CHAPTER 11.3

Inverses of Matrices and Matrix Equations

Multiple-Choice Old Exam Questions

12 questions • 2 topics • options A–E • two questions per page

Topic 1 | Inverse of a Matrix

Finding elements or sums of elements of an inverse, a product with an inverse, or an unknown entry • Questions 1–6

Q **1**

If $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$, then the sum of the elements in the first column of A^{-1} is equal to

A) 5

B) 1

C) -2

D) 0

E) 3

Q **2**

If $X^{-1} = \begin{bmatrix} 1 & -2 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 2 \end{bmatrix}$, then the sum of the elements in the 3^{rd} column of X is

A) -1

B) 0

C) $-\frac{1}{2}$

D) $\frac{1}{2}$

E) $\frac{3}{2}$

Q
3

If $A = \begin{bmatrix} 3 & -5 \\ 1 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -4 \\ 4 & -6 \end{bmatrix}$ and $C = A^{-1}B$, then the sum of all elements of the matrix C is

A) -6

B) $-\frac{19}{2}$

C) -10

D) 12

E) $\frac{9}{2}$

Q
4

Given the matrices $M^{-1} = \begin{bmatrix} 2 & 7 \\ 1 & 4 \end{bmatrix}$ and $N^{-1} = \begin{bmatrix} 1 & 2 \\ -2 & -3 \end{bmatrix}$, then the sum of the elements in the 1^{st} row of $(MN)^{-1}$ is

A) 19

B) -34

C) -22

D) -11

E) -3

Q
5

If the inverse of the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 3 & -1 \\ 3 & 6 & -n \end{bmatrix}$ is $A^{-1} = \begin{bmatrix} 0 & 2 & m \\ -1 & -1 & 1 \\ -3 & 0 & 1 \end{bmatrix}$, then the sum of m and n is

A) 1

B) -1

C) -4

D) -3

E) 2

Q
6

If $A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ and $BA = \begin{bmatrix} -1 & 2 \\ 4 & 3 \end{bmatrix}$, then the sum of all the elements of the matrix B is equal to

A) 1

B) -4

C) 3

D) 2

E) -2

Topic 2 | Matrix Equations, Systems and Properties

Writing the solution of a system with the inverse of its coefficient matrix, deciding whether a matrix equation has a solution, and matrix identities • Questions 7–12

Q 7

The system $\begin{cases} 3x - 5y = -18 \\ 2x - 3y = -9 \end{cases}$ has the solution in the form

A) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 9 & -15 \\ 6 & -9 \end{bmatrix} \begin{bmatrix} 6 \\ 3 \end{bmatrix}$

B) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 & 5 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} -8 \\ -9 \end{bmatrix}$

C) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -5 & 3 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} -18 \\ -9 \end{bmatrix}$

D) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -15 & 9 \\ -9 & 6 \end{bmatrix} \begin{bmatrix} 6 \\ 3 \end{bmatrix}$

E) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 & 5 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} -18 \\ -9 \end{bmatrix}$

Q 8

If $A = \begin{bmatrix} 2 & -5 \\ 3 & -6 \end{bmatrix}$, $B = \begin{bmatrix} 15 \\ 36 \end{bmatrix}$ and $X = \begin{bmatrix} x \\ y \end{bmatrix}$, then the matrix solution of the system $AX = B$ is given by

A) $X = \begin{bmatrix} -6 & 5 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} 5 \\ 12 \end{bmatrix}$

B) $X = \begin{bmatrix} -6 & 5 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} 5 \\ 12 \end{bmatrix}$

C) $X = \begin{bmatrix} 2 & -\frac{5}{3} \\ 1 & -\frac{2}{3} \end{bmatrix} \begin{bmatrix} -6 \\ 15 \end{bmatrix}$

D) $X = \begin{bmatrix} 2 & \frac{5}{3} \\ -1 & -\frac{2}{3} \end{bmatrix} \begin{bmatrix} 15 \\ 36 \end{bmatrix}$

E) $X = \begin{bmatrix} -2 & \frac{5}{3} \\ 1 & -\frac{2}{3} \end{bmatrix} \begin{bmatrix} 15 \\ 36 \end{bmatrix}$

Q
9

The linear system $\begin{bmatrix} 2 & 1 & 1 \\ -1 & 3 & 2 \\ 2 & 1 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = 2 \begin{bmatrix} 9 \\ 5 \\ -11 \end{bmatrix}$ has

A) infinitely many solutions

B) no solution

C) a unique solution $(-3, -12, -4)$

D) a unique solution $(1, 2, 2)$

E) a unique solution $(5, 4, 4)$

Q
10

The solution of the system $\begin{cases} 3x + 5y = -10 \\ -2x - 4y = 6 \end{cases}$ can be given by

A) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 & 5 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} -5 \\ 3 \end{bmatrix}$

B) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 & 5 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} -10 \\ 6 \end{bmatrix}$

C) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -4 & -5 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} -5 \\ 3 \end{bmatrix}$

D) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 & 4 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} -10 \\ 6 \end{bmatrix}$

E) $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} -5 \\ 3 \end{bmatrix}$

Q
11

If $A = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 2 & 4 \\ -1 & 0 & 2 \end{bmatrix}$, then the sum of all the elements in the second row of A^{-1} is equal to

A) $-\frac{7}{2}$

B) $\frac{3}{2}$

C) $\frac{1}{2}$

D) 0

E) 2

Q
12

If A, B and C are $n \times n$ matrices and I_n is the identity matrix of order n, then which of the following statements is TRUE?

A) $(A+B)(A^2 - AB + B^2) = A^3 + B^3$

B) $(A+I_n)(A-I_n) = A^2 - {I_n}^2$

C) $A^2C = ACA$

D) $(A-B)^2 = A^2 - 2AB + B^2$

E) $(A+I_n)^2 = A^2 + I_n$

Answer Key

"Original" shows the question number in the source worksheet.

Q	Original	Ans.	Value
1	2	**A**	5
2	3	**A**	-1
3	4	**A**	-6
4	5	**A**	19
5	6	**A**	1
6	8	**A**	1
7	7	**A**	$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 9 & -15 \\ 6 & -9 \end{bmatrix} \begin{bmatrix} 6 \\ 3 \end{bmatrix}$
8	9	**A**	$X = \begin{bmatrix} -6 & 5 \\ -3 & 2 \end{bmatrix} \begin{bmatrix} 5 \\ 12 \end{bmatrix}$
9	10	**B**	no solution
10	11	**A**	$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 & 5 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} -5 \\ 3 \end{bmatrix}$
11	12	**A**	$-\frac{7}{2}$
12	1	**B**	$(A + I_n)(A - I_n) = A^2 - {I_n}^2$