NCERT Solutions Class 12 Maths
Chapter 4: Determinants
Exercise 4.1

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Quick Summary: In NCERT Solutions Class 12 Maths Chapter 4 Exercise 4.1, students learn fundamental concepts of determinants including evaluation of 2×2 and 3×3 matrices using expansion methods. This exercise covers essential determinant properties, scalar multiplication effects, and evaluation techniques with algebraic and trigonometric expressions, which form the foundation for advanced topics like Cramer's rule in CBSE board exams.

Key Takeaways:

- For a 2×2 matrix, \beginvmatrix a & b \\ c & d \endvmatrix = ad - bc
- Scalar multiplication property: |kA| = k^n|A| where n is the order of matrix A
- 3×3 determinants can be evaluated using cofactor expansion along any row or column
- Determinants involving trigonometric functions require careful application of trigonometric identities

Complete Solutions

Question 1

QUESTION

Evaluate the determinant:

\left| \beginmatrix 2 & 4 \\ -5 & -1 \endmatrix \right|

SOLUTION

We are asked to evaluate the determinant of a 2x2 matrix.

Step 1: Recall the formula for the determinant of a 2x2 matrix.

For a matrix , the determinant is given by .

Step 2: Identify the elements of the given matrix.

In our case, the matrix is . So, we have:

, , , and .

Step 3: Apply the formula.

The determinant is .

Step 4: Calculate the products.

Step 5: Substitute the products back into the expression.

The determinant is .

Step 6: Simplify the expression.

Therefore, the determinant of the given matrix is 18.

Final Answer: 18

ANSWER

18

Question 2

QUESTION

Evaluate the determinants:

(i) \left| \beginmatrix \cosθ & -\sinθ \\ \sinθ & \cosθ \endmatrix \right|

(ii) \left| \beginmatrix x^2 - x + 1 & x - 1 \\ x + 1 & x + 1 \endmatrix \right|

SOLUTION

This question asks us to evaluate two determinants. The first involves trigonometric functions, and the second involves algebraic expressions. We will use the formula for the determinant of a 2x2 matrix: .

(i) Evaluate

Step 1: Apply the determinant formula

For a 2x2 matrix , the determinant is . In this case, , , , and .

So, the determinant is:

Step 2: Simplify the expression

Step 3: Use the trigonometric identity

We know that .

Final Answer: 1

(ii) Evaluate

Step 1: Apply the determinant formula

The determinant is .

Step 2: Expand the terms

Step 3: Substitute the expanded terms back into the determinant expression

Step 4: Simplify the expression

Final Answer:

ANSWER

(i) 1

(ii) x^3 - x^2 + 2

Question 3

QUESTION

If A = \beginbmatrix 1 & 2 \\ 4 & 2 \endbmatrix, then show that |2A| = 4|A|.

SOLUTION

This question tests our understanding of how scalar multiplication affects the determinant of a matrix. Specifically, it asks us to verify that for a 2x2 matrix A, .

Step 1: Calculate 2A

Given , we multiply each element of the matrix by 2:

Step 2: Calculate |2A|

The determinant of a 2x2 matrix is given by . Therefore:

Step 3: Calculate |A|

Now, we calculate the determinant of the original matrix A:

Step 4: Calculate 4|A|

Next, we multiply the determinant of A by 4:

Step 5: Compare |2A| and 4|A|

We found that and . Therefore:

Final Answer: We have shown that for the given matrix A.

ANSWER

Question 4

QUESTION

If A = \beginbmatrix 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \endbmatrix, then show that |3A| = 27|A|.

SOLUTION

This question tests our understanding of how scalar multiplication affects the determinant of a matrix. Specifically, it explores the property where is an matrix and is a scalar.

Step 1: Calculate |A|

We are given the matrix . Since A is an upper triangular matrix, its determinant is the product of its diagonal elements.

Step 2: Calculate 3A

Multiply the matrix by the scalar 3:

Step 3: Calculate |3A|

Since is also an upper triangular matrix, its determinant is the product of its diagonal elements:

Step 4: Calculate 27|A|

We know that , so:

Step 5: Compare |3A| and 27|A|

We found that and . Therefore, .

