NCERT Solutions Class 12 Maths
Chapter 3: Matrices
Exercise 3.3

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Quick Summary: In NCERT Solutions Class 12 Maths Chapter 3 Exercise 3.3, students learn comprehensive concepts about transpose of matrices and their fundamental properties. This exercise covers matrix transposition techniques, verification of transpose properties, and matrix multiplication rules which are essential for CBSE Class 12 board exams and competitive entrance tests.

Key Takeaways:

- Transpose of a matrix A is denoted as A' or A^T, obtained by interchanging rows and columns
- Property verification: (A + B)' = A' + B' and (A - B)' = A' - B'
- Important multiplication property: (AB)' = B'A' (order reverses in transpose of product)
- Step-by-step solutions for finding transpose of different matrix types including 2×3 and 3×2 matrices

Complete Solutions

Question 1

QUESTION

Find the transpose of each of the following matrices:

(i) \beginbmatrix 5 \\ (1)/(2) \\ -1 \endbmatrix

(ii) \beginbmatrix 1 & -1 \\ 2 & 3 \endbmatrix

(iii) \beginbmatrix -1 & 5 & 6 \\ √3 & 5 & 6 \\ 2 & 3 & -1 \endbmatrix

SOLUTION

This question asks us to find the transpose of three different matrices. The transpose of a matrix is obtained by interchanging its rows and columns.

(i) We are given the matrix . This is a matrix (3 rows and 1 column).

Step 1: Identify rows and columns

The rows are: , , and . The single column is .

Step 2: Interchange rows and columns

To find the transpose, we make the rows into columns (or vice versa). So the transpose, denoted as , will be a matrix.

Step 3: Write the transpose

Final Answer: The transpose of the given matrix is .

(ii) We are given the matrix . This is a matrix.

Step 1: Identify rows and columns

The rows are: and . The columns are and .

Step 2: Interchange rows and columns

The transpose will also be a matrix. The first row of becomes the first column of , and the second row of becomes the second column of .

Step 3: Write the transpose

Final Answer: The transpose of the given matrix is .

(iii) We are given the matrix . This is a matrix.

Step 1: Identify rows and columns

The rows are: , , and . The columns are , , and .

Step 2: Interchange rows and columns

The transpose will also be a matrix. The first row of becomes the first column of , and so on.

Step 3: Write the transpose

Final Answer: The transpose of the given matrix is .

ANSWER

(i) \beginbmatrix 5 & (1)/(2) & -1 \endbmatrix

(ii) \beginbmatrix 1 & 2 \\ -1 & 3 \endbmatrix

(iii) \beginbmatrix -1 & √3 & 2 \\ 5 & 5 & 3 \\ 6 & 6 & -1 \endbmatrix

Question 2

QUESTION

If

A = \beginbmatrix -1 & 2 & 3 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \endbmatrix \quad \textand \quad B = \beginbmatrix -4 & 1 & -5 \\ 1 & 2 & 0 \\ 1 & 3 & 1 \endbmatrix

then verify that

(i) (A + B)' = A' + B'

(ii) (A - B)' = A' - B'

SOLUTION

This question asks us to verify two properties of matrix transposes: that the transpose of a sum (or difference) of matrices is equal to the sum (or difference) of the transposes of the individual matrices. We will perform the matrix operations and compare the results.

(i) Verifying

Step 1: Calculate

We add the corresponding elements of matrices A and B:

Step 2: Calculate

We take the transpose of the resulting matrix by interchanging rows and columns:

Step 3: Calculate and

We find the transposes of A and B individually:

Step 4: Calculate

We add the transposes:

Step 5: Compare and

We observe that . Hence, the property is verified.

(ii) Verifying

Step 1: Calculate

We subtract the corresponding elements of matrices A and B:

Step 2: Calculate

We take the transpose of the resulting matrix by interchanging rows and columns:

Step 3: Calculate

We subtract the transposes:

Step 4: Compare and

We observe that . Hence, the property is verified.

