

CHAPTER-1 RELATIONS AND FUNCTIONS

(MULTIPLE CHOICE QUESTIONS)

- Let S be a relation on the set $\mathbf{R}$ of all real numbers and it is given by $(a, b) \in S \Leftrightarrow ab \geq 0$, then S is
(a) Symmetric and transitive only (b) Reflexive and symmetric
(c) Transitive and reflexive only (d) Equivalence.
- In the set $\mathbf{Z}$ of all integers, which of the following relation R is not an equivalence relation?
(a) $xRy \Leftrightarrow x \leq y$ (b) $xRy \Leftrightarrow x = y$
(c) $xRy \Leftrightarrow x - y$ is an even integer (d) $xRy \Leftrightarrow |x - y|$ is multiple of 3
- Let $A = \{1, 2, 3\}$, then number of relations on A containing $(1, 2)$ and $(1, 3)$ which are reflexive and symmetric but not transitive
(a) 1 (b) 2 (c) 3 (d) 4
- If $R = \{(x, y) : x, y \in \mathbf{Z}, x^2 + y^2 \leq 4\}$ is a relation in the **set of integers** then domain of R is
(a) $\{0, 1, 2\}$ (b) $\{-2, -1, 0\}$
(c) $\{-2, -1, 0, 1, 2\}$ (d) none of these
- The function $f: [-1, 1] \rightarrow [-1, 1]$ be a function given by $f(x) = x|x|$ then f is
(a) one-one but not onto (b) onto but not one-one
(c) one-one and onto (d) neither one-one nor onto

VERY SHORT ANSWER TYPE (2MARKS)

- If $f: \mathbf{R} \rightarrow \mathbf{R}$ is the function defined by $f(x) = 4x^3 + 7$, then show that f is a bijection.
- Show that the function $f: \mathbf{R} \rightarrow \mathbf{R}$ defined by $f(x) = \frac{x}{x^2+1}$, $\forall x \in \mathbf{R}$ is neither one-one nor onto.
- Show that the relation R on the **set $\mathbf{Z}$ of all integers** defined by $(x, y) \in R \Leftrightarrow (x - y)$ is divisible by 5 is an equivalence relation.

HIGHER ORDER THINKING SKILL (HOTS) QUESTIONS

- Let $\mathbf{N}$ denotes the set of all natural numbers and R be the relation on $\mathbf{N} \times \mathbf{N}$ defined by $(a, b) R (c, d)$ if $ad(b + c) = bc(a + d)$. Prove that R is an equivalence relation.
- Let A and B be two sets. Show that $f: A \times B \rightarrow B \times A$ defined by $f(a, b) = (b, a)$ is a bijection.
- Let a relation R on the set $\mathbf{R}$ of real numbers be defined as $R = \{(a, b) : 1 + ab > 0, \text{ for all } a, b \in \mathbf{R}\}$. Show that R is reflexive and symmetric but not transitive.

CHAPTER-2 INVERSE TRIGONOMETRIC FUNCTIONS

(MULTIPLE CHOICE QUESTIONS)

1. The value of $\tan^{-1}\{2\cos(2\sin^{-1} \frac{1}{2})\}$ is

- (a) 1 (b) $\frac{3\pi}{4}$ (c) $\frac{1}{2}$ (d) $\frac{\pi}{4}$

2. The value of $\cos^{-1}(\cos 2\pi/3) + \sin^{-1}(\sin 2\pi/3)$ is

- (a) $\frac{2\pi}{3}$ (b) $\frac{4\pi}{3}$ (c) π (d) $\frac{\pi}{3}$

SHORT ANSWER TYPE (3MARKS)

1. Prove the following :

$$\cos^{-1} \frac{4}{5} + \cos^{-1} \frac{12}{13} = \cos^{-1} \frac{33}{65}$$

2. Prove that $\tan^{-1} \left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}+\sqrt{1-x}} \right) = \frac{\pi}{4} - \frac{1}{2} \cos^{-1} x$

CHAPTER-3 MATRICES

MULTIPLE CHOICE QUESTIONS (1 MARK EACH)

1. For which values of x and y, $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$

- a. $x = \frac{-1}{3}, y = 7$ b. $x = \frac{-1}{3}, y = \frac{-2}{3}$ c. $x = \frac{-2}{3}, y = 7$ d. No solution

2. If $A = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$, then $A + A' = I$, then the value of α is

- a. $\frac{\pi}{6}$ b. $\frac{\pi}{3}$ c. π d. $\frac{3\pi}{2}$

3. If $A = \begin{bmatrix} 2 & -3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$, $X = \begin{bmatrix} 1 & 2 & 3 \end{bmatrix}$ and $Y = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$, then $AB + XY$ equals

