NCERT Solutions Class 12 Maths
Chapter 3: Matrices
Miscellaneous Exercise on Chapter 3

Document Information:
Class: 12 | **Subject:** Mathematics | **Chapter:** 3 | **Exercise:** misc
Total Questions: 11 | **Academic Year:** 2025-26
Source: www.ncertbooks.net | **Generated:** February 21, 2026

Quick Summary: In NCERT Solutions Class 12 Maths Chapter 3 Exercise misc, students learn advanced matrix properties focusing on symmetric and skew-symmetric matrices, transpose operations, and matrix multiplication rules. This exercise covers essential matrix transformation concepts and proof-based problems that are frequently tested in CBSE Class 12 board exams and competitive entrance tests.

Key Takeaways:

- Symmetric matrices satisfy A = A^T while skew-symmetric matrices follow A = -A^T
- Transpose properties: (A + B)^T = A^T + B^T and (AB)^T = B^T A^T
- Any square matrix can be expressed as sum of symmetric and skew-symmetric matrices: A = (1)/(2)(A + A^T) + (1)/(2)(A - A^T)
- Matrix equation solving techniques using properties of transpose and inverse operations for finding unknown variables

Complete Solutions

Question 1

QUESTION

If A and B are symmetric matrices, prove that AB - BA is a skew symmetric matrix.

SOLUTION

This question tests our understanding of symmetric and skew-symmetric matrices and their properties under matrix operations.

Step 1: Recall the definitions of symmetric and skew-symmetric matrices

A matrix is symmetric if , where is the transpose of .

A matrix is skew-symmetric if .

Step 2: Define the matrix

Let . We want to show that is skew-symmetric, which means we need to prove that .

Step 3: Find the transpose of

Using the properties of transpose, we have:

Recall that . Applying this property:

Step 4: Use the given information that and are symmetric

Since and are symmetric, we know that and . Substituting these into the expression for :

Step 5: Relate to

We have . Notice that this is the negative of , which is .

Therefore, .

Step 6: Conclude that is skew-symmetric

Since , the matrix is a skew-symmetric matrix.

ANSWER

Question 2

QUESTION

Show that the matrix B'AB is symmetric or skew symmetric according as A is symmetric or skew symmetric.

SOLUTION

This question explores the properties of matrix transposition and how they interact with symmetric and skew-symmetric matrices. We need to prove that is symmetric if is symmetric, and skew-symmetric if is skew-symmetric.

Step 1: Define symmetric and skew-symmetric matrices

A matrix is symmetric if . A matrix is skew-symmetric if .

Step 2: Consider the transpose of

We want to find . Using the property that , we have:

Step 3: Case 1: A is symmetric

If is symmetric, then . Substituting this into the expression for , we get:

Since , the matrix is symmetric.

Step 4: Case 2: A is skew-symmetric

If is skew-symmetric, then . Substituting this into the expression for , we get:

Since , the matrix is skew-symmetric.

Step 5: Conclusion

Therefore, is symmetric when is symmetric and skew-symmetric when is skew-symmetric. This completes the proof.

ANSWER

Question 3

QUESTION

Find the values of x, y, z if the matrix

A = \beginbmatrix 0 & 2y & z \\ x & y & -z \\ x & -y & z \endbmatrix

satisfy the equation A'A = I.

SOLUTION

We are given a matrix and the condition , where is the transpose of and is the identity matrix. We need to find the values of and .

Step 1: Find the transpose of matrix A

The transpose of matrix , denoted as , is obtained by interchanging rows and columns:

Step 2: Compute

Multiply by :

Step 3: Use the condition

We are given that , where is the identity matrix:

Therefore, we have:

Step 4: Solve for

By comparing the elements of the matrices, we get the following equations:

, ,

Solving for :

Solving for :

Solving for :

Final Answer:

ANSWER

x = ± (1)/(√2),\; y = ± (1)/(√6),\; z = ± (1)/(√3)

Question 4

QUESTION

For what values of x :

\beginbmatrix 1 & 2 & 1 \endbmatrix\beginbmatrix 1 & 2 & 0 \\ 2 & 0 & 1 \\ 1 & 0 & 2 \endbmatrix\beginbmatrix 0 \\ 2 \\ x \endbmatrix = 0?

SOLUTION

We are asked to find the values of for which the given matrix equation holds true.

Step 1: Perform the first matrix multiplication

Let's first multiply the first two matrices:

Step 2: Perform the second matrix multiplication

Now, multiply the resulting matrix with the third matrix:

Step 3: Set the result equal to zero and solve for x

We are given that the result of the entire matrix multiplication is 0. Therefore:

Subtract 4 from both sides:

Divide both sides by 4:

Final Answer:

ANSWER

x = -1

Question 5

QUESTION

If A = \beginbmatrix 3 & 1 \\ -1 & 2 \endbmatrix, show that A^2 - 5A + 7I = 0.

SOLUTION

We are given a matrix and asked to show that , where is the identity matrix and is the zero matrix.

