MATRICES

Ex.3.1

Q1. **In the matrix** $A = \begin{bmatrix} 2 & 5 & 19 & -7 \\ 35 & -2 & \frac{5}{2} & 12 \\ \sqrt{3} & 1 & -5 & 17 \end{bmatrix}$

A.1.(*i*) Order of *a* matrix '$m \times n$' is the no. of rows, m and no. of column, n
So, order of *a*matrix A = 3×4.

(*ii*) a_{13} = element of 1st row and 3rd column = 19
a_{21} = elementof 2nd now and 1stcolumn = 35
a_{33} =element of 3rd row & 3rdcolumn = – 5
a_{29} = element of 2rd row & 4th column = 12
a_{23} = element of2nd row & 3rd column = $\frac{5}{2}$

Q2. **If a matrix has 24 elements, what are the possible orders it can have? What, if it has 13 elements?**

A.2. As, number of elements of matrix having order $m \times n = m \cdot n$.
(b) So, (possible) order of matrix with 24 elements are (1 × 24), (2 × 12), (3 × 8), (4 × 6), (6 × 4), (8 × 3), (12 × 2), 24 × 1).
Similarly, possible order of matrix with 13 elements are (1 × 13) and (13 × 1)

Q3. **If a matrix has 18 elements, what are the possible orders it can have? What, if it has 5 elements?**

A.3. As number of elements of matrix with order m × n
(E) Possible order of matrix with 18 elements are (1 × 18), (2 × 9), (3 × 6), (6 × 3), (9 × 2) and (18 × 1)
Similarly, possible order of matrix with 5 elements are (1 × 5) and (5 × 1)

Q4. **Construct a 2 × 2 matrix,** $A = \left[a_{ij}\right]$**, whose elements are given by:**

(i) $a_{ij} = \frac{(i+j)^2}{2}$ **(ii)** $a_{ij} = \frac{i}{j}$ **(iii)** $a_{ij} = \frac{(i+2j)^2}{2}$

A.4. (E) (i) $a^{ij} \frac{(i+j)^2}{2}$ such that i = 1, 2 and j = 1 × 2 for 2 × 2 matrix

Therefore $a_{11} = \frac{(1+1)^2}{2} = \frac{2^2}{2} = 2$ $\therefore A_{2\times2} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

$a_{12} = \frac{(1+2)^2}{2} = \frac{3^2}{2} = \frac{9}{2}$

$a_{21} \frac{(2+1)^2}{2} = \frac{3^2}{2} = \frac{9}{2}$ $\begin{bmatrix} 2 & 9/2 \\ 9/2 & 8 \end{bmatrix}$

$a_{22} = \frac{(2+2)^2}{2} = \frac{4^2}{2} = \frac{16}{2} = 8$

(*ii*) $a^{ij} = \frac{i}{j}$ such that $i = 1, 2$ and $j = 1, 2$ for 2×2 matrix

Therefore $a_{11}\ \frac{1}{1} = 1 = 1$

$a_{12} = \frac{1}{2} = 2$

$a_{21} = \frac{2}{1} = 2$

$a_{22} = \frac{2}{2} = 1$

$\therefore A_{2\times2} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

$= \begin{bmatrix} 1 & 1/2 \\ 2 & 1 \end{bmatrix}$

(*iii*) $a^{ij} = \frac{(i+2j)^2}{2}$ such that $i = 1, 2$ and $j = 1, 2$ for 2×2 matrix

Therefore $a_{11} = \frac{(1+2.1)^2}{2} = \frac{(1+2)^2}{2} = \frac{3^2}{2} = \frac{9}{2}$

$a_{12} = \frac{(1+2.2)^2}{2} = \frac{(1+4)^2}{2} = \frac{5^2}{2} = \frac{25}{2}$

$a_{21} = \frac{(2+2.1)^2}{2} = \frac{4^2}{2} = \frac{16}{2} = 8$

$a_{22} = \frac{(2+2.2)^2}{2} = \frac{(2+4)^2}{2} = \frac{6^2}{2} = \frac{36}{2} = 18.$

$\therefore A_{2\times2} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} = \begin{bmatrix} 9/2 & 25/2 \\ 8 & 18 \end{bmatrix}$

Q5. Construct a 3 × 4 matrix, whose elements are given by:

