Then, a = 2 + b

= 2 + 3

= 5

Therefore, the value of a is 5 and b is 3.

3. Find the values of x and y, if $\begin{bmatrix} 3x - y \\ 5 \end{bmatrix} = \begin{bmatrix} 7 \\ x + y \end{bmatrix}$

Solution:-

Consider the given two matrices,

$$\begin{bmatrix} 3x - y \\ 5 \end{bmatrix} = \begin{bmatrix} 7 \\ x + y \end{bmatrix}$$

The given two matrices are rectangular matrices of 2 × 1.

3x - y = 7 … [equation (i)]

x + y = 5 … [equation (ii)]

x = 5 - y

Now, substitute the value of x in equation (i),

3(5 - y) – y = 7

15 – 3y – y = 7

15 – 4y = 7

15 – 7 = 4y

8 = 4y

y = 8/4

y = 2

Then, x + y = 5

x = 5 – y
x = 5 – 2
x = 3

Therefore, the value of x is 3 and y is 2.

4. Find the values of a, b, c and d, if $\begin{bmatrix} a+3b & 3c+d \\ 2a-b & c-2d \end{bmatrix} = \begin{bmatrix} 5 & 8 \\ 3 & 5 \end{bmatrix}$**.**

Solution:-

From the given matrices,

a + 3b = 5 … [equation (i)]

2a – b = 3 … [equation (ii)]

b = 2a – 3

Now, substitute the value of b in equation (i), we get

a + 3(2a - 3) = 5

a + 6a – 9 = 5

By transposing,

7a = 5 + 9

7a = 14

a = 14/7

a = 2

Again substitute the value of a in equation (i),

2 + 3b = 5

3b = 5 – 2

3b = 3

b = 3/3

b = 1

Then,

3c + d = 8 … [equation (iii)]

c – 2d = 5 … [equation (iv)]

c = 5 + 2d

Now substitute the value of c in equation (iii),

3(5 + 2d) + d = 8

15 + 6d + d = 8

7d = 8 – 15

7d = - 7

d = -7/7

d = -1

substitute the value of d in equation (iv),
c – 2d = 5
c = 5 + 2d
c = 5 + 2(-1)
c = 5 – 2
c = 3

5. If $A = \begin{bmatrix} 12 & 15 \\ 11 & 17 \end{bmatrix}$ $and\ B = \begin{bmatrix} 2 & 7 \\ 4 & 9 \end{bmatrix}$ **find: (i) A + B (ii) 2A + 3B (iii) A – 2B.**

Solution:-

Given two matrices are square matrices of 2 × 2

$$(i)\ A + B = \begin{bmatrix} 12+2 & 15+7 \\ 11+4 & 17+9 \end{bmatrix}$$

$$= \begin{bmatrix} 14 & 22 \\ 15 & 26 \end{bmatrix}$$

(ii) 2A + 3B

$$2A = \begin{bmatrix} 14\times 2 & 22\times 2 \\ 15\times 2 & 26\times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 24 & 30 \\ 22 & 34 \end{bmatrix}$$

$$3B = \begin{bmatrix} 2\times 3 & 7\times 3 \\ 4\times 3 & 9\times 3 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 21 \\ 12 & 27 \end{bmatrix}$$

$$2A + 3B = \begin{bmatrix} 24+6 & 30+21 \\ 22+12 & 34+27 \end{bmatrix}$$

$$= \begin{bmatrix} 30 & 51 \\ 34 & 61 \end{bmatrix}$$

(iii) A – 2B

$$2B = \begin{bmatrix} 2\times 2 & 7\times 2 \\ 4\times 2 & 9\times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 14 \\ 8 & 18 \end{bmatrix}$$

$$A - 2B = \begin{bmatrix} 12-4 & 15-14 \\ 11-8 & 17-18 \end{bmatrix}$$

$$= \begin{bmatrix} 8 & 1 \\ 3 & -1 \end{bmatrix}$$

6. If A = [4 7] and B = [3 1], find: (i) A + 2B (ii) A –B (iii) 2A – 3B

Solution:-

From the question it is given that,

A = $[4\ 7]_{1\times 2}$

B = $[3\ 1]_{1\times 2}$

Then,

(i) A + 2B

2B = [3 × 2 1 × 2]

= [6 2]

So, A + 2B = [4 + 6 7 + 2]

= $[10\ 9]_{1\times 2}$

(ii) A - B

A - B = [4 - 3 7 + 1]

= $[1\ 6]_{1\times 2}$

(iii) 2A - 3B

2A= [4 × 2 7 × 2]

= [8 14]

3B = [3 × 3 1 × 3]

= [9 3]

So, 2A – 3B = [8 - 9 14 - 3]

= $[-1\ 11]_{1\times 2}$

7. If P = $\begin{bmatrix} 2 & 9 \\ 5 & 7 \end{bmatrix}$ and Q = $\begin{bmatrix} 7 & 3 \\ 4 & 1 \end{bmatrix}$ find: (i) 2P + 3Q (ii) 2Q – P (iii) 3P – 2Q.