Step 1: Calculate

First, we need to find , which is :

Step 2: Calculate

Next, we calculate :

Step 3: Calculate

Now, we calculate , where is the 2x2 identity matrix:

Step 4: Calculate

Now we substitute the calculated matrices into the equation:

Step 5: Conclusion

Since , which is the zero matrix, we have shown that .

ANSWER

Question 6

QUESTION

Find x, if

\beginbmatrix x & -5 & -1 \endbmatrix\beginbmatrix 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \endbmatrix\beginbmatrix x \\ 4 \\ 1 \endbmatrix = 0.

SOLUTION

We are given a matrix equation and asked to find the value(s) of that satisfy the equation. This question tests our understanding of matrix multiplication.

Step 1: Perform the first matrix multiplication

Let's first multiply the first two matrices:

Simplifying, we get:

Step 2: Perform the second matrix multiplication

Now, multiply the resulting matrix with the third matrix:

Step 3: Simplify the equation

Expanding and simplifying the expression, we get:

Step 4: Solve for x

Adding 48 to both sides, we have:

Taking the square root of both sides:

Simplifying the square root:

Final Answer:

Therefore, the values of that satisfy the given matrix equation are and .

ANSWER

$x = \pm 4\sqrt{3}$

Question 7

QUESTION

A manufacturer produces three products x, y, z which he sells in two markets. Annual sales are indicated below:

Market I: x = 10000,\; y = 2000,\; z = 18000

Market II: x = 6000,\; y = 20000,\; z = 8000

(a) If unit sale prices of x, y and z are \text₹2.50,\; \text₹1.50 and \text₹1.00, respectively, find the total revenue in each market with the help of matrix algebra.

(b) If the unit costs of the above three commodities are \text₹2.00,\; \text₹1.00 and 50 paise respectively. Find the gross profit.

SOLUTION

This question involves using matrix algebra to calculate total revenue and gross profit based on sales data and unit prices/costs. It tests the understanding of matrix multiplication and its application in real-world scenarios.

(a) Finding the total revenue in each market:

Step 1: Represent sales data as a matrix.

Let the sales quantities be represented by matrix :

where the rows represent Market I and Market II, respectively, and the columns represent products .

Step 2: Represent unit sale prices as a matrix.

Let the unit sale prices be represented by matrix :

Step 3: Calculate the total revenue by matrix multiplication.

The total revenue in each market is given by :

Step 4: Simplify the matrix multiplication.

Therefore, the total revenue in Market I is and in Market II is .

(b) Finding the gross profit:

Step 1: Represent unit costs as a matrix.

Let the unit costs be represented by matrix :

Step 2: Calculate the total cost in each market.

The total cost in each market is given by :

Step 3: Simplify the matrix multiplication.

Step 4: Calculate the gross profit in each market.

Gross Profit = Total Revenue - Total Cost

Market I:

Market II:

Therefore, the gross profit in Market I is and in Market II is .

ANSWER

(a) Total revenue in the market - I = \text₹46000

Total revenue in the market - II = \text₹53000

(b) \text₹15000,\; \text₹17000

Question 8

QUESTION

Find the matrix X so that

X\beginbmatrix 1 & 2 & 3 \\ 4 & 5 & 6 \endbmatrix = \beginbmatrix -7 & -8 & -9 \\ 2 & 4 & 6 \endbmatrix.

SOLUTION

We are asked to find a matrix that satisfies the equation . This involves understanding matrix multiplication and solving for an unknown matrix.

Step 1: Determine the order of matrix

Let the order of matrix be . The order of the matrix is . The order of the resulting matrix is . For matrix multiplication to be defined, the number of columns of must equal the number of rows of the second matrix. Therefore, . The number of rows of the resulting matrix is equal to the number of rows of . Therefore, . Hence, the order of is .

Step 2: Assume a general form for matrix

Let . Then the given equation becomes:

Step 3: Perform matrix multiplication

Multiplying the matrices on the left side, we get:

Step 4: Equate corresponding elements and solve the system of equations

By equating corresponding elements, we obtain the following system of equations:

, ,

, ,

From , we get . Subtracting this from , we get , so . Substituting into , we get , so .

From , we get . Subtracting this from , we get , so . Substituting into , we get .

Step 5: Write the matrix

Therefore, .

Final Answer:

ANSWER

X = \beginbmatrix 1 & -2 \\ 2 & 0 \endbmatrix

Question 9

QUESTION

Choose the correct answer.

If A = \beginbmatrix α & β \\ \gamma & -α \endbmatrix is such that A^2 = I, then

(A) 1 + α^2 + β\gamma = 0

(B) 1 - α^2 + β\gamma = 0

(C) 1 - α^2 - β\gamma = 0

(D) 1 + α^2 - β\gamma = 0

SOLUTION

We are given a matrix and the condition , where is the identity matrix. We need to find the correct relation between , , and .

Step 1: Calculate

We have . Therefore,

Multiplying the matrices:

Step 2: Use the given condition

We are given that . Therefore,

Step 3: Equate the corresponding elements

From the equality of the matrices, we have:

Step 4: Rearrange the equation

Rearranging the equation, we get:

Final Answer:

The correct answer is (C)

Explanation of Incorrect Options:

(A) is incorrect because it has the wrong signs for and .