(i) $a_{ij} = \frac{1}{2}|-3i + j|$ **(ii)** $a_{ij} = 2i - j$

A.5. (E) (*i*) $a^{ij} = \frac{1}{2}\ |-3i + j|$ such that $i = 1, 2, 3$ and $j = 1, 2, 3, 4$ for 3×4 matrix

So, $a_{11} = \frac{1}{2}.|-3.1+1| = \frac{1}{2}|-3+1| = \frac{1}{2}|-3+1| = \frac{1}{2}|-2| = \frac{2}{2} = 1.$

$a_{12} = \frac{1}{2}|-3.1+2| = \frac{1}{2}|-1| = \frac{1}{2}$

$a_{13} = \frac{1}{2}|-3.1+3| = \frac{1}{2}\times 0 = 0$

$a_{14} = \frac{1}{2}|-3.1+4| = \frac{1}{2}|1| = \frac{1}{2}$

$a_{21} = \frac{1}{2}|-3.2+1| = \frac{1}{2}|-6+1| = \frac{1}{2}|5| = \frac{5}{2}$

$a_{22} = \frac{1}{2}|-3.2+2| = \frac{1}{2}|-6+2| = \frac{1}{2}|-4| = \frac{4}{2} = 2$

$$a_{23} = \frac{1}{2}|-3.2+3| = \frac{1}{2}|-6+3| = \frac{1}{2}|-3| = \frac{3}{2}$$

$$a_{24} = \frac{1}{2}|-3\cdot 2+4| = \frac{1}{2}|-6+4| = \frac{1}{2}+4|-2| = \frac{2}{2} = 1$$

$$a_{31} = \frac{1}{2}|-3\cdot 3+1| = \frac{1}{2}|-0+1| = \frac{1}{2}|-8| = \frac{8}{2} = 4.$$

$$a_{32} = \frac{1}{2}|-3\cdot 2+2| = \frac{1}{2}|-9+2| = -\frac{7}{2} = \frac{7}{2}$$

$$a_{33} = \frac{1}{2}|-3\cdot 3+3| = \frac{1}{2}|-9+3| = \frac{|-6|}{2} = \frac{6}{2} = 3$$

$$a_{34} = \frac{1}{2}|-3\cdot 3+4| = \frac{1}{2}|-9+4| = \frac{|5|}{2} = \frac{5}{2}.$$

$$\therefore a_{3\times 4} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \end{bmatrix} = \begin{bmatrix} 1 & 1/2 & 0 & 1/2 \\ 5/2 & 2 & 3/2 & 1 \\ 4 & 7/2 & 3 & 5/2 \end{bmatrix}$$

(ii) aij = 2i–j such that $i = 1,2,3$ and j = 1,2,3,4, for 3 × 4matrix

So.a_{11} = 2.1 –1 = 2–1 = 1

a_{12} = 2.1 –2 = 2–2 = 0

a_{13} = 2.1 – 2 = 2–3 = 1

a_{14} = 2.1 – 4 = 2–4 = –2

a_{21} = 2.2 –1 = 4–1 = 3

a_{22} = 2.2 –2 = 4–2 = 2

a_{23} = 2.2 –3 = 4–3 = 1

a_{24} = 2.2 –4 = 4–4 = 0

a_{31} = 2,3–1 = 6–1 = 5

a_{32} = 2.3 –2 = 6–2 = 4

$a_{33} = 2\cdot 3 - 3 = 6 - 3 = 3$

a_{34} = 2.3 –4 = 6–4 = 2

$$a_{2\times 2} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1 & -2 \\ 3 & 2 & 1 & 0 \\ 5 & 4 & 3 & 2 \end{bmatrix}.$$

Q6. Find the values of x, y and z from the following equations:

(i) $\begin{bmatrix} 4 & 3 \\ x & 5 \end{bmatrix} = \begin{bmatrix} y & z \\ 1 & 5 \end{bmatrix}$ **(ii)** $\begin{bmatrix} x+y & 2 \\ 5+z & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$ **(iii)** $\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$

A.6. (i) $\begin{bmatrix} 4 & 3 \\ x & 5 \end{bmatrix} = \begin{bmatrix} y & z \\ 1 & 5 \end{bmatrix}$

corresponding

By equating the elements of the matrices, we get,

x= 1

y= 4

z= 3.