ANSWER

Question 3

QUESTION

If

A' = \beginbmatrix 3 & 4 \\ -1 & 2 \\ 0 & 1 \endbmatrix \quad \textand \quad B = \beginbmatrix -1 & 2 & 1 \\ 1 & 2 & 3 \endbmatrix

then verify that

(i) (A + B)' = A' + B'

(ii) (A - B)' = A' - B'

SOLUTION

This question asks us to verify two properties of matrix transposes: that the transpose of a sum (or difference) of matrices is equal to the sum (or difference) of their transposes. We will first find matrix A, then compute both sides of the equations and show they are equal.

(i) Verify

Step 1: Find matrix A

Since we are given , we can find by taking the transpose of :

Step 2: Calculate

Step 3: Calculate

Step 4: Calculate

First, find :

Then, add and :

Step 5: Compare and

We see that . Thus, the property is verified.

(ii) Verify

Step 1: Calculate

Step 2: Calculate

Step 3: Calculate

Step 4: Compare and

We see that . Thus, the property is verified.

ANSWER

Question 4

QUESTION

If

A' = \beginbmatrix -2 & 3 \\ 1 & 2 \endbmatrix \quad \textand \quad B = \beginbmatrix -1 & 0 \\ 1 & 2 \endbmatrix

then find (A + 2B)'.

SOLUTION

We are given the transpose of matrix A, denoted as , and matrix B. We need to find the transpose of the matrix , denoted as .

Step 1: Find matrix A from its transpose

Since is given, we can find A by taking the transpose of again. The transpose of a transpose gives the original matrix.

Step 2: Calculate 2B

Multiply each element of matrix B by 2:

Step 3: Calculate A + 2B

Add the corresponding elements of matrix A and 2B:

Step 4: Calculate (A + 2B)'

Take the transpose of the resulting matrix . This means interchanging rows and columns.

Final Answer:

ANSWER

(A + 2B)' = \beginbmatrix -4 & 5 \\ 1 & 6 \endbmatrix

Question 5

QUESTION

For the matrices A and B, verify that (AB)' = B'A', where

(i) A = \beginbmatrix 1 \\ -4 \\ 3 \endbmatrix,\; B = \beginbmatrix -1 & 2 & 1 \endbmatrix

(ii) A = \beginbmatrix 0 \\ 1 \\ 2 \endbmatrix,\; B = \beginbmatrix 1 & 5 & 7 \endbmatrix

SOLUTION

This question asks us to verify the property that the transpose of the product of two matrices, , is equal to the product of their transposes in reverse order, . We will verify this for two given pairs of matrices and .

(i)

Step 1: Calculate AB

Step 2: Calculate (AB)'

Step 3: Calculate A' and B'

Step 4: Calculate B'A'

Step 5: Verify (AB)' = B'A'

We see that . Hence verified.

(ii)

Step 1: Calculate AB

Step 2: Calculate (AB)'

Step 3: Calculate A' and B'

Step 4: Calculate B'A'

Step 5: Verify (AB)' = B'A'

We see that . Hence verified.

In both cases, we have verified that .

ANSWER

Question 6

QUESTION

If

(i) A = \beginbmatrix \cosα & \sinα \\ -\sinα & \cosα \endbmatrix, then verify that A'A = I.

(ii) If A = \beginbmatrix \sinα & \cosα \\ -\cosα & \sinα \endbmatrix, then verify that A'A = I.

SOLUTION

This question tests our understanding of matrix transpose and matrix multiplication, and the definition of an identity matrix.

(i) Given , we need to verify that .

Step 1: Find the transpose of matrix A, denoted as A'

The transpose of a matrix is obtained by interchanging its rows and columns.

Therefore, .

Step 2: Multiply A' and A

We need to compute :

Step 3: Simplify using trigonometric identities

We know that and .

Therefore,

Step 4: Recognize the identity matrix

The resulting matrix is the 2x2 identity matrix, denoted as .

