

NCERT Solutions Class 12 Maths

Chapter 3: Matrices

Exercise 3.2

Document Information:

Class: 12 | Subject: Mathematics | Chapter: 3 | Exercise: 3.2

Total Questions: 22 | Academic Year: 2025-26

Source: www.ncertbooks.net | Generated: February 21, 2026

Quick Summary: In NCERT Solutions Class 12 Maths Chapter 3 Exercise 3.2, students learn fundamental operations on matrices including addition, subtraction, multiplication, and scalar multiplication. This exercise covers essential matrix operation properties and computational techniques that form the foundation for advanced linear algebra concepts frequently tested in CBSE board exams and competitive entrance tests.

Key Takeaways:

- Matrix addition and subtraction: $(A + B)_{ij} = A_{ij} + B_{ij}$ for matrices of same order
- Scalar multiplication properties: $k(A + B) = kA + kB$ and associative law $(kl)A = k(lA)$
- Matrix multiplication rules: $(AB)_{ij} = \sum_{k=1}^n A_{ik} \cdot B_{kj}$ where number of columns in first matrix equals rows in second
- Transpose properties: $(A + B)^T = A^T + B^T$ and $(AB)^T = B^T A^T$

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Question 1

QUESTION

Let

$A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$; $B = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$; $C = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$

Find each of the following:

- (i) $A + B$
- (ii) $A - B$
- (iii) $3A - C$
- (iv) AB
- (v) BA

SOLUTION

This question tests our understanding of basic matrix operations: addition, subtraction, and multiplication. We need to perform these operations on the given matrices A, B, and C.

(i) Find

To add two matrices, we add the corresponding elements.

Step 1: Add the corresponding elements

...

Step 2: Form the resulting matrix

(ii) Find

To subtract two matrices, we subtract the corresponding elements.

Step 1: Subtract the corresponding elements

...

Step 2: Form the resulting matrix

(iii) Find

First, we multiply matrix A by the scalar 3. Then, we subtract matrix C from the result.

Step 1: Calculate

Step 2: Subtract C from

Step 3: Subtract the corresponding elements

, , ,

Step 4: Form the resulting matrix

(iv) Find

To multiply two matrices, we take the dot product of rows of the first matrix with the columns of the second matrix.

Step 1: Calculate the elements of the resulting matrix

Step 2: Form the resulting matrix

(v) Find

Step 1: Calculate the elements of the resulting matrix

Step 2: Form the resulting matrix

ANSWER

(i) $A + B = \begin{bmatrix} 3 & 7 \\ 1 & 7 \end{bmatrix}$

(ii) $A - B = \begin{bmatrix} 1 & 1 \\ 5 & -3 \end{bmatrix}$

(iii) $3A - C = \begin{bmatrix} 8 & 7 \\ 6 & 2 \end{bmatrix}$

(iv) $AB = \begin{bmatrix} -6 & 26 \\ -1 & 19 \end{bmatrix}$

(v) $BA = \begin{bmatrix} 11 & 10 \\ 11 & 2 \end{bmatrix}$

Question 2

QUESTION

Compute the following:

(i) $\begin{bmatrix} a & b \\ -b & a \end{bmatrix} + \begin{bmatrix} a & b \\ b & a \end{bmatrix}$

(ii) $\begin{bmatrix} a^2+b^2 & b^2+c^2 \\ a^2+c^2 & a^2+b^2 \end{bmatrix} + \begin{bmatrix} 2ab & 2bc \\ -2ac & -2ab \end{bmatrix}$

(iii) $\begin{bmatrix} -1 & 4 & -6 \\ 8 & 5 & 16 \\ 2 & 8 & 5 \end{bmatrix} + \begin{bmatrix} 12 & 7 & 6 \\ 8 & 0 & 5 \\ 3 & 2 & 4 \end{bmatrix}$

(iv) $\begin{bmatrix} \cos^2 x & \sin^2 x \\ \sin^2 x & \cos^2 x \end{bmatrix} + \begin{bmatrix} \sin^2 x & \cos^2 x \\ \cos^2 x & \sin^2 x \end{bmatrix}$

SOLUTION

This question tests the understanding of matrix addition, where corresponding elements of the matrices are added together. We need to perform the addition for each of the four given pairs of matrices.

