# Class 12 Maths Chapter 4: Determinants - Notes, Important Questions and MCQs (2026-27)

Free PDF notes from Nextoper.in | Session 2026-27 | Read online:
https://nextoper.in/class-12-maths-chapter-4-pdf-notes/

These Class 12 Maths Chapter 4 notes cover “Determinants” from the NCERT Mathematics Part I textbook (2026-27): determinants of order 2 and 3, area of a triangle, minors and cofactors, adjoint and inverse of a matrix, and solving systems of linear equations using the matrix method with consistency conditions – with formula tables, solved examples, Q&A, 10 MCQs and a free PDF.

Use the table of contents below to jump to the part you need, or read top to bottom for a complete revision of the chapter.

## Table of Contents

- Chapter Overview
- Important Topics and Concepts
- Solved Examples
- Key Determinant Results
- Important Definitions and Terms
- Short Answer Questions
- Long Answer Questions
- MCQs with Answers
- Quick Revision Points
- Chapter Summary
- Exam Tips and PYQ Pattern
- Frequently Asked Questions
- Conclusion

Want notes for every chapter? Explore the full Class 12 Maths notes on Nextoper, arranged book-wise and chapter-wise.

## Chapter Overview

Every square matrix A has a number associated with it called its determinant, written |A| or det A. For a 2 × 2 matrix [[a, b], [c, d]], |A| = ad – bc; a 3 × 3 determinant is expanded along any row or column using cofactors.

Determinants help find areas, test whether a matrix is invertible (|A| ≠ 0) and solve systems of linear equations through $X = A^{-1}B$, where $A^{-1} = (1/|A|)$ adj A.

## Important Topics and Concepts

### Determinant of a Matrix

- Order 1: |[a]| = a.

- Order 2: $|A| = a_{11}a_{22} - a_{12}a_{21}$.
- Order 3: expand along any row/column: $|A| = a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13}$.
- Choose the row/column with most zeros for easy expansion.
- Determinants are defined only for square matrices.

### Area of a Triangle

- Area = $\frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$.
- In determinant form: $\Delta = \frac{1}{2} |[[x_1, y_1, 1], [x_2, y_2, 1], [x_3, y_3, 1]]|$; take absolute value.
- Area = 0 ⇒ the three points are collinear.
- Used to find the equation of a line through two points.

### Minors and Cofactors

- Minor $M_{ij}$: determinant left after deleting row i and column j.
- Cofactor $A_{ij} = (-1)^{(i+j)} M_{ij}$.
- Sum of products of elements of a row with their own cofactors = $|A|$.
- Sum of products of elements of a row with cofactors of another row = 0.

### Adjoint and Inverse

- adj A = transpose of the cofactor matrix.
- A(adj A) = (adj A)A = $|A| I$.
- A is singular if $|A| = 0$, non-singular if $|A| \neq 0$.
- $A^{-1} = (1/|A|)$ adj A, exists only if $|A| \neq 0$.
- $|AB| = |A||B|$; $|kA| = k^n|A|$ for order n; $|\text{adj } A| = |A|^{n-1}$; $|A^{-1}| = 1/|A|$.

### Solving Linear Equations

- Write system as AX = B.
- If $|A| \neq 0$: unique solution $X = A^{-1}B$ (consistent).
- If $|A| = 0$ and (adj A)B ≠ O: no solution (inconsistent).
- If $|A| = 0$ and (adj A)B = O: infinitely many solutions or none – check further.
- Consistent system: has one or more solutions.

## Solved Examples

Board-pattern practice.

- Evaluate $|[[2, 4], [-5, -1]]|$. $-2 + 20 = 18$.
- Area of triangle with vertices (1, 0), (6, 0), (4, 3). $\frac{1}{2}|1(0 - 3) + 6(3 - 0) + 4(0 - 0)| = \frac{1}{2} \times 15 = 7.5$ sq units.
- Find adj A for A = [[1, 2], [3, 4]]. adj A = [[4, –2], [–3, 1]]; $|A| = -2$; $A^{-1}$ = [[–2, 1], [3/2, –1/2]].
- Solve 2x + 5y = 1, 3x + 2y = 7. $|A| = -11$; $X = A^{-1}B$ gives x = 3, y = –1.
- If $|A| = 3$ for a 3 × 3 matrix, find $|2A|$ and $|\text{adj } A|$. $|2A| = 8 \times 3 = 24$; $|\text{adj } A| = 3^2 = 9$.