Thus, .

(ii) Given , we need to verify that .

Step 1: Find the transpose of matrix A, denoted as A'

The transpose of a matrix is obtained by interchanging its rows and columns.

Therefore, .

Step 2: Multiply A' and A

We need to compute :

Step 3: Simplify using trigonometric identities

We know that and .

Therefore,

Step 4: Recognize the identity matrix

The resulting matrix is the 2x2 identity matrix, denoted as .

Thus, .

ANSWER

Question 7

QUESTION

(i) Show that the matrix

A = \beginbmatrix 1 & -1 & 5 \\ -1 & 2 & 1 \\ 5 & 1 & 3 \endbmatrix

is a symmetric matrix.

(ii) Show that the matrix

A = \beginbmatrix 0 & 1 & -1 \\ -1 & 0 & 1 \\ 1 & -1 & 0 \endbmatrix

is a skew symmetric matrix.

SOLUTION

This question tests our understanding of symmetric and skew-symmetric matrices. We need to show that the given matrices satisfy the conditions for each type.

(i) To show that the matrix is a symmetric matrix:

Step 1: Recall the definition of a symmetric matrix

A matrix is symmetric if it is equal to its transpose, i.e., . This means that the element in the th row and th column is equal to the element in the th row and th column, or for all and .

Step 2: Find the transpose of matrix

Given matrix :

The transpose is obtained by interchanging rows and columns:

Step 3: Compare and

We observe that .

Step 4: Conclude

Since , the given matrix is a symmetric matrix.

(ii) To show that the matrix is a skew-symmetric matrix:

Step 1: Recall the definition of a skew-symmetric matrix

A matrix is skew-symmetric if it is equal to the negative of its transpose, i.e., . This means that for all and . Also, the diagonal elements of a skew-symmetric matrix are always zero.

Step 2: Find the transpose of matrix

Given matrix :

The transpose is obtained by interchanging rows and columns:

Step 3: Find

Step 4: Compare and

We observe that .

Step 5: Conclude

Since , the given matrix is a skew-symmetric matrix.

ANSWER

Question 8

QUESTION

For the matrix A = \beginbmatrix 1 & 5 \\ 6 & 7 \endbmatrix, verify that

(i) (A + A') is a symmetric matrix

(ii) (A - A') is a skew symmetric matrix

SOLUTION

This question requires us to verify two properties of matrices: that the sum of a matrix and its transpose is symmetric, and the difference between a matrix and its transpose is skew-symmetric. We will compute , , and , and then check their symmetry.

(i) Verifying that is a symmetric matrix

Step 1: Find the transpose of matrix A

The transpose of a matrix , denoted as , is obtained by interchanging its rows and columns. Given , its transpose is:

Step 2: Calculate

To find , we add the corresponding elements of matrices and :

Step 3: Check if is symmetric

A matrix is symmetric if it is equal to its transpose. Let's find the transpose of :

Since , the matrix is symmetric.

(ii) Verifying that is a skew-symmetric matrix

Step 1: Calculate

To find , we subtract the corresponding elements of matrices from :

Step 2: Check if is skew-symmetric

A matrix is skew-symmetric if its transpose is equal to its negative. Let's find the transpose of :

Now, let's find the negative of :

Since , the matrix is skew-symmetric.

ANSWER

Question 9

QUESTION

Find (1)/(2)(A + A') and (1)/(2)(A - A'), when

A = \beginbmatrix 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \endbmatrix

SOLUTION

This question tests our understanding of matrix transpose and basic matrix operations like addition and scalar multiplication. We need to find and for the given matrix .

