EXERCISE 3.1

1. Write the number of rows and number of columns in each matrix.

$$A=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix},\qquad B=\begin{bmatrix}3\\ 4\\ 7\end{bmatrix},\qquad C=\begin{bmatrix}8 & -10 & 11\end{bmatrix},$$

$$D=\begin{bmatrix}3 & 2 & 1\\ 1 & 0 & 3\\ 4 & 5 & 6\end{bmatrix},\qquad E=\begin{bmatrix}5 & 9 & -2\\ -3 & 4 & 5\end{bmatrix}$$

2. Write the order of each matrix.

$$A=\begin{bmatrix}1\\ 0\end{bmatrix},\ B=\begin{bmatrix}3 & 4\end{bmatrix},\ C=\begin{bmatrix}3 & 5\\ 5 & 6\end{bmatrix},\ D=\begin{bmatrix}0 & 3 & 4\\ 5 & 0 & 9\end{bmatrix},\ E=\begin{bmatrix}0 & 1\\ 3 & 4\\ 5 & 6\end{bmatrix},\ F=\begin{bmatrix}5\end{bmatrix}$$

3. Which of the following matrices are equal?

$$A=\begin{bmatrix}0 & 3\\ 4 & 1\end{bmatrix},\qquad B=\begin{bmatrix}9\\ -7\end{bmatrix},\qquad C=\begin{bmatrix}2\times 3 & 2-1\\ 2\times 2 & 4-2\\ 4+4 & 3+0\end{bmatrix},$$

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

4. If $\begin{bmatrix}a+2 & c-3\\ b-1 & d+4\end{bmatrix}=\begin{bmatrix}5 & 8\\ 6 & 4\end{bmatrix}$, then find the values of a, b, c and d.

5. If $\begin{bmatrix}2x+1 & 4\\ 7 & 5\end{bmatrix}=\begin{bmatrix}9 & 4\\ 7 & y\end{bmatrix}$, then find the values of x and y.

6. If $\begin{bmatrix}a+b & 2d-1\\ 3b+2 & 4\end{bmatrix}=\begin{bmatrix}10 & 5\\ 11 & c\end{bmatrix}$, then find the values of a, b, c and d.

7. If $\begin{bmatrix}p+q & 5\\ 11 & p-2q\end{bmatrix}=\begin{bmatrix}6 & 5\\ 11 & 0\end{bmatrix}$, then find the values of p and q.

EXERCISE 3.1 - MATRICES

Complete Step-by-Step Solutions

Question 1: Number of Rows and Columns

Matrix A:

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

- Rows: 2
- Columns: 2

Answer: 2×2

Matrix B:

$$B = \begin{bmatrix} 3 \\ 4 \\ 7 \end{bmatrix}$$

- Rows: 3
- Columns: 1

Answer: 3×1

Matrix C:

$$C = \begin{bmatrix} 8 & -10 & 11 \end{bmatrix}$$

- Rows: 1
- Columns: 3

Answer: 1×3

Matrix D:

$$D = \begin{bmatrix} 3 & 2 & 1 \\ 1 & 0 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

- Rows: 3
- Columns: 3

Answer: 3×3

Matrix E:

$$E = \begin{bmatrix} 5 & 9 & -2 \\ -3 & 4 & 5 \end{bmatrix}$$

- Rows: 2
- Columns: 3

Answer: 2×3

Question 2: Order of Each Matrix

Matrix A:

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

- Rows: 2, Columns: 1

Answer: 2×1

Matrix B:

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

- Rows: 1, Columns: 2

Answer: 1×2

Matrix C:

$$C = \begin{bmatrix} 3 & 5 \\ 5 & 6 \end{bmatrix}$$

- Rows: 2, Columns: 2

Answer: 2×2

Matrix D:

$$D = \begin{bmatrix} 0 & 3 & 4 \\ 5 & 0 & 9 \end{bmatrix}$$

- Rows: 2, Columns: 3

Answer: 2×3

Matrix E:

$$E = \begin{bmatrix} 0 & 1 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$$

- Rows: 3, Columns: 2

Answer: 3×2

Matrix F:

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

- Rows: 1, Columns: 1

Answer: 1×1

Question 3: Which Matrices are Equal?

Given Matrices:

$$A = \begin{bmatrix} 0 & 3 \\ 4 & 1 \end{bmatrix} B = \begin{bmatrix} 9 \\ -7 \end{bmatrix} C = \begin{bmatrix} 2 \times 3 & 2 & -1 \\ 2 \times 2 & 4 & -2 \\ 4 & 4 & 3+0 \end{bmatrix} D = \begin{bmatrix} 5 & 4 \\ -8 & 1 \end{bmatrix} E = \begin{bmatrix} 6 & 1 \\ 4 & 2 \\ 8 & 3 \end{bmatrix} F = \begin{bmatrix} 3 & -3 & 3 \\ 3 & +1 & 1 \end{bmatrix}$$