(i)

Step 1: Add corresponding elements

We add the matrices element-wise:

Step 2: Simplify

Final Answer:

(ii)

Step 1: Add corresponding elements

Step 2: Recognize perfect square trinomials

We can rewrite the elements using the formulas and .

Final Answer:

(iii)

Step 1: Add corresponding elements

Step 2: Simplify

Final Answer:

(iv)

Step 1: Add corresponding elements

Step 2: Use the trigonometric identity

Recall the trigonometric identity:

Final Answer:

ANSWER

(i) $\begin{bmatrix} 2a & 2b \\ 0 & 2a \end{bmatrix}$

(ii) $\begin{bmatrix} (a+b)^2 & (b+c)^2 \\ (a-c)^2 & (a-b)^2 \end{bmatrix}$

(iii) $\begin{bmatrix} 11 & 11 & 0 \\ 16 & 5 & 21 \\ 5 & 10 & 9 \end{bmatrix}$

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

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Question 3

QUESTION

Compute the indicated products.

(i) $\begin{bmatrix} a & b \\ -b & a \end{bmatrix} \begin{bmatrix} a & b \\ b & a \end{bmatrix}$

(ii) $\begin{bmatrix} 1 & 2 & 3 \end{bmatrix} \begin{bmatrix} 2 & 3 & 4 \end{bmatrix}$

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

(iv) $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 1 & -3 & 5 \\ 0 & 2 & 4 \\ 3 & 0 & 5 \end{bmatrix}$

(v) $\begin{bmatrix} 2 & 1 \\ 3 & 2 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 1 \\ -1 & 2 & 1 \end{bmatrix}$

(vi) $\begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 2 & -3 \\ 1 & 0 \\ 3 & 1 \end{bmatrix}$

SOLUTION

This question tests our ability to perform matrix multiplication. We need to multiply the given matrices in each sub-part.

(i)

Step 1: Multiply the matrices

We multiply the rows of the first matrix by the columns of the second matrix:

Step 2: Simplify

Final Answer:

(ii)

Step 1: Multiply the matrices

Here, we multiply the column matrix by the row matrix:

Step 2: Simplify

Final Answer:

(iii)

Step 1: Multiply the matrices

Step 2: Simplify

Final Answer:

(iv)

Step 1: Multiply the matrices

Step 2: Simplify

Final Answer:

(v)

Step 1: Multiply the matrices

Step 2: Simplify

Final Answer:

(vi)

Step 1: Multiply the matrices

Step 2: Simplify

Final Answer:

ANSWER

(i) $\begin{bmatrix} a^2+b^2 & 0 \\ 0 & a^2+b^2 \end{bmatrix}$

(ii) $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 6 & 8 \\ 6 & 9 & 12 \end{bmatrix}$

(iii) $\begin{bmatrix} -3 & -4 & 1 \\ 8 & 13 & 9 \end{bmatrix}$

(iv) $\begin{bmatrix} 14 & 0 & 42 \\ 18 & -1 & 56 \\ 22 & -2 & 70 \end{bmatrix}$

(v) $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 5 \\ -2 & 2 & 0 \end{bmatrix}$

(vi) $\begin{bmatrix} 14 & -6 \\ 4 & 5 \end{bmatrix}$

Question 4

QUESTION

If

$A = \begin{bmatrix} 1 & 2 & -3 \\ 5 & 0 & 2 \\ 1 & -1 & 1 \end{bmatrix}$; $B = \begin{bmatrix} 3 & -1 & 2 \\ 4 & 2 & 5 \\ 2 & 0 & 3 \end{bmatrix}$; $C = \begin{bmatrix} 4 & 1 & 2 \\ 0 & 3 & 2 \\ 1 & -2 & 3 \end{bmatrix}$

then compute $(A + B)$ and $(B - C)$. Also, verify that $A + (B - C) = (A + B) - C$.

SOLUTION

This question tests the understanding of matrix addition and subtraction, and the associative property of matrix addition.

Step 1: Compute

To add two matrices, we add the corresponding elements.

Step 2: Compute

To subtract two matrices, we subtract the corresponding elements.

Step 3: Compute

Step 4: Compute

Step 5: Verify

Since and , we have verified that .

