CHAPTER 11.2

The Algebra of Matrices

Multiple-Choice Old Exam Questions

14 questions • 3 topics • options A–E • two questions per page

Topic 1 | Products of Matrices

Multiplying matrices and finding the sum of the elements, or one element, of a product • Questions 1–6

Q **1**

If $C = \begin{bmatrix} -1 & 3 \\ 2 & 1 \\ -3 & -2 \end{bmatrix}$ and $D = \begin{bmatrix} 0 & -1 & 2 \\ 1 & 2 & -4 \end{bmatrix}$, then the sum of all elements of $CD - I$ is

A) -4

B) -14

C) -7

D) 13

E) 17

Q **2**

If $A = \begin{bmatrix} 0 & -2 & 7 \\ 5 & 4 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 \\ -1 & 5 \\ 6 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 40 & -10 \\ 28 & 23 \end{bmatrix}$, and $D = AB - C$, then the element in the second row and second column of the matrix D is equal to

A) 2

B) 48

C) 0

D) 28

E) -10

Q
3

If $A = \begin{bmatrix} 2 & -1 & 3 \\ 4 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 \\ 0 & 3 \\ 2 & 1 \end{bmatrix}$, then the sum of all the elements of the matrix AB is

A) 9

B) 14

C) -5

D) 5

E) 3

Q
4

If $A = \begin{bmatrix} -5 & 4 & 1 \\ -5 & 7 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -8 & 6 & -4 \\ -1 & 5 & -3 \\ -7 & 5 & -1 \end{bmatrix}$, then the sum of all the elements of the third column of the matrix AB is

A) 4

B) 10

C) -6

D) 0

E) -3

Q
5

If $A = \begin{bmatrix} 2 & 0 & -2 \\ 3 & -1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 2 & -1 \\ 0 & -3 & 1 \\ -2 & 6 & 0 \end{bmatrix}$, then the element in the second row and third column of the matrix AB is

A) 0

B) 2

C) -4

D) -2

E) 10

Q
6

If $C = BA$, where $A = \begin{bmatrix} 0 & 1 & 2 & 3 \\ 4 & 5 & 6 & 7 \\ 8 & 9 & 10 & 11 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 & -2 \\ -3 & 4 & -5 \\ -6 & 7 & -8 \\ -9 & 10 & -11 \end{bmatrix}$, then c_{23}, the element in the second row and third column of C, is equal to

A) 32

B) -32

C) 158

D) -158

E) 116

Topic 2 | Powers and Matrix Equations

Finding elements of a power of a matrix, and solving equations that contain matrices • Questions 7–12

Q 7

$A = \begin{bmatrix} 1 & -2 & 0 \\ 3 & 0 & -1 \\ 1 & 1 & 4 \end{bmatrix}$. The element in the third row and second column of the matrix $A^2 + 3A$ is

A) 5

B) -2

C) 0

D) -1

E) 7

Q 8

If $A = \begin{bmatrix} 1 & 2 & -5 \\ 2 & 4 & 3 \\ 3 & -1 & -2 \end{bmatrix}$, then the element in the second row and third column of A^2 is equal to

A) -4

B) 4

C) -5

D) 11

E) 19

Q
9

If X is a 3×3 matrix, I is the 3×3 identity matrix, and $A = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$ such that $2(X - A) = X - 3I$, then the sum of all elements in the second row of matrix X is

A) 27

B) 18

C) 24

D) 31

E) 30

Q
10

If $A = \begin{bmatrix} 2 & -1 & -2 & 5 \\ 3 & 0 & 1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -6 & 3 & 1 & 0 \\ 3 & 2 & 7 & 4 \end{bmatrix}$ and $3A + 5X = 3X + B$, then $X =$

A) $\begin{bmatrix} -6 & 3 & \frac{7}{2} & -\frac{15}{2} \\ -3 & 1 & 2 & -4 \end{bmatrix}$

B) $\begin{bmatrix} -4 & 2 & -1 & 3 \\ 6 & 2 & 8 & 8 \end{bmatrix}$

C) $\begin{bmatrix} 0 & 0 & -5 & 13 \\ 12 & 2 & 10 & 16 \end{bmatrix}$

D) $\begin{bmatrix} 0 & 0 & -\frac{5}{2} & \frac{15}{2} \\ 6 & 1 & 5 & 8 \end{bmatrix}$

E) $\begin{bmatrix} -12 & 6 & 7 & -15 \\ -6 & 2 & 4 & -8 \end{bmatrix}$

Q
11

Given that $A = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 0 \\ x & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & 0 \\ 6 & 1 \end{bmatrix}$. If $AB = 2A^2 - C$, then $x =$

A) -4

B) 4

C) 0

D) 2

E) -2

Q
12

If $\begin{bmatrix} x+2 & 8 & -3 \\ 1 & 2y & 2x+1 \\ 7 & -2 & y+2 \end{bmatrix} = \begin{bmatrix} 2x+6 & 8 & -3 \\ 1 & 18 & -7 \\ 7 & -2 & 11 \end{bmatrix}$, then $x + y =$

A) -13

B) -5

C) 5

D) 4

E) 13

Topic 3 | Orders and Properties of Matrices

Deciding which matrix expressions are possible, and which statement about matrices is true • Questions 13–14

Q **13**

Let A be a (3×4) matrix and B be a (4×3) matrix. Then which one of the following expressions is possible to find?

A) $A(BA)$

B) $A + B$

C) B^{-1}

D) A^{-1}

E) $A(AB)$

Q **14**

If A, B and C are matrices each of order $n \times n$, then which one of the following is TRUE?

A) $(AB)C = A(BC)$

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

C) $(A + B) \cdot C = A + (B \cdot C)$

D) $C(AB) + C(BA) = 2C(AB)$

E) $(A - B)(A + B) = A^2 - B^2$

Answer Key

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

Q	Original	Ans.	Value
1	1	**C**	-7
2	4	**A**	2
3	7	**A**	9
4	9	**A**	4
5	10	**C**	-4
6	13	**B**	-32
7	2	**A**	5
8	8	**A**	-4
9	6	**A**	27
10	12	**A**	$\begin{bmatrix} -6 & 3 & \frac{7}{2} & -\frac{15}{2} \\ -3 & 1 & 2 & -4 \end{bmatrix}$
11	14	**E**	-2
12	11	**C**	5
13	3	**A**	$A(BA)$
14	5	**A**	$(AB)C = A(BC)$