(ii) $\begin{bmatrix} x+y & 2 \\ 5+z & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$

By equating the corresponding elements of the matrices we get,

$x + y = 6$ —— (I)

$5 + Z = 5 \Rightarrow \quad z = 5 - 5 \Rightarrow \quad z = 0$

$xy = 8$

$\Rightarrow x = \frac{8}{y} \quad \rightarrow (2)$

putting $\text{eq}^n(2)$ in (1) we get

$\frac{8}{y} + y = 6.$

$\Rightarrow 8 + y^2 = 6y$

$\Rightarrow y^2 - 6y + 8 = 0.$

$\Rightarrow y^2 - 4y - 2y + 8 = 0$

$\Rightarrow y(y-4) - 2(y-4) = 0$

$\Rightarrow (y-4)(y-2) = 0$

$\Rightarrow y = 4$ 0r $y = 2$.

When $y = 4, x = 6 - y = 6 - 4 =$ and z = 0.

When $y = 2, x = 6 - y = 6 - 2 = 4$ and z = 0.

(ii) $\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}.$

By equating the corresponding elements of the matrices we get,

$x + y + z = 9$ —— (i)

$x + z = 7$ —— (ii)

$y + z = 7$ ——(iii)

Subtracting eq^n (3) from (1) and (2) from (1) we get,

$x + y + z - y - z = 9 - 7$ and $x + y + z - x - z = 9 - 5$

$\Rightarrow x = 2$ and $y = 4$.

Putting $x = 2$ in eq^n (2)

$2 + z = 5$

$\Rightarrow z = 5 - 2 = 3.$

So, $x = 2, y = 4, z = 3.$

Q7. Find the value of *a, b, c* and *d* from the equation:

$$\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$$

A.7. $\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$

(5) Equating the corresponding elements of the matrices we get,

$a - b = -1$ ——(i)

$2a + c = 5$ ——(2)

$2a - b = 0$ ——(3)

$3c + d = 13$ ——(4)

Subtracting eq^n(1) from (3) we get,
$2a-b-(a-b)=0-(-1)$
$2a-b-a+b=0+1=1$
$\Rightarrow [a=1]$
Put $a=1$ in $eq^n(2)$ we get,
$2\times 1+c=5 \Rightarrow c=5-2 \Rightarrow [c=3]$
Put $c=3$ in q^n (4) we get,
$3\times 3+d=13 \Rightarrow d=13-9 \Rightarrow [d=4.]$
put $a=1$ in $q^2(1)$ we get, $1-b=-1 \Rightarrow b=1+1 \Rightarrow [b=2]$

Q8. **A=$\left[a_{ij}\right]_{mxn\backslash}$ is a square matrix, if**

(A) m <n **(B) m > n** **(C) m = n** **(D) None of these**

A.8. $=\left[a_{ij}\right]_{m\times n}$ is a square matrix if $m=n$
(E) Option C is correct.

Q9. **Which of the given values of x and y make the following pair of matrices equal:**

$$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}, \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$$

(A) $x=\frac{-1}{3}, y=7$ **(B) Not possible to find** **(C)** $y=7, x=\frac{-2}{3}$

(D) $x=\frac{-1}{3}, y=\frac{-2}{3}$

A.9. For the matrices to be equal, the corresponding elements
(B) heed to be equal so,
For a_{11}, $3x+7=0$
$\Rightarrow 3x=-7.$
$\Rightarrow x=-\frac{7}{3}$
for a_{12}, $5=y-2$
$\Rightarrow y=+5+2=7.$
For a_{21}, $y+1=8$
$\Rightarrow y=8-1=7.$
for a_{22}, $2-3x=4.$
$\Rightarrow 3x=2-4$
$\Rightarrow x=-\frac{2}{3}$
As the variable x and y has more than one value which is not peacetable.
Option B is correct.

Q10. **The number of all possible matrices of order 3 × 3 with each entry 0 or 1 is:**
(A) 27 **(B) 18** **(C) 81** **(D) 512**

A.10 . A 3 × 3 order matrix will have 9 elements
(M) Since, the elements can be either 1 or 0il, number of choices for each element is 2 .

The required no. of arrangement = 29(4,2 × 2 × 2 9 times) $\Rightarrow$ 512
So, option D is correct.