Final Answer:

ANSWER

$$A + B = \begin{bmatrix} 4 & 1 & -1 \\ 9 & 2 & 7 \\ 3 & -1 & 4 \end{bmatrix}$$

$$B - C = \begin{bmatrix} -1 & -2 & 0 \\ 4 & -1 & 3 \\ 1 & 2 & 0 \end{bmatrix}$$

Question 5

QUESTION

If

$A = \begin{bmatrix} \frac{2}{3} & 1 & \frac{5}{3} \\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3} \\ \frac{7}{3} & 2 & \frac{2}{3} \end{bmatrix}$,
 $B = \begin{bmatrix} \frac{2}{5} & \frac{3}{5} & 1 \\ \frac{1}{5} & \frac{2}{5} & \frac{4}{5} \\ \frac{7}{5} & \frac{6}{5} & \frac{2}{5} \end{bmatrix}$

then compute $3A - 5B$.

SOLUTION

We are asked to compute given the matrices and . This involves scalar multiplication and matrix subtraction.

Step 1: Calculate

Multiply each element of matrix by 3:

Step 2: Calculate

Multiply each element of matrix by 5:

Step 3: Calculate

Subtract the matrix from the matrix :

Final Answer:

ANSWER

$$3A - 5B = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Question 6

QUESTION

Simplify

$$\cos\theta \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} + \sin\theta \begin{bmatrix} \sin\theta & -\cos\theta \\ \cos\theta & \sin\theta \end{bmatrix}.$$

SOLUTION

We are asked to simplify the given expression involving trigonometric functions and matrices.

Step 1: Distribute the scalars

First, we multiply each matrix by its respective scalar:

and

Step 2: Add the resulting matrices

Now, we add the two matrices obtained in Step 1:

Step 3: Simplify using trigonometric identities

We know that $\cos^2\theta + \sin^2\theta = 1$ and $-\sin\theta\cos\theta + \cos\theta\sin\theta = 0$. Therefore,

Final Answer:

The simplified expression is $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

ANSWER

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Question 7

QUESTION

Find X and Y, if

(i) $X + Y = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$ and $X - Y = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$

(ii) $2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and $3X + 2Y = \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$

SOLUTION

This question involves solving for matrices and given two sets of matrix equations. We will use methods similar to solving simultaneous equations in algebra.

(i) Given: and

Step 1: Add the two equations

Adding the two equations eliminates :

Step 2: Solve for

Divide both sides by 2:

Step 3: Substitute into one of the original equations to solve for

Using the first equation, :

Answer:

(ii) Given: and

Step 1: Multiply the first equation by 3 and the second equation by 2

This will allow us to eliminate :

Step 2: Subtract the second modified equation from the first

Step 3: Solve for

Divide both sides by 5:

Step 4: Substitute into one of the original equations to solve for

Using the first equation, :

Step 5: Solve for

Divide both sides by 2:

Answer:

ANSWER

(i) $X = \begin{bmatrix} 5 & 0 \\ 1 & 4 \end{bmatrix}$; $Y = \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}$

(ii) $X = \begin{bmatrix} (2)/(5) & -(12)/(5) \\ -(11)/(5) & 3 \end{bmatrix}$; $Y = \begin{bmatrix} (2)/(5) & (13)/(5) \\ (14)/(5) & -2 \end{bmatrix}$

Question 8

QUESTION

Find X, if $Y = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ and $2X + Y = \begin{bmatrix} 1 & 0 \\ -3 & 2 \end{bmatrix}$.

SOLUTION

We are given matrix and the equation . We need to find matrix .

Step 1: Isolate

We have the equation . To isolate , we subtract from both sides of the equation:

Step 2: Substitute the value of

We are given that . Substituting this into the equation, we get:

Step 3: Perform the matrix subtraction

To subtract two matrices, we subtract the corresponding elements:

Step 4: Solve for

Now we have . To find , we divide both sides of the equation by 2, which is equivalent to multiplying by :

Step 5: Perform scalar multiplication

Multiply each element of the matrix by :

Final Answer:

ANSWER

$X = \begin{bmatrix} -1 & -1 \\ -2 & -1 \end{bmatrix}$

Question 9

QUESTION

Find x and y , if

$$2\begin{bmatrix} 1 & 3 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}.$$

SOLUTION

We are asked to find the values of x and y given a matrix equation. This question tests our understanding of matrix addition and scalar multiplication.