- a. $[28]$ b. $[24]$ c. 28 d. 24

4. A matrix $A = [a_{ij}]_{3 \times 3}$ is defined by

$$a_{ij} = \begin{cases} 2i + 3j, & i < j \\ 5, & i = j \\ 3i - 2j, & i > j \end{cases}$$

The number of elements in A which are more

than 5 is

- a. 3 b. 4 c. 5 d. 6

5. If A and B are matrices of same order, then $(AB^T - BA^T)$ is a

- a. Skew-symmetric matrix b. Null matrix c. Symmetric matrix d. Unit matrix

6. A 2×2 matrix whose element a_{ij} are given by $a_{ij} = \frac{(i-j)^2}{2}$ is :

- a. $\begin{bmatrix} 0 & \frac{1}{2} \\ \frac{1}{2} & 0 \end{bmatrix}$ b. $\begin{bmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{bmatrix}$ c. $\begin{bmatrix} 0 & -\frac{1}{2} \\ -\frac{1}{2} & 0 \end{bmatrix}$
 d. $\begin{bmatrix} \frac{1}{2} & -\frac{1}{2} \\ 0 & \frac{1}{2} \end{bmatrix}$

7. If $A = \begin{bmatrix} 2 & 3 & -5 \\ 1 & 4 & 9 \\ 0 & 7 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ -3 & 4 \\ 1 & 2 \end{bmatrix}$, then value of $a_{11}b_{11} + a_{22}b_{22}$ is

- a. 10 b. 15 c. 22 d. 25

8. If $\begin{bmatrix} x-y & z \\ 2x-y & w \end{bmatrix} = \begin{bmatrix} -1 & 4 \\ 0 & 5 \end{bmatrix}$, then values of x and y are :

- a. 2, 3 b. 2, 1 c. 1, 2 d. 3, 2

VERY SHORT ANSWER TYPE (2 MARKS)

1. Write the number of all possible matrices of order 3×2 with entries -1 or 0 or 1 ?

2. If $\begin{bmatrix} 1 & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ -1 \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$, then find $x + y + z$.

3. If $\begin{bmatrix} 1 & 2 \\ -2 & -b \end{bmatrix} + \begin{bmatrix} a & 4 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 0 \end{bmatrix}$, then find the value of $a^2 + b^2$.

4. If $A = \begin{bmatrix} 3 & -3 \\ -3 & 3 \end{bmatrix}$ and $A^2 = kA$, then find the value of k.

5. If $\begin{bmatrix} a+b & 2 \\ 5 & b \end{bmatrix} = \begin{bmatrix} 6 & 5 \\ 2 & 2 \end{bmatrix}^T$, then what is the value of a?

ANSWER

Q .NO.	1	2	3	4	5
ANSWER	2	0	20	6	4

SHORT ANSWER TYPE (3MARKS)

1. If A is a square matrix such that $A^2 = A$, then find the value of $(A - I)^3 + (A + I)^3 - 7A$?

2. If $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix} \begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} -4 & 6 \\ -9 & x \end{bmatrix}$, then find value of x.

3. Show that $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$ satisfies the equation $A^2 - 6A - 17 = 0$. Thus find A^{-1}

4. For the matrix $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$, find a and b such that $A^2 + aA + bI = 0$. Hence find A^{-1} .

ANSWER

Q.NO.	1	2	3	4
ANSWER	A	13	$\frac{1}{17} \begin{bmatrix} 4 & 3 \\ -3 & 2 \end{bmatrix}$	$a = -4$ $b = 1$, $A^{-1} = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$

LONG ANSWER TYPE (5 MARK EACH)

1. Let $A = \begin{bmatrix} 0 & -\tan \frac{\alpha}{2} \\ \tan \frac{\alpha}{2} & 0 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Prove that $I + A = (I - A) \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$.

2. Find the matrix P satisfying the matrix equation $\begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix} P \begin{bmatrix} -1 & 1 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ 0 & 4 \end{bmatrix}$.

3. If $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, then show that $A^2 - 4A + 7I = 0$. Hence find A^5 .

4. Use the product $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix} \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$ to solve $2x - y + z = -1$, $-x + 2y - z = 4$, $x - y + 2z = -3$.

ANSWER

Q.NO.	1	2	3	4
ANSWER	To be proved	$\begin{bmatrix} -16 & 3 \\ 24 & -5 \end{bmatrix}$	$\begin{bmatrix} -118 & -93 \\ 31 & -118 \end{bmatrix}$	$x=1$ $y=2$ $z=-1$