Final Answer: We have shown that .

Conclusion: This example illustrates the property that for an matrix , . In this case, and , so .

ANSWER

Question 5

QUESTION

Evaluate the determinants:

(i) $\left| \begin{matrix} 3 & -1 & -2 \\ 0 & 0 & -1 \\ 3 & -5 & 0 \end{matrix} \right|$

(ii) $\left| \begin{matrix} 3 & -4 & 5 \\ 1 & 1 & -2 \\ 2 & 3 & 1 \end{matrix} \right|$

(iii) $\left| \begin{matrix} 0 & 1 & 2 \\ -1 & 0 & -3 \\ -2 & 3 & 0 \end{matrix} \right|$

(iv) $\left| \begin{matrix} 2 & -1 & -2 \\ 0 & 2 & -1 \\ 3 & -5 & 0 \end{matrix} \right|$

SOLUTION

This question requires us to evaluate the determinant of four different 3x3 matrices. We will use the expansion method along a row or column to find the determinant in each case.

(i) Evaluate

Step 1: Expand along the second row (since it has two zeros, simplifying the calculation).

Where represents the cofactor of the element in the -th row and -th column.

Step 2: Calculate the cofactor .

Step 3: Substitute the cofactor back into the expression.

Therefore, the determinant is -12 (note the sign change because of the original -(-1)).

Final Answer: -12

(ii) Evaluate

Step 1: Expand along the first row.

Step 2: Calculate the cofactors.

Step 3: Substitute the cofactors back into the expression.

Final Answer: 46

(iii) Evaluate

Step 1: Expand along the first row.

Step 2: Calculate the cofactors.

Step 3: Substitute the cofactors back into the expression.

Final Answer: 0

(iv) Evaluate

Step 1: Expand along the first row.

Step 2: Calculate the cofactors.

Step 3: Substitute the cofactors back into the expression.

Final Answer: 5

ANSWER

(i) -12

(ii) 46

(iii) 0

(iv) 5

Question 6

QUESTION

If A = \beginbmatrix 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \endbmatrix, find |A|.

SOLUTION

We are asked to find the determinant of the matrix .

Step 1: Write down the matrix

The given matrix is:

Step 2: Calculate the determinant using the first row

We can calculate the determinant by expanding along the first row:

Step 3: Evaluate the 2x2 determinants

Now, we calculate each of the 2x2 determinants:

Step 4: Substitute the values back into the expression for |A|

Substituting these values back into the expression for , we get:

Final Answer:

ANSWER

0

Question 7

QUESTION

Find values of x, if

(i) $\left| \begin{matrix} 2 & 4 \\ 5 & 1 \end{matrix} \right| = \left| \begin{matrix} 2x & 4 \\ 6 & x \end{matrix} \right|$

(ii) $\left| \begin{matrix} 2 & 3 \\ 4 & 5 \end{matrix} \right| = \left| \begin{matrix} x & 3 \\ 2x & 5 \end{matrix} \right|$

SOLUTION

This question involves finding the values of by equating the determinants of two matrices. We need to compute the determinants on both sides and solve the resulting equation.

(i)

Step 1: Calculate the determinant of the first matrix

The determinant of the matrix is calculated as follows:

Step 2: Calculate the determinant of the second matrix

The determinant of the matrix is calculated as follows:

Step 3: Equate the determinants and solve for

We are given that the two determinants are equal. Therefore:

Add 24 to both sides:

Divide by 2:

Take the square root of both sides:

Therefore, the values of are and .

(ii)

Step 1: Calculate the determinant of the first matrix

The determinant of the matrix is calculated as follows:

Step 2: Calculate the determinant of the second matrix

The determinant of the matrix is calculated as follows:

Step 3: Equate the determinants and solve for

We are given that the two determinants are equal. Therefore:

Multiply both sides by -1:

Therefore, the value of is 2.