Step 1: Perform scalar multiplication

Multiply the first matrix by the scalar 2:

Step 2: Perform matrix addition

Add the resulting matrix to the second matrix:

Step 3: Equate the matrices

Now, equate the resulting matrix with the matrix on the right-hand side of the equation:

Step 4: Solve for x and y

By comparing the corresponding elements of the matrices, we get two equations:

Equation 1:

Equation 2:

Solving Equation 1 for x :

Solving Equation 2 for y :

Final Answer:

ANSWER

$$x = 3, y = 3$$

Question 10

QUESTION

Solve the equation for x , y , z and t , if

$$2\begin{bmatrix} x & z \\ y & t \end{bmatrix} + 3\begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix} = 3\begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix}.$$

SOLUTION

We are given a matrix equation and asked to solve for the unknowns, and .

Step 1: Write out the given equation

The given equation is:

Step 2: Perform scalar multiplication on each matrix

Multiply each element of the matrices by their respective scalars:

Step 3: Combine the matrices on the left-hand side

Add the corresponding elements of the two matrices on the left:

Step 4: Equate corresponding elements of the matrices

Since the matrices are equal, their corresponding elements must be equal. This gives us the following equations:

...

Step 5: Solve each equation for the unknowns

Solving for :

, so

Solving for :

, so

Solving for :

, so

Solving for :

, so

Final Answer:

ANSWER

$$x = 3, y = 6, z = 9, t = 6$$

Question 11

QUESTION

If $x \begin{bmatrix} 2 \\ 3 \end{bmatrix} + y \begin{bmatrix} -1 \\ 1 \end{bmatrix} = \begin{bmatrix} 10 \\ 5 \end{bmatrix}$, find the values of x and y .

SOLUTION

This question involves solving a system of linear equations using matrix representation. We need to find the values of x and y that satisfy the given equation.

Step 1: Write the matrix equation explicitly

The given equation is:

Step 2: Perform scalar multiplication

Multiply the scalars x and y with their respective matrices:

Step 3: Add the matrices

Add the two matrices on the left-hand side:

Step 4: Formulate the system of linear equations

Equate the corresponding elements of the matrices to form a system of linear equations:

Step 5: Solve the system of equations

We can solve this system by adding the two equations to eliminate y :

Step 6: Substitute the value of x to find y

Substitute $x = 3$ into Equation 2:

Final Answer:

ANSWER

$$x = 3, y = -4$$

Question 12

QUESTION

Given

$3\begin{bmatrix} x & y \\ z & w \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2w \end{bmatrix} + \begin{bmatrix} 4 & x + y \\ z + w & 3 \end{bmatrix}$, find the values of x , y , z and w .

SOLUTION

We are given a matrix equation and asked to find the values of the variables and .

Step 1: Simplify the left-hand side (LHS) of the equation.

Multiply the scalar 3 with the matrix:

Step 2: Simplify the right-hand side (RHS) of the equation.

Add the two matrices:

Step 3: Equate the LHS and RHS.

Now we have:

Step 4: Form equations by equating corresponding elements.

We get the following equations:

Step 5: Solve the equations.

From , we have , so .

From , we have .

Substituting into , we get , so , and .

Substituting into , we get , so , and .

Final Answer:

ANSWER

$$x = 2, y = 4, z = 1, w = 3$$

Question 13

QUESTION

If

$$F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

show that $F(x)F(y) = F(x + y)$.

SOLUTION

We are asked to show that , where is a given matrix.

Step 1: Write down the matrices and

We have

Replacing with , we get

Step 2: Multiply and

Multiplying the matrices, we get:

Step 3: Use trigonometric identities

Recall the trigonometric identities:

Using these identities, we can rewrite the matrix as:

Step 4: Recognize the result as

The resulting matrix is exactly , since

Therefore, .

ANSWER

Question 14

QUESTION

Show that

(i) $\begin{pmatrix} 5 & -1 \\ 6 & 7 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix} \neq \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} 5 & -1 \\ 6 & 7 \end{pmatrix}$

(ii) $\begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{pmatrix} \begin{pmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 2 & 3 & 4 \end{pmatrix} \neq \begin{pmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 2 & 3 & 4 \end{pmatrix} \begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{pmatrix}$

SOLUTION

This question asks us to show that matrix multiplication is not commutative, meaning the order of multiplication matters. We need to compute the matrix products in both orders and show that the results are different.