Solution:-

Given two matrices are square matrices of 2 × 2

Then,

(i) 2P + 3Q

$$2P = \begin{bmatrix} 2 \times 2 & 9 \times 2 \\ 5 \times 2 & 7 \times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 18 \\ 10 & 14 \end{bmatrix}$$

$$3Q = \begin{bmatrix} 7 \times 3 & 3 \times 3 \\ 4 \times 3 & 1 \times 3 \end{bmatrix}$$

$$= \begin{bmatrix} 21 & 9 \\ 12 & 3 \end{bmatrix}$$

$$2P + 3Q = \begin{bmatrix} 4 + 21 & 18 + 9 \\ 10 + 12 & 14 + 3 \end{bmatrix}$$

$$= \begin{bmatrix} 25 & 27 \\ 22 & 17 \end{bmatrix}$$

(ii) 2Q – P

$$2Q = \begin{bmatrix} 7 \times 2 & 3 \times 2 \\ 4 \times 2 & 1 \times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 14 & 6 \\ 8 & 2 \end{bmatrix}$$

Then,

$$2Q - P = \begin{bmatrix} 14 - 2 & 6 - 9 \\ 8 - 5 & 2 - 7 \end{bmatrix}$$

$$= \begin{bmatrix} 12 & -3 \\ 3 & -5 \end{bmatrix}$$

(iii) 3P – 2Q

$$2Q = \begin{bmatrix} 7\times 2 & 3\times 2 \\ 4\times 2 & 1\times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 14 & 6 \\ 8 & 2 \end{bmatrix}$$

$$3P = \begin{bmatrix} 2\times 3 & 9\times 3 \\ 5\times 3 & 7\times 3 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 27 \\ 15 & 21 \end{bmatrix}$$

Then,

$$3P - 2Q = \begin{bmatrix} 6-14 & 27-6 \\ 15-8 & 21-2 \end{bmatrix}$$

$$= \begin{bmatrix} -8 & 21 \\ 7 & 19 \end{bmatrix}$$

8. If $A = \begin{bmatrix} 17 & 5 & 19 \\ 11 & 8 & 13 \end{bmatrix}$ **and** $B = \begin{bmatrix} 9 & 3 & 7 \\ 1 & 6 & 5 \end{bmatrix}$ **find 2A – 3B.**

Solution:-

Given two matrices are rectangular matrices of 2 × 3

Then,

$$2A = \begin{bmatrix} 17\times 2 & 5\times 2 & 19\times 2 \\ 11\times 2 & 8\times 2 & 13\times 2 \end{bmatrix}$$

$$= \begin{bmatrix} 34 & 10 & 38 \\ 22 & 16 & 26 \end{bmatrix}$$

$$3B = \begin{bmatrix} 9\times 3 & 3\times 3 & 7\times 3 \\ 1\times 3 & 6\times 3 & 5\times 3 \end{bmatrix}$$

$$= \begin{bmatrix} 27 & 9 & 21 \\ 3 & 18 & 15 \end{bmatrix}$$

Then,

$$2A - 3B = \begin{bmatrix} 34-27 & 10-9 & 38-21 \\ 22-3 & 16-18 & 26-15 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & 1 & 17 \\ 19 & -2 & 11 \end{bmatrix}$$

9. If $M = \begin{bmatrix} 8 & 3 \\ 9 & 7 \\ 4 & 3 \end{bmatrix}$ **and** $N = \begin{bmatrix} 4 & 7 \\ 5 & 3 \\ 10 & 1 \end{bmatrix}$ **find: (i) M + N (i) M – N**

Solution:-

Given two matrices are rectangular matrices of 3 × 2

Then,

(i)

$$M + N = \begin{bmatrix} 8+4 & 3+7 \\ 9+5 & 7+3 \\ 4+10 & 3+1 \end{bmatrix}$$

$$= \begin{bmatrix} 12 & 10 \\ 14 & 10 \\ 14 & 4 \end{bmatrix}$$

(ii)

$$M - N = \begin{bmatrix} 8-4 & 3-7 \\ 9-5 & 7-3 \\ 4-10 & 3-1 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & -4 \\ 4 & 4 \\ -6 & 2 \end{bmatrix}$$

10. If $A = \begin{bmatrix} 1 & 9 & 4 \\ 5 & 0 & 3 \end{bmatrix}$ **find: (i) negative A (ii) A'**

Solution:-

Given matrix is a rectangular matrix of 2 × 3.

