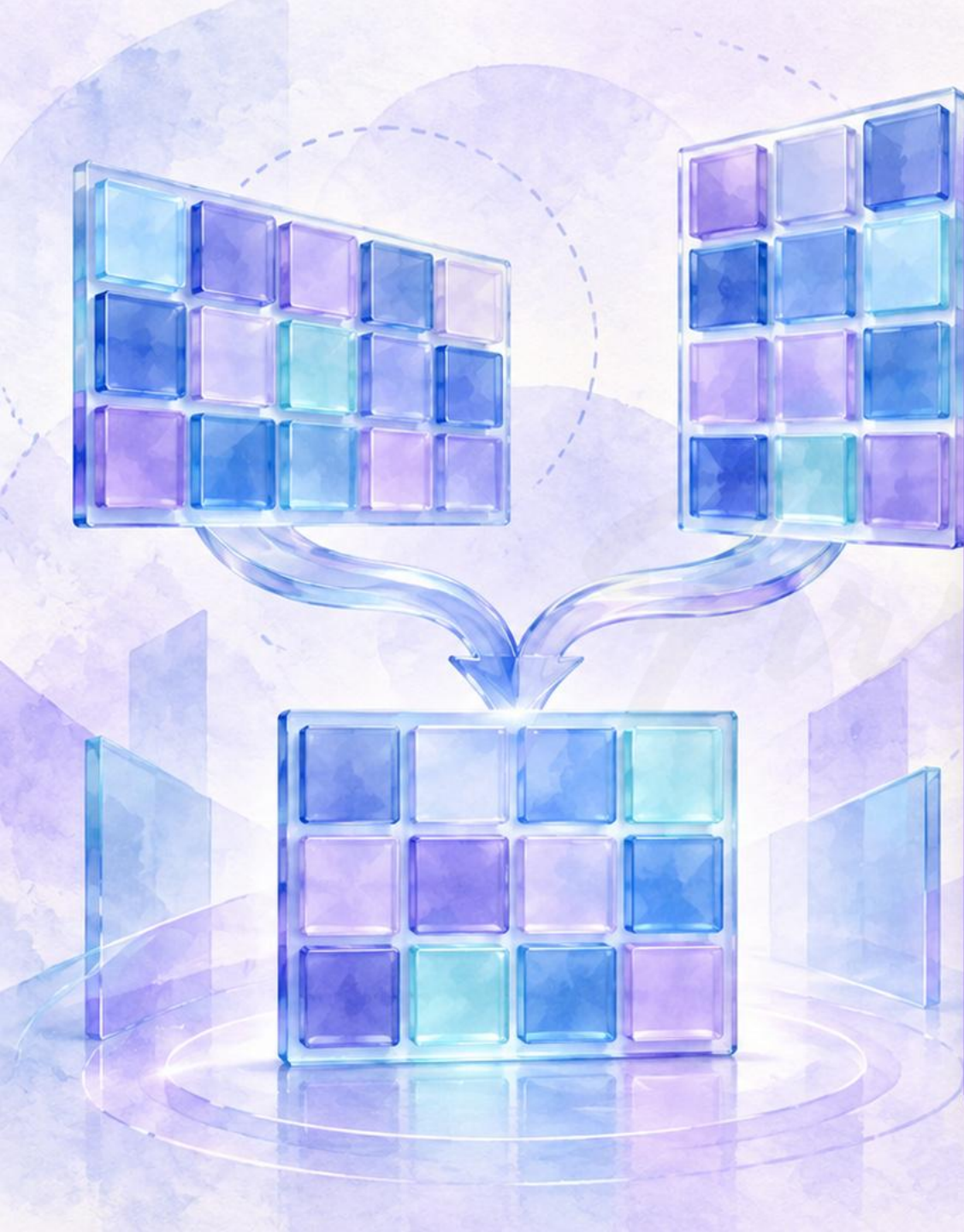




MATHEMATICS • CLASS 12

3

CHAPTER

Matrices

NCERT SOLUTIONS

ORDER AND ENTRIES – EXERCISE 3.1 Q1

Q. In $A = \begin{bmatrix} 2 & 5 & 19 & -7 \\ 35 & -2 & 5/2 & 12 \\ \sqrt{3} & 1 & -5 & 17 \end{bmatrix}$, write (i) the order, (ii) the number of elements, (iii) a_{13} , a_{21} , a_{33} , a_{24} and a_{23} .

Answer:

Count rows and columns

The matrix has three rows and four columns.