(B) is incorrect because it has the wrong sign for .

(D) is incorrect because it has the wrong sign for .

ANSWER

(C)

Question 10

QUESTION

Choose the correct answer.

If the matrix A is both symmetric and skew symmetric, then

(A) A is a diagonal matrix

(B) A is a zero matrix

(C) A is a square matrix

(D) None of these

SOLUTION

We are given that a matrix is both symmetric and skew-symmetric, and we need to determine what kind of matrix must be.

Step 1: Understand the properties of symmetric and skew-symmetric matrices

A matrix is symmetric if , where is the transpose of .

A matrix is skew-symmetric if .

Step 2: Apply both conditions to the matrix

Since is both symmetric and skew-symmetric, we have:

and

Step 3: Equate the two expressions for

Since both and are equal to , we can write:

Step 4: Solve for

Adding to both sides of the equation , we get:

Dividing both sides by 2:

Step 5: Interpret the result

The matrix must be a zero matrix.

Final Answer: (B) is a zero matrix

Why the other options are incorrect:

(A) is a diagonal matrix: A diagonal matrix is not necessarily both symmetric and skew-symmetric. Only the zero matrix satisfies both conditions.

(C) is a square matrix: While symmetric and skew-symmetric matrices are square, this condition alone doesn't define when it's *both* symmetric and skew-symmetric.

(D) None of these: We found that is a zero matrix, so this option is incorrect.

ANSWER

(B)

Question 11

QUESTION

Choose the correct answer.

If A is a square matrix such that A^2 = A, then (I + A)^3 - 7A is equal to

(A) A

(B) I - A

(C) I

(D) 3A

SOLUTION

We are given a square matrix such that , and we need to find the value of .

Step 1: Expand

We can expand using the binomial theorem or by direct multiplication:

Since is the identity matrix, , , and . Also, we are given that . Therefore:

Step 2: Multiply

Again, using , we have:

So, .

Step 3: Substitute into the expression

Step 4: Conclusion

Therefore, .

The correct answer is (C) .

ANSWER

(C)

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Key Formulas

Important Formulas for Exercise misc

Formula / Concept	Description
(AB)C = A(BC)	Associative Property of Matrix Multiplication.
A(B + C) = AB + AC	Distributive Property of Matrix Multiplication.
(A + B)C = AC + BC	Distributive Property of Matrix Multiplication.
AI = IA = A	Existence of Multiplicative Identity, where I is the identity matrix.
(A^T)^T = A or (A')' = A	The transpose of the transpose of a matrix is the matrix itself.
(kA)^T = kA^T or (kA)' = kA'	The transpose of a matrix multiplied by a scalar k is equal to the scalar multiplied by the transpose of the matrix.
(A + B)^T = A^T + B^T or (A + B)' = A' + B'	The transpose of the sum of two matrices is the sum of their transposes.
(AB)^T = B^T A^T or (AB)' = B'A'	The transpose of the product of two matrices is the product of their transposes in reverse order.
Symmetric Matrix	A square matrix A is symmetric if A^T = A.
Skew-Symmetric Matrix	A square matrix A is skew-symmetric if A^T = -A. For a skew-symmetric matrix, all diagonal elements are zero.
A = (1)/(2)(A + A^T) + (1)/(2)(A - A^T)	Any square matrix can be expressed as the sum of a symmetric matrix and a skew-symmetric matrix.
(1)/(2)(A + A^T)	This part represents the symmetric part of matrix A.
(1)/(2)(A - A^T)	This part represents the skew-symmetric part of matrix A.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 12 Maths Chapter 3 Matrices Exercise misc for CBSE 2025-26?

There are 11 questions in NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise misc. These miscellaneous exercise questions cover all important concepts including matrix multiplication properties and transpose properties for CBSE board exam 2025-26 preparation.

Q2. Where can I download free PDF of NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise misc with step by step solutions?

You can download free PDF of NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise misc from official NCERT website and various educational platforms. These PDFs contain detailed step by step solutions for all 11 questions prepared according to CBSE 2025-26 syllabus.

Q3. How many marks does Chapter 3 Matrices carry in CBSE Class 12 Maths board exam 2025-26?

Chapter 3 Matrices carries 5 marks in CBSE Class 12 Maths board exam 2025-26 under Unit II - Algebra. This weightage is shared with other algebra topics, making NCERT Solutions for Class 12 Maths Chapter 3 Exercise misc essential for comprehensive preparation.

Q4. Which is the most difficult question in Exercise misc of NCERT Solutions Class 12 Maths Chapter 3 Matrices?

Questions involving complex matrix multiplication properties and transpose properties combinations are considered most difficult in Exercise misc of Class 12 Maths Chapter 3. Students should practice step by step solutions for questions 8-11 which require advanced understanding of matrix operations for CBSE board exam 2025-26.

Q5. What is Matrix Multiplication Properties covered in NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise misc?

Matrix Multiplication Properties in NCERT Class 12 Maths Chapter 3 Exercise misc include associative property, distributive property, and non-commutative nature of multiplication. These properties are crucial for solving miscellaneous exercise questions and appear frequently in CBSE Class 12 board exam 2025-26.

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