PARISHRAM 2025

Mathematics

DPP: 5

Matrices

Q1 If $x\begin{bmatrix}-3\\4\end{bmatrix}+y\begin{bmatrix}4\\3\end{bmatrix}=\begin{bmatrix}10\\-5\end{bmatrix}$, then:

(A) $x=-2, y=1$

(B) $x=-9, y=10$

(C) $x=22, y=1$

(D) $x=2, y=-1$

Q2 If $2\begin{pmatrix}3&4\\5&x\end{pmatrix}+\begin{pmatrix}1&y\\0&1\end{pmatrix}=\begin{pmatrix}7&0\\10&5\end{pmatrix}$, then:

(A) $x=2, y=-6$

(B) $x=2, y=-6$

(C) $x=2, y=-8$

(D) $x=-2, y=8$

Q3 If $\mathrm{A}=\begin{bmatrix}x&1\\1&0\end{bmatrix}$, and A^2 is the identity matrix, then x is equal to

(A) -1 (B) 0

(C) 1 (D) 2

Q4 If $\begin{bmatrix}1&x&1\end{bmatrix}\begin{bmatrix}1&2&3\\0&5&1\\0&3&2\end{bmatrix}\begin{bmatrix}x\\1\\-2\end{bmatrix}=0$, then the value of x is:

(A) 0

(B) $2/3$

(C) $\frac{5}{4}$

(D) $-4/5$

Q5 If $\mathrm{U}=\begin{bmatrix}2&-3&4\end{bmatrix}, \mathrm{X}=\begin{bmatrix}0&2&3\end{bmatrix}, \mathrm{V}=\begin{bmatrix}3\\2\\1\end{bmatrix}$ and $\mathrm{Y}=\begin{bmatrix}2\\2\\4\end{bmatrix}$, then $\mathrm{UV}+\mathrm{XY}$ is equal to:

(A) $[20]$

(B) 20

(C) $[-20]$

(D) -20

Q6 If $m\begin{bmatrix}-3&4\end{bmatrix}+\mathrm{n}\begin{bmatrix}4&-3\end{bmatrix}=\begin{bmatrix}10&-11\end{bmatrix}$, then $3m+7n$ is equal to:

(A) 3 (B) 5

(C) 10 (D) 1

Q7 If $A=\begin{bmatrix}6&8&5\\4&2&3\\9&7&1\end{bmatrix}$ is the sum of a symmetric matrix B and skew -symmetric matrix C, then B is equal to

(A) $\begin{bmatrix}6&6&7\\6&2&5\\7&5&1\end{bmatrix}$

(B) $\begin{bmatrix}0&2&-2\\-2&5&-2\\2&2&0\end{bmatrix}$

(C) $\begin{bmatrix}6&6&7\\-6&2&-5\\-7&5&1\end{bmatrix}$

(D) $\begin{bmatrix}0&6&-2\\2&0&-2\\-2&-2&0\end{bmatrix}$

Q8 If A and B are two matrices such that both $A+B$ and $A\times B$ are defined, then

(A) A and B are of same order

(B) A is of order $m\times m$ and B is of order $n\times n$, $m\neq n$

(C) Both A and B are of same order $n\times n$

(D) A is of order $m\times n$ and B is of order $n\times m$

Q9 If $A=\begin{bmatrix}2x&0\\x&x\end{bmatrix}$ and $A^{-1}=\begin{bmatrix}1&0\\-1&2\end{bmatrix}$, then x equals to:

(A) $1/2$ (B) 1

(C) $-1/2$ (D) 2

Q10 If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$, then $A + A' = I$, if value of α is

(A) $\frac{\pi}{6}$

(B) $\frac{\pi}{3}$

(C) π

(D) $\frac{3\pi}{2}$

Q11 If a matrix A is both symmetric and skew-symmetric matrix, then:

(A) A is a diagonal matrix

(B) A is zero square matrix

(C) A is a square matrix

(D) None of the above

Q12 If matrix $A = \begin{bmatrix} 0 & 2 \\ 0 & 0 \end{bmatrix}$ and $f(x) = 1 + x + x^2 + x^4 + x^8 + x^{16}$, find $f(A)$.

(A) $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 2 & 2 \\ 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & -2 \\ 1 & 0 \end{bmatrix}$

(D) $\begin{bmatrix} -1 & 2 \\ 0 & -1 \end{bmatrix}$

Q13 If $\begin{bmatrix} 1 & -1 & 1 \\ 1 & -1 & 1 \\ 1 & -1 & 1 \end{bmatrix}$, then $A^5 - A^4 - A^3 + A^2$ is equal to

(A) 2***A*** (B) 3***A***

(C) 4***A*** (D) ***O***

Q14 If ***A*** is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to

(A) ***I*** (B) ***O***

(C) ***I*** − ***A*** (D) ***I*** + ***A***

Q15 Let $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix}$, $a, b \in N$. Then

(A) There cannot exist any ***B*** such that ***AB = BA***

(B) There exist more than one but finite number of ***B***'s such that ***AB = BA***

(C) There exist exactly one ***B*** such that ***AB =BA***

(D) There exist infinitely many ***B***'s such that ***AB = BA***

Q16 If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, find α satisfying $0 < \alpha < \frac{\pi}{2}$ when $A + A^T = \sqrt{2}I_2$ where A^T is transpose of ***A***.

Q17 If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$, then find the values of ***a*** and ***b***.

Q18 If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, show by induction that $A^n = \begin{bmatrix} \cos n\theta & \sin n\theta \\ -\sin n\theta & \cos n\theta \end{bmatrix}$

Q19 If $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$ then find $A^2 - 5A - 14I$. Hence, obtain A^3.

Q20 Read the following and answer the questions given below:

A manufacturer produces three stationery products Pencil, Eraser and Sharpener which he sells in two markets. Annual sales are indicated below:

Market	Products (in number)		
	Pencil	Eraser	Sharpener
A	10,000	2,000	18,000
B	6,000	20,000	8,000

If the unit Sale price of Pencil, Eraser and Sharpener are Rs. 2.50 , Rs. 1.50 and Rs. 1.00 respectively, and unit cost of the above three commodities are Rs. 2.00 , Rs. 1.00 and Rs. 0.50 respectively. Using matrices

(A) Calculate total revenue of market A.

(B) Calculate total revenue of market B.

(C) Calculate total cost incurred in market A.

(D) Calculate gross profit in both markets.

Answer Key

Q1 (A)

Q2 (C)

Q3 (B)

Q4 (C)

Q5 (A)

Q6 (D)

Q7 (A)

Q8 (C)

Q9 (A)

Q10 (B)

Q11 (B)

Q12 (A)

Q13 (D)

Q14 (A)

Q15 (D)

Q16 $\alpha = \frac{\pi}{4}$

Q17 ***a*** = 1 and ***b*** = 4

Q18 **Check the solution**

Q19 $A^2 - 5A + 14I = O$

and $A^3 = 5A^2 + 14A$

$$A^3 = \begin{bmatrix} 187 & -195 \\ -156 & 148 \end{bmatrix}$$

Q20 (1) Total revenue of market ***A*** = Rs. 46,000

(2) Total revenue of market ***B*** = Rs. 53,000

(3) Cost incurred in market ***A*** = Rs. 31,000

(4) Gross profit from both markets = Rs. (15,000 + 17,000) = Rs. 32,000