Then,

Transpose of a matrix by switching its rows with its columns

$(i)\ Negative\ A = \begin{bmatrix} -1 & -9 & -4 \\ -5 & -0 & -3 \end{bmatrix}$

(ii) $A^t = \begin{bmatrix} 1 & 5 \\ 9 & 0 \\ 4 & 3 \end{bmatrix}$

11. If $P = \begin{bmatrix} 8 & 5 \\ 7 & 2 \end{bmatrix}$, find: (i) P^t (ii) $P + P^t$ (iii) $P - P^t$

Solution:-

From the question it is given that,

$P = \begin{bmatrix} 8 & 5 \\ 7 & 2 \end{bmatrix}$

Then,

(i) $P^t = \begin{bmatrix} 8 & 7 \\ 5 & 2 \end{bmatrix}$

(ii) $P + P^t = \begin{bmatrix} 8 & 5 \\ 7 & 2 \end{bmatrix} + \begin{bmatrix} 8 & 7 \\ 5 & 2 \end{bmatrix}$

$= \begin{bmatrix} 16 & 12 \\ 12 & 4 \end{bmatrix}$

(iii) $P - P^t = \begin{bmatrix} 8 & 5 \\ 7 & 2 \end{bmatrix} - \begin{bmatrix} 8 & 7 \\ 5 & 2 \end{bmatrix}$

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

12. If B = $\begin{bmatrix} 15 & 13 \\ 11 & 12 \\ 10 & 17 \end{bmatrix}$, find the transpose of matrix B and if possible find the sum of the two matrices. If not possible state the reason.

Solution:-

From the question it is given that,

B = $\begin{bmatrix} 15 & 13 \\ 11 & 12 \\ 10 & 17 \end{bmatrix}$

$B^t = \begin{bmatrix} 15 & 11 & 10 \\ 13 & 12 & 17 \end{bmatrix}$

We cannot add them, because to add two matrices their corresponding number of rows and number of columns should be same. But in the above case B and B^t are not same.

13. If A = $\begin{bmatrix} 5 & r \\ p & 7 \end{bmatrix}$, B = $\begin{bmatrix} q & 4 \\ 3 & s \end{bmatrix}$ and A + B = $\begin{bmatrix} 9 & 7 \\ 5 & 8 \end{bmatrix}$, find the values of p, q, r and s.

Solution:-

From the question it is given that,

A = $\begin{bmatrix} 5 & r \\ p & 7 \end{bmatrix}$, B = $\begin{bmatrix} q & 4 \\ 3 & s \end{bmatrix}$

Now we have to add 2 given matrices,

A + B = $\begin{bmatrix} 5 & r \\ p & 7 \end{bmatrix} + \begin{bmatrix} q & 4 \\ 3 & s \end{bmatrix}$

So, A + B = $\begin{bmatrix} 5+q & r+4 \\ p+3 & 7+s \end{bmatrix}$ ... [1]

But it is given in the question, A + B = $\begin{bmatrix} 9 & 7 \\ 5 & 8 \end{bmatrix}$ ... [2]

From [1] and [2] we get,

$\begin{bmatrix} 5+q & r+4 \\ p+3 & 7+s \end{bmatrix} = \begin{bmatrix} 9 & 7 \\ 5 & 8 \end{bmatrix}$

Then,

5 + q = 9

q = 9 – 5

q = 4

r + 4 = 7

r = 7 – 4

r = 3

p + 3 = 5

p = 5 – 3

p = 2

7 + s = 8

s = 8 – 7

s = 1

14. If A = $\begin{bmatrix} p & q \\ 8 & 5 \end{bmatrix}$, B = $\begin{bmatrix} 3p & 5q \\ 2q & 7 \end{bmatrix}$ and A + B = $\begin{bmatrix} 12 & 6 \\ 2r & 3s \end{bmatrix}$, find the values of p, q, r and s.

Solution:-

From the question it is given that,

A = $\begin{bmatrix} p & q \\ 8 & 5 \end{bmatrix}$, B = $\begin{bmatrix} 3p & 5q \\ 2q & 7 \end{bmatrix}$

Now we have to add 2 given matrices,

A + B = $\begin{bmatrix} p+3p & q+5q \\ 8+2q & 5+7 \end{bmatrix}$

So, A + B = $\begin{bmatrix} 4p & 6q \\ 8+2q & 12 \end{bmatrix}$ ... [1]

But it is given in the question, A + B = $\begin{bmatrix} 12 & 6 \\ 2r & 3s \end{bmatrix}$ ... [2]

From [1] and [2] we get,

$\begin{bmatrix} 4p & 6q \\ 8+2q & 12 \end{bmatrix} = \begin{bmatrix} 12 & 6 \\ 2r & 3s \end{bmatrix}$

Then,

4p = 12

p = 12/4

p = 3

6q = 6

q = 6/6

q = 1

8 + 2q = 2r

8 + 2(1) = 2r

8 + 2 = 2r

r = 10/2

r = 5

12 = 3s

s = 12/3

s = 4

15. If $\begin{bmatrix} 2a+b & c \\ d & 3a-b \end{bmatrix} = \begin{bmatrix} 4 & 3a \\ 7 & 6 \end{bmatrix}$, find the values of a, b, c and d.

Solution:-

From the question it is given that,

$\begin{bmatrix} 2a+b & c \\ d & 3a-b \end{bmatrix} = \begin{bmatrix} 4 & 3a \\ 7 & 6 \end{bmatrix}$

Then,

2a + b = 4 … [equation (i)]

3a – b = 6 … [equation (ii)]

Now we have to add both equation (i) and equation (ii) we get,

5a = 10

a = 10/5

a = 2

substitute the value of a in equation (i)we get,

2(2) + b = 4

4 + b = 4

b = 0

Then,

c = 3a

c = 3(2)

c = 6

d = 7