Order = 3×4 .

Count the entries

Number of elements = number of rows $\times$ number of columns.

Number of elements = $3 \times 4 = 12$.

Read the specified positions

The first subscript gives the row; the second gives the column.

$$a_{13} = 19, \quad a_{21} = 35, \quad a_{33} = -5.$$

$$a_{24} = 12, \quad a_{23} = \frac{5}{2}.$$

Hence, Order 3×4 ; twelve entries; 19, 35, -5 , 12, $\frac{5}{2}$.

POSSIBLE MATRIX ORDERS – EXERCISE 3.1 Q2

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

Answer:

Use the entry count

For any matrix, the entry count is the product of its row and column counts.

$$mn = 24.$$

Here m and n are positive integers, since a matrix must have a positive number of rows and columns.

List all factor pairs

The factor pairs of 24 are

$$24 = 1 \times 24 = 2 \times 12 = 3 \times 8 = 4 \times 6.$$

Include the reverse orders as well, since $m \times n$ and $n \times m$ both give 24.

Orders: 1×24 , 2×12 , 3×8 , 4×6 , 6×4 , 8×3 , 12×2 , 24×1 .

Use the prime entry count

The second number is prime.

$$13 = 1 \times 13 = 13 \times 1.$$

Since 13 has only two positive factors, the only possible orders are

$$1 \times 13 \text{ and } 13 \times 1.$$

Hence, for 24 entries: 1×24 , 2×12 , 3×8 , 4×6 , 6×4 , 8×3 , 12×2 , 24×1 .

For 13 entries: 1×13 and 13×1 .

FACTOR PAIRS AND MATRIX ORDER – EXERCISE 3.1 Q3

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

Answer:

Use the entry count

$$mn = 18.$$

The row and column counts must be positive integer factors.

List every factor pair

$$18 = 1 \times 18 = 2 \times 9 = 3 \times 6.$$

Each factor pair (a, b) gives an order $a \times b$, and the reversed pair (b, a) also gives a valid order since m and n can be interchanged.

Orders: 1×18 , 2×9 , 3×6 , 6×3 , 9×2 , 18×1 .

Consider the prime count

$$mn = 5.$$

Since 5 is a prime number, its only positive integer factors are 1 and 5.

The only factor pairs give the following orders.

$$5 = 1 \times 5.$$

Thus the possible orders are 1×5 and 5×1 . There are no other orders because 5 has no other positive factors.

Hence, For 18 entries: 1×18 , 2×9 , 3×6 , 6×3 , 9×2 , 18×1 .

For 5 entries: 1×5 and 5×1 .

CONSTRUCTING TWO BY TWO MATRICES — EXERCISE 3.1 Q4

Q. Construct a 2×2 matrix $A = [a_{ij}]$ whose elements are (i) $a_{ij} = \frac{(i+j)^2}{2}$; (ii) $a_{ij} = \frac{i}{j}$; (iii) $a_{ij} = \frac{(i+2j)^2}{2}$.

Answer:

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

Substitute the row and column indices $i, j \in \{1, 2\}$.

$$a_{11} = \frac{(1+1)^2}{2} = \frac{4}{2} = 2$$

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

$$a_{21} = \frac{(2+1)^2}{2} = \frac{9}{2}$$

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

Place each entry in its position

$$\text{Hence, } A = \begin{bmatrix} 2 & \frac{9}{2} \\ \frac{9}{2} & 8 \end{bmatrix}$$

(ii) $a_{ij} = \frac{i}{j}$

Substitute the row and column indices $i, j \in \{1, 2\}$.

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

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

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

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

Place each entry in its position

$$\text{Hence, } A = \begin{bmatrix} 1 & \frac{1}{2} \\ 2 & 1 \end{bmatrix}$$

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

Substitute the row and column indices $i, j \in \{1, 2\}$.

$$a_{11} = \frac{(1+2 \times 1)^2}{2} = \frac{9}{2}$$

$$a_{12} = \frac{(1+2 \times 2)^2}{2} = \frac{25}{2}$$

$$a_{21} = \frac{(2+2 \times 1)^2}{2} = \frac{16}{2} = 8$$

$$a_{22} = \frac{(2+2 \times 2)^2}{2} = \frac{36}{2} = 18$$

Place each entry in its position

$$\text{Hence, } A = \begin{bmatrix} \frac{9}{2} & \frac{25}{2} \\ 8 & 18 \end{bmatrix}$$



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