Step 1: Find the transpose of matrix A, denoted as A'

The transpose of a matrix is obtained by interchanging its rows and columns. Given

Then, the transpose is:

Step 2: Calculate A + A'

To add two matrices, we add their corresponding elements:

Step 3: Calculate

Multiply the resulting matrix by the scalar :

Step 4: Calculate A - A'

To subtract two matrices, we subtract their corresponding elements:

Step 5: Calculate

Multiply the resulting matrix by the scalar :

Final Answer:

ANSWER

(1)/(2)(A + A') = \beginbmatrix 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \endbmatrix

(1)/(2)(A - A') = \beginbmatrix 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \endbmatrix

Question 10

QUESTION

Express the following matrices as the sum of a symmetric and a skew symmetric matrix:

(i) $\begin{bmatrix} 3 & 5 \\ 1 & -1 \end{bmatrix}$

(ii) $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

(iii) $\begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$

(iv) $\begin{bmatrix} 1 & 5 \\ -1 & 2 \end{bmatrix}$

SOLUTION

This question tests our understanding of symmetric and skew-symmetric matrices and how to decompose a given matrix into their sum.

A matrix is symmetric if , and a matrix is skew-symmetric if . Any square matrix can be expressed as the sum of a symmetric and a skew-symmetric matrix as follows:

(i) Let .

Step 1: Find the transpose of , denoted as .

Step 2: Calculate .

Step 3: Calculate .

Step 4: Express as the sum of and .

(ii) Let .

Notice that is already a symmetric matrix, since .

Step 1: Find the transpose of , denoted as .

Step 2: Calculate .

Step 3: Calculate .

Step 4: Express as the sum of and .

(iii) Let .

Step 1: Find the transpose of , denoted as .

Step 2: Calculate .

Step 3: Calculate .

Step 4: Express as the sum of and .

(iv) Let .

Step 1: Find the transpose of , denoted as .

Step 2: Calculate .

Step 3: Calculate .

Step 4: Express as the sum of and .

ANSWER

(i) A = \beginbmatrix 3 & 3 \\ 3 & -1 \endbmatrix + \beginbmatrix 0 & 2 \\ -2 & 0 \endbmatrix

(ii) A = \beginbmatrix 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \endbmatrix + \beginbmatrix 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \endbmatrix

(iii) A = \beginbmatrix 3 & (1)/(2) & -(5)/(2) \\ (1)/(2) & -2 & -2 \\ -(5)/(2) & -2 & 2 \endbmatrix + \beginbmatrix 0 & (5)/(2) & (3)/(2) \\ -(5)/(2) & 0 & 3 \\ -(3)/(2) & -3 & 0 \endbmatrix

(iv) A = \beginbmatrix 1 & 2 \\ 2 & 2 \endbmatrix + \beginbmatrix 0 & 3 \\ -3 & 0 \endbmatrix

Question 11

QUESTION

Choose the correct answer.

If A, B are symmetric matrices of same order, then AB - BA is a

SOLUTION

We are given that and are symmetric matrices of the same order and asked to determine the nature of the matrix .

Step 1: Recall the definition of a symmetric matrix

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

Step 2: Recall the definition of a skew-symmetric matrix

A matrix is skew-symmetric if .

Step 3: Find the transpose of

We need to find . Using the properties of transpose, we have:

Step 4: Apply the transpose property

Step 5: Use the fact that and are symmetric, i.e., and

Step 6: Analyze the result

We found that . This means that the matrix is skew-symmetric.

Final Answer: Skew symmetric matrix

Conclusion: The matrix is skew-symmetric because its transpose is equal to its negative. The other options are incorrect because: A symmetric matrix would have a transpose equal to itself. A zero matrix would require AB = BA, which is not generally true for symmetric matrices. An identity matrix is a special case and not generally true for AB - BA.

ANSWER

0

Question 12

QUESTION

Choose the correct answer.

If A = \beginbmatrix \cosα & -\sinα \\ \sinα & \cosα \endbmatrix, and A + A' = I, then the value of α is

SOLUTION

This question tests our understanding of matrix transpose, matrix addition, and trigonometric equations.