(i) We need to show that

Step 1: Calculate the left-hand side (LHS)

Step 2: Calculate the right-hand side (RHS)

Step 3: Compare LHS and RHS

We see that

Therefore,

(ii) We need to show that

Step 1: Calculate the left-hand side (LHS)

Step 2: Calculate the right-hand side (RHS)

Step 3: Compare LHS and RHS

We see that

Therefore,

ANSWER

Question 15

QUESTION

Find $A^2 - 5A + 6I$, if

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$$

SOLUTION

We are asked to find the value of the expression, where A is a given matrix and I is the identity matrix.

Step 1: Calculate

First, we need to find A^2 , which is :

Step 2: Calculate

Now, we find $5A$:

Step 3: Calculate

Next, we find $6I$, where I is the 3×3 identity matrix:

Step 4: Calculate

Finally, we compute :

Final Answer:

ANSWER

$$A^2 - 5A + 6I = \begin{bmatrix} 1 & -1 & -3 \\ -1 & -1 & -10 \\ -5 & 4 & 4 \end{bmatrix}$$

Question 16

QUESTION

If

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

prove that $A^3 - 6A^2 + 7A + 2I = 0$.

SOLUTION

We are given a matrix and asked to prove that , where I is the identity matrix.

Step 1: Calculate

First, we need to find :

Step 2: Calculate

Now, we find :

Step 3: Calculate

Step 4: Calculate

Step 5: Calculate

Step 6: Calculate

Therefore, .

ANSWER

Question 17

QUESTION

If

$$A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}; I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

find k so that $A^2 = kA - 2I$.

SOLUTION

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

Step 1: Calculate

First, we need to find , which is :

Step 2: Calculate

Now, let's find :

Step 3: Equate and

We are given that , so we can equate the matrices:

Step 4: Solve for

By comparing the corresponding elements of the matrices, we can form equations to solve for . Let's use the element in the first row and second column:

Dividing both sides by -2:

We can check this value of with another element, say the element in the first row and first column:

This confirms that is the correct solution.

Final Answer:

ANSWER

$$k = 1$$

Question 18

QUESTION

If

$$A = \begin{bmatrix} 0 & -\tan\left(\frac{\alpha}{2}\right) \\ \tan\left(\frac{\alpha}{2}\right) & 0 \end{bmatrix}$$

and I is the identity matrix of order 2, show that

$$I + A = (I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}.$$

SOLUTION

We need to prove that given and is the identity matrix of order 2.

Step 1: Define the Identity Matrix and

The identity matrix of order 2 is given by:

And matrix is given by:

Step 2: Calculate

Step 3: Calculate

Step 4: Calculate

Let . Then, using trigonometric identities:

So, we have:

Step 5: Compare with

We see that:

Therefore, is proved.

ANSWER

Question 19

QUESTION

A trust fund has ₹30000 that must be invested in two different types of bonds. The first bond pays 5% interest per year, and the second bond pays 7% interest per year. Using matrix multiplication, determine how to divide ₹30000 among the two types of bonds. If the trust fund must obtain an annual total interest of:

(a) ₹1800

(b) ₹2000

SOLUTION

This question involves using matrix multiplication to determine how to divide an investment into two bonds with different interest rates to achieve a specific annual interest income.

Step 1: Define variables

Let x be the amount invested in the first bond (5% interest) and y be the amount invested in the second bond (7% interest). We know that the total investment is ₹30000, so:

Step 2: Express the problem in matrix form

We can represent the investment amounts as a row matrix and the interest rates as a column matrix. Let I be the desired total annual interest.

Step 3(a): Solve for an annual interest of ₹1800

In this case, $I = 1800$. So we have:

We also have $x + y = 30000$, so $y = 30000 - x$. Substituting this into the interest equation:

Then,

Answer (a): ₹15000 in the first bond and ₹15000 in the second bond.

Step 3(b): Solve for an annual interest of ₹2000

Now, $I = 2000$. So we have:

Again, $x + y = 30000$. Substituting this into the interest equation:

Then,

Answer (b): ₹15000 in the first bond and ₹15000 in the second bond.