Step 1: Simplify matrix C

- $2 \times 3 = 6$
- $2 \times 2 = 4$
- $3 + 0 = 3$

$$C = \begin{bmatrix} 6 & 2 & -1 \\ 4 & 4 & -2 \\ 4 & 4 & 3 \end{bmatrix}$$

- Order: 3×3

Step 2: Simplify matrix F

- $3 + 1 = 4$

$$F = \begin{bmatrix} 3 & -3 & 3 \\ 4 & 1 & 1 \end{bmatrix}$$

- Order: 2×3

Step 3: Compare orders first

Matrix	Order
A	2×2
B	2×1
C	3×3
D	2×2
E	3×2
F	2×3

Step 4: Equal matrices must have same order and corresponding entries equal

- A and D both have order 2×2
- Compare A and D:

$$A = \begin{bmatrix} 0 & 3 \\ 4 & 1 \end{bmatrix}, D = \begin{bmatrix} 5 & 4 \\ -8 & 1 \end{bmatrix}$$

Not equal

Answer: No two matrices are equal

Question 4: Find a, b, c, d

Given:

$$\begin{bmatrix} a+2 & c-3 \\ b-1 & d+4 \end{bmatrix} = \begin{bmatrix} 5 & 8 \\ 6 & 4 \end{bmatrix}$$

Step 1: Equate corresponding entries

$$a + 2 = 5 c - 3 = 8 b - 1 = 6 d + 4 = 4$$

Step 2: Solve each equation

- $a + 2 = 5 \rightarrow a = 3$
- $c - 3 = 8 \rightarrow c = 11$
- $b - 1 = 6 \rightarrow b = 7$
- $d + 4 = 4 \rightarrow d = 0$

Answer: $a = 3, b = 7, c = 11, d = 0$

Summary Table

1(A)	2×2
1(B)	3×1
1(C)	1×3
1(D)	3×3
1(E)	2×3
2(A)	2×1
2(B)	1×2
2(C)	2×2
2(D)	2×3
2(E)	3×2
2(F)	1×1
3	No two matrices are equal
4	$a = 3, b = 7, c = 11, d = 0$

Key Concepts

1. **Order of a Matrix:** $m \times n$ where m = number of rows, n = number of columns
2. **Equal Matrices:** Two matrices are equal if:
   - They have the same order
   - Their corresponding entries are equal
3. **Types of Matrices:**
   - **Column Matrix:** $m \times 1$ (one column)
   - **Row Matrix:** $1 \times n$ (one row)
   - **Square Matrix:** $m = n$ (same number of rows and columns)

EXERCISE 3.1 - MATRICES (Continued)

Complete Step-by-Step Solutions

Question 5: Find x and y

Given:

$$\begin{bmatrix} 2x+1 & 4 \\ 7 & 5 \end{bmatrix} = \begin{bmatrix} 9 & 4 \\ 7 & y \end{bmatrix}$$

Step 1: Equate corresponding entries

- $2x + 1 = 9$ ... (1)
- $4 = 4$ (already equal)
- $7 = 7$ (already equal)
- $5 = y$ ... (2)

Step 2: Solve equation (1)

$$2x + 1 = 92x = 8x = 4$$

Step 3: From equation (2)

$$y = 5$$

Answer: $x = 4, y = 5$

Question 6: Find a, b, c, d

Given:

$$\begin{bmatrix} a+b & 2d-1 \\ 3b+2 & 4 \end{bmatrix} = \begin{bmatrix} 10 & 5 \\ 11 & c \end{bmatrix}$$

Step 1: Equate corresponding entries

- $a + b = 10$ ... (1)
- $2d - 1 = 5$ ... (2)
- $3b + 2 = 11$ ... (3)
- $4 = c$ ... (4)

Step 2: Solve equation (2)

$$2d - 1 = 52d = 6d = 3$$

Step 3: Solve equation (3)

$$3b + 2 = 113b = 9b = 3$$

Step 4: Solve equation (1)

$$a + b = 10a + 3 = 10a = 7$$

Step 5: From equation (4)

$$c = 4$$

Answer: $a = 7, b = 3, c = 4, d = 3$

Question 7: Find p and q

Given:

$$\begin{bmatrix} p+q & 5 \\ 11 & p-2q \end{bmatrix} = \begin{bmatrix} 6 & 5 \\ 11 & 0 \end{bmatrix}$$

Step 1: Equate corresponding entries

- $p + q = 6$ ... (1)
- $5 = 5$ (already equal)
- $11 = 11$ (already equal)
- $p - 2q = 0$ ... (2)

Step 2: From equation (2)

$$p = 2q$$

Step 3: Substitute $p = 2q$ in equation (1)

$$2q + q = 63q = 6q = 2$$

Step 4: Find p

$$p = 2q = 2(2) = 4$$

Answer: $p = 4, q = 2$

Summary Table

	Given	
5	$\begin{bmatrix} 2x+1 & 4 \\ 7 & 5 \end{bmatrix} = \begin{bmatrix} 9 & 4 \\ 7 & y \end{bmatrix}$	$x = 4, y = 5$
6	$\begin{bmatrix} a+b & 2d-1 \\ 3b+2 & 4 \end{bmatrix} = \begin{bmatrix} 10 & 5 \\ 11 & c \end{bmatrix}$	$a = 7, b = 3, c = 4, d = 3$
7	$\begin{bmatrix} p+q & 5 \\ 11 & p-2q \end{bmatrix} = \begin{bmatrix} 6 & 5 \\ 11 & 0 \end{bmatrix}$	$p = 4, q = 2$

Key Concept: Matrix Equality

Two matrices are equal if and only if:

1. **Same order** (same number of rows and columns)
2. **Corresponding entries** are equal

This allows us to set up equations and solve for unknown variables.