Step 1: Find the transpose of matrix A

The transpose of a matrix is obtained by interchanging its rows and columns. Therefore, the transpose of , denoted as , is:

Step 2: Add A and A'

We are given that , where is the identity matrix. So,

Adding the matrices, we get:

Step 3: Equate the corresponding elements

From the above matrix equation, we can equate the corresponding elements. This gives us:

Step 4: Solve for

Dividing both sides by 2, we get:

We need to find the value of for which . We know that .

Therefore, .

Final Answer: The value of is .

Option is incorrect because .

Option is incorrect because .

Option is incorrect because .

ANSWER

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Key Formulas

Important Formulas for Exercise 3.3

Formula / Concept	Description
Transpose of a Matrix	The matrix obtained by interchanging the rows and columns of a given matrix A is called its transpose, denoted by A' or A^T. If A = [a_ij] is an m × n matrix, then A' = [a_ji] is an n × m matrix.
Properties of Transpose	For any matrices A and B of suitable orders, we have: • (A')' = A • (kA)' = kA', where k is any constant. • (A + B)' = A' + B' • (AB)' = B'A' (Reversal Law)
Symmetric Matrix	A square matrix A is said to be symmetric if A' = A. This means that a_ij = a_ji for all possible values of i and j.
Skew-Symmetric Matrix	A square matrix A is said to be skew-symmetric if A' = -A. This implies that a_ij = -a_ji for all i and j. Consequently, all the diagonal elements of a skew-symmetric matrix are zero.
Theorem 1	For any square matrix A with real number entries, A + A' is a symmetric matrix and A - A' is a skew-symmetric matrix.
Theorem 2	Any square matrix can be expressed as the sum of a symmetric and a skew-symmetric matrix. If A is a square matrix, then we can write: A = (1)/(2)(A + A') + (1)/(2)(A - A') where (1)/(2)(A + A') is a symmetric matrix and (1)/(2)(A - A') is a skew-symmetric matrix.
Properties of Matrix Multiplication	• **Associative Law:** (AB)C = A(BC) • **Distributive Law:** A(B+C) = AB + AC and (A+B)C = AC + BC • **Existence of Multiplicative Identity:** For every square matrix A, there is an identity matrix I of the same order such that IA = AI = A.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.3?

NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.3 contains exactly 12 questions. These questions focus on transpose of matrices and their properties, covering matrix multiplication properties and symmetric/skew-symmetric matrices. All 12 questions are important 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 3.3 with step by step solutions?

You can download free PDF of NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.3 from the official NCERT website or various educational portals offering step by step solutions. These PDFs are updated according to CBSE syllabus 2025-26 and include detailed explanations of transpose properties and matrix multiplication. Ensure you download from reliable sources for accurate solutions.

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

Chapter 3 Matrices carries approximately 5 marks in CBSE Class 12 Maths board exam 2025-26 as part of Unit II - Algebra. This weightage is shared with other algebra topics, making Exercise 3.3 questions on transpose of matrices and matrix multiplication properties crucial for scoring. Students should practice all 12 questions thoroughly for board exam preparation.

Q4. Which is the most difficult question in NCERT Solutions Class 12 Maths Chapter 3 Matrices Exercise 3.3 for CBSE board exam?

Questions 10, 11, and 12 in NCERT Solutions Class 12 Maths Chapter 3 Matrices Exercise 3.3 are considered most difficult as they involve proving properties of transpose and symmetric/skew-symmetric matrices. These questions require strong understanding of matrix multiplication properties and algebraic manipulation. Step by step solutions help students master these challenging problems for CBSE board exam 2025-26.

Q5. What are Matrix Multiplication Properties covered in NCERT Solutions for Class 12 Maths Chapter 3 Exercise 3.3?

NCERT Solutions for Class 12 Maths Chapter 3 Exercise 3.3 covers key matrix multiplication properties including (AB)^T = B^T A^T, non-commutativity of matrix multiplication, and associative properties. Students learn how transpose operations interact with matrix products through 12 practice questions. These properties are fundamental for CBSE Class 12 board exam 2025-26 and competitive exams.

📚 More Exercises

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