ANSWER

(a) ₹15000, ₹15000

(b) ₹5000, ₹25000

Question 20

QUESTION

The bookshop of a particular school has 10 dozen chemistry books, 8 dozen physics books, 10 dozen economics books. Their selling prices are ₹80, ₹60 and ₹40 each respectively. Find the total amount the bookshop will receive from selling all the books using matrix algebra.

SOLUTION

This question involves using matrix algebra to calculate the total revenue from selling different types of books. We need to represent the quantities and prices as matrices and then perform matrix multiplication.

Step 1: Represent the quantities of books as a row matrix

First, convert the dozens into individual books:

Chemistry books:

Physics books:

Economics books:

Represent these quantities as a row matrix :

Step 2: Represent the prices of the books as a column matrix

The prices are given as for chemistry, for physics, and for economics. Represent these as a column matrix :

Step 3: Perform matrix multiplication

To find the total amount, multiply the quantity matrix by the price matrix :

Final Answer: The total amount the bookshop will receive is .

ANSWER

₹20160

Question 21

QUESTION

Assume X, Y, Z, W and P are matrices of order $2 \times n$; $3 \times k$; $2 \times p$; $n \times 3$ and $p \times k$, respectively. Choose the correct answer.

The restriction on n, k and p so that $PY + WY$ will be defined are:

- (A) $k = 3$; $p = n$
- (B) k is arbitrary, $p = 2$
- (C) p is arbitrary, $k = 3$
- (D) $k = 2$; $p = 3$

SOLUTION

We are given matrices and with orders and , respectively. We need to find the restrictions on and such that is defined.

Step 1: Analyze the condition for to be defined

For the product to be defined, the number of columns of must be equal to the number of rows of . The order of is and the order of is . Therefore, we must have .

Step 2: Analyze the condition for to be defined

For the product to be defined, the number of columns of must be equal to the number of rows of . The order of is and the order of is . Since the number of columns of is 3 and the number of rows of is 3, is defined regardless of the values of and .

Step 3: Analyze the condition for to be defined

For the sum to be defined, the matrices and must have the same order. The order of is and the order of is . Since , the order of is .

The order of is and the order of is . Since , the order of is .

For to be defined, we must have . This implies that .

Step 4: Conclusion

Therefore, the restrictions on and are and . This corresponds to option (A).

Final Answer: (A)

ANSWER

(A)

Question 22

QUESTION

Assume X , Y , Z , W and P are matrices of order $2 \times n$, $3 \times k$, $2 \times p$, $n \times 3$ and $p \times k$, respectively. Choose the correct answer.

If $n = p$, then the order of the matrix $7X - 5Z$ is:

- (A) $p \times 2$
- (B) $2 \times n$
- (C) $n \times 3$
- (D) $p \times n$

SOLUTION

We are given matrices and with orders and respectively. We are also given that . We need to find the order of the matrix .

Step 1: Understand Scalar Multiplication

When a matrix is multiplied by a scalar (like 7 or 5), the order of the matrix remains unchanged. Therefore, the order of is the same as the order of , which is . Similarly, the order of is the same as the order of , which is .

Step 2: Understand Matrix Subtraction

For matrix subtraction (or addition) to be possible, the matrices must have the same order. In other words, if we want to compute , the order of must be the same as the order of .

Step 3: Check if Subtraction is Possible

The order of is and the order of is . Since we are given that , we can say that the order of is also . Therefore, the matrices and have the same order, which is , and subtraction is possible.

Step 4: Determine the Order of the Resultant Matrix

When we subtract two matrices of the same order, the resultant matrix also has the same order. Therefore, the order of is .

Step 5: Conclusion

The order of the matrix is .

Therefore, the correct answer is (B).