Final Answer:

(i)

(ii)

ANSWER

(i) $x = \pm \sqrt{3}$

(ii) $x = 2$

Question 8

QUESTION

If

$$\left| \begin{matrix} x & 2 \\ 18 & x \end{matrix} \right| = \left| \begin{matrix} 6 & 2 \\ 18 & 6 \end{matrix} \right|$$

then x is equal to

(A) 6

(B) ± 6

(C) -6

(D) 0

SOLUTION

We are given an equation involving determinants and asked to find the value of .

Step 1: Evaluate the determinant on the left-hand side (LHS)

The determinant of a 2x2 matrix is given by . Therefore, the LHS determinant is:

Step 2: Evaluate the determinant on the right-hand side (RHS)

Similarly, the RHS determinant is:

Step 3: Set up the equation

We are given that the two determinants are equal, so we have:

Step 4: Solve for

Add 36 to both sides of the equation:

Take the square root of both sides:

Final Answer:

Therefore, the correct option is (B).

Option (A) is incorrect because it only considers the positive root.

Option (C) is incorrect because it only considers the negative root.

Option (D) is incorrect because it doesn't satisfy the original equation.

ANSWER

(B)

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📐 Key Formulas

Important Formulas for Exercise 4.1

Formula / Concept	Description
Determinant of a 1x1 Matrix	For a square matrix A = [a] of order 1, the determinant is the number itself. $\|A\| = a$
Determinant of a 2x2 Matrix	For a square matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ of order 2, the determinant is calculated as: $\|A\| = ad - bc$
Determinant of a 3x3 Matrix (Expansion along the first row)	For a square matrix $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ of order 3, the determinant can be calculated by expanding along the first row: $\|A\| = a_{11} \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} - a_{12} \begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix} + a_{13} \begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}$
Value of a Determinant	To every square matrix A, we can associate a number (real or complex) called the determinant. It is denoted by $\|A\|$ or $\det(A)$. Only square matrices have determinants.
Condition for which determinant value is zero	If the corresponding elements of any two rows or columns of a determinant are identical or in proportion, then the value of the determinant is zero.

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 12 Maths Chapter 4 Determinants Exercise 4.1 for CBSE board exam 2025-26?

Exercise 4.1 of NCERT Solutions for Class 12 Maths Chapter 4 Determinants contains exactly 8 questions. These questions focus on fundamental concepts of determinants including evaluation of 2x2 and 3x3 determinants, and form an essential part of the CBSE Class 12 board exam 2025-26 syllabus under Unit II - Algebra.

Q2. Where can I download free PDF of NCERT Solutions for Class 12 Maths Chapter 4 Determinants Exercise 4.1 with step by step solutions?

You can download the free PDF of NCERT Solutions for Class 12 Maths Chapter 4 Determinants Exercise 4.1 from the official NCERT website or various educational platforms offering step by step solutions. These PDFs contain detailed explanations for all 8 questions and are updated according to the latest CBSE syllabus 2025-26, making them ideal for board exam preparation.

Q3. How many marks does Chapter 4 Determinants carry in CBSE Class 12 Maths board exam 2025-26 syllabus?

Chapter 4 Determinants carries 5 marks in the CBSE Class 12 Maths board exam 2025-26, as it is part of Unit II - Algebra. This weightage is shared with other topics in the Algebra unit, making NCERT Solutions for Class 12 Maths Chapter 4 Exercise 4.1 crucial for scoring well in the board examination.

Q4. Which is the most difficult question in Exercise 4.1 of NCERT Solutions Class 12 Maths Chapter 4 Determinants?

Question 8 in Exercise 4.1 of NCERT Solutions Class 12 Maths Chapter 4 Determinants is generally considered the most challenging as it involves complex applications of determinant properties. Students preparing for CBSE board exam 2025-26 should focus on step by step solutions for this question to master the concepts thoroughly.

Q5. What is Properties of Determinants covered in NCERT Solutions for Class 12 Maths Chapter 4 Exercise 4.1?

Properties of Determinants in NCERT Class 12 Maths Chapter 4 Exercise 4.1 include basic evaluation of determinants, understanding the order of determinants, and fundamental operations on determinants. These properties form the foundation for advanced topics like Cramer's Rule and are essential for CBSE Class 12 board exam 2025-26 preparation.

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