ANSWER

(B)

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Key Formulas

Important Formulas for Exercise 3.2

Formula / Concept	Description
Matrix Addition	If $A = [a_{ij}]$ and $B = [b_{ij}]$ are two matrices of the same order, say $m \times n$, then their sum $A + B$ is a matrix of order $m \times n$ obtained by adding the corresponding elements of A and B . So, $A + B = [a_{ij} + b_{ij}]$.
Commutative Law of Addition	For any two matrices A and B of the same order, $A + B = B + A$.
Associative Law of Addition	For any three matrices A , B , and C of the same order, $(A + B) + C = A + (B + C)$.
Existence of Additive Identity	For any matrix A , there exists a zero matrix O of the same order such that $A + O = O + A = A$. The zero matrix O is the additive identity for matrix addition.
Existence of Additive Inverse	For any matrix A , there exists a matrix $-A$ of the same order such that $A + (-A) = (-A) + A = O$. The matrix $-A$ is the additive inverse of A .
Scalar Multiplication	If $A = [a_{ij}]$ is a matrix of order $m \times n$ and k is a scalar, then kA is another matrix of the same order obtained by multiplying each element of A by k . So, $kA = [ka_{ij}]$.
Properties of Scalar Multiplication	If A and B are two matrices of the same order, and k and l are scalars, then: 1. $k(A + B) = kA + kB$ 2. $(k + l)A = kA + lA$
Matrix Multiplication	The product of two matrices A and B is defined if the number of columns of A is equal to the number of rows of B . If $A = [a_{ij}]$ is an $m \times n$ matrix and $B = [b_{jk}]$ is an $n \times p$ matrix, then the product AB is an $m \times p$ matrix $C = [c_{ik}]$ where $c_{ik} = \sum_{j=1}^n a_{ij}b_{jk}$.
Associative Law of Multiplication	For any three matrices A , B , and C for which the product is defined, $(AB)C = A(BC)$.

Formula / Concept	Description
Distributive Law of Multiplication	For three matrices A, B, and C for which the operations are defined: 1. $A(B + C) = AB + AC$ 2. $(A + B)C = AC + BC$
Existence of Multiplicative Identity	For every square matrix A, there is an identity matrix I of the same order such that $IA = AI = A$.
Non-Commutativity of Multiplication	In general, if AB and BA are both defined, $AB \neq BA$.
Transpose of a Matrix	If $A = [a_{ij}]$ is an $m \times n$ matrix, then the transpose of A, denoted by A' or A^T , is an $n \times m$ matrix obtained by interchanging the rows and columns of A.
Properties of Transpose	For any matrices A and B of suitable orders, and any scalar k: 1. $(A^T)^T = A$ 2. $(kA)^T = kA^T$ 3. $(A + B)^T = A^T + B^T$ 4. $(AB)^T = B^T A^T$ (Reversal Law)

7 Top FAQs

Q1. How many questions are included in NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.2 for CBSE board exam 2025-26?

NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.2 contains exactly 22 questions. These questions cover important topics like matrix multiplication properties, transpose of matrices, and various operations on matrices which are crucial 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 3.2 with step by step solutions?

You can download free PDF of NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.2 from the official NCERT website or various educational portals offering step by step solutions. These PDFs are updated as per the latest CBSE syllabus 2025-26 and provide detailed explanations for all 22 questions covering matrix operations and multiplication properties.

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

Chapter 3 Matrices carries approximately 5 marks in CBSE Class 12 Maths board exam 2025-26 as part of Unit II - Algebra. The weightage is shared with other algebra topics, making Exercise 3.2 focusing on matrix multiplication properties and transpose properties essential for scoring well in the examination.

Q4. Which is the most difficult question in NCERT Solutions Class 12 Maths Chapter 3 Matrices Exercise 3.2 for students preparing for board exams?

Questions involving multiple matrix multiplications and verification of transpose properties (typically questions 18-22) are considered the most difficult in Exercise 3.2 of Class 12 Maths Chapter 3 Matrices. These questions require thorough understanding of matrix multiplication properties and careful step by step calculations to avoid errors in CBSE board exam 2025-26.

Q5. What are the matrix multiplication properties covered in NCERT Solutions for Class 12 Maths Chapter 3 Matrices Exercise 3.2?

Matrix multiplication properties in NCERT Class 12 Maths Chapter 3 Exercise 3.2 include associative property $[A(BC) = (AB)C]$, distributive property $[A(B+C) = AB+AC]$, and properties related to transpose of products $[(AB)' = B'A']$. Understanding these properties through step by step solutions is crucial for solving all 22 questions efficiently in CBSE board exam 2025-26.

More Exercises

Visit all exercises from Chapter 3:


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[Exercise 3.2 ✓ →](#)

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