## Key Determinant Results

| Result | Formula |
|---|---|
| 2 × 2 | ad – bc |
| Cofactor | $A_{ij} = (-1)^{(i+j)} M_{ij}$ |

| Result | Formula |
|---|---|
| Inverse | $A^{-1} = \text{adj } A / \lvert A \rvert$ |
| $\lvert kA \rvert$ | $k^n \lvert A \rvert$ |
| $\lvert AB \rvert$ | $\lvert A \rvert \lvert B \rvert$ |
| $\lvert \text{adj } A \rvert$ | $\lvert A \rvert^{n-1}$ |
| Area of triangle | $\frac{1}{2} \lvert \det[[x_1,y_1,1],[x_2,y_2,1],[x_3,y_3,1]] \rvert$ |

## Important Definitions and Terms

| Term | Meaning |
|---|---|
| Determinant | Number associated with a square matrix |
| Minor | Determinant after deleting a row and column |
| Cofactor | Signed minor |
| Adjoint | Transpose of cofactor matrix |
| Singular matrix | $\lvert A \rvert = 0$ |
| Non-singular matrix | $\lvert A \rvert \neq 0$ |
| Consistent system | Has at least one solution |
| Inconsistent system | Has no solution |
| Collinear points | Lie on one line; area zero |
| Matrix method | $X = A^{-1}B$ |

## Short Answer Questions

Q1. Evaluate |[[3, 1], [2, 4]]|.

12 – 2 = 10.

Q2. When is a matrix singular?

When its determinant is zero.

Q3. Define cofactor.

$A_{ij} = (-1)^{(i+j)} M_{ij}$.

Q4. Write the formula for $A^{-1}$.

$A^{-1} = (1/|A|) \text{ adj } A$, provided $|A| \neq 0$.

Q5. If A is 3 × 3 and |A| = 4, find |3A|.

27 × 4 = 108.

Q6. What does zero area of a triangle indicate?

The three points are collinear.

Q7. When does AX = B have a unique solution?

When $|A| \neq 0$.

Q8. What is A(adj A)?

## Long Answer Questions

Q1. Solve using matrix method: x + y + z = 6, y + 3z = 11, x – 2y + z = 0.

A = [[1,1,1],[0,1,3],[1,–2,1]], |A| = 9.

Find cofactors and adj A.

$X = A^{-1}B$ with $B = [6, 11, 0]^T$.

x = 1, y = 2, z = 3.

Verify by substitution.

Q2. Show that points (a, b + c), (b, c + a), (c, a + b) are collinear.

Write area determinant with columns x, y, 1.

Add column 1 to column 2: entries become a + b + c.

Take (a + b + c) common; two columns identical.

Determinant = 0.

Hence collinear.

Q3. Explain conditions for consistency of a system of linear equations.

Write AX = B.

$|A| \neq 0$: unique solution.

$|A| = 0$, (adj A)B ≠ O: inconsistent.

$|A| = 0$, (adj A)B = O: may have infinite solutions or none.

Check by substitution.

## MCQs with Answers

1. |[[2, 3], [1, 4]]| =(a) 5 (b) 11 (c) 8 (d) –5Answer: (a) 5

2. A is invertible iff(a) |A| = 0 (b) $|A| \neq 0$ (c) A is rectangular (d) A = I onlyAnswer: (b) $|A| \neq 0$

3. |kA| for 3 × 3 matrix(a) k|A| (b) $k^2|A|$ (c) $k^3|A|$ (d) 3k|A|Answer: (c) $k^3|A|$

4. |adj A| for order n(a) |A| (b) $|A|^n$ (c) $|A|^{n-1}$ (d) n|A|Answer: (c) $|A|^{n-1}$

5. Cofactor $A_{12}$ =(a) $M_{12}$ (b) $-M_{12}$ (c) 0 (d) $M_{21}$Answer: (b) $-M_{12}$

6. Area zero means points are(a) vertices (b) collinear (c) concyclic (d) perpendicularAnswer: (b) collinear

7. A(adj A) =(a) A (b) |A| I (c) adj A (d) OAnswer: (b) |A| I

8. |AB| =(a) |A| + |B| (b) |A||B| (c) |A| – |B| (d) |A|/|B|Answer: (b) |A||B|

9. If |A| = 2 then $|A^{-1}|$ =(a) 2 (b) 1/2 (c) –2 (d) 4Answer: (b) 1/2

10. AX = B with $|A| \neq 0$ has(a) no solution (b) unique solution (c) infinite solutions (d) two solutionsAnswer: (b) unique solution

## Quick Revision Points

- 2 × 2 and 3 × 3 expansion.
- Area of triangle; collinearity.
- Minor and cofactor.
- Adjoint; $A^{-1}$ = adj A / |A|.
- |kA|, |AB|, |adj A|.
- Matrix method and consistency.

## Chapter Summary

A determinant is a number associated with a square matrix, found by ad – bc for order 2 and cofactor expansion for order 3. Determinants give the area of a triangle, with zero area meaning collinear points.

Minors and cofactors lead to the adjoint, and $A^{-1} = (1/|A|)$ adj A when $|A| \neq 0$. Systems of linear equations AX = B have the unique solution $X = A^{-1}B$ when $|A| \neq 0$, and consistency is tested using (adj A)B when $|A| = 0$.

## Exam Tips and PYQ Pattern

- Expand along the row with most zeros.
- Use correct sign pattern for cofactors.
- Verify $A^{-1}$ by multiplying with A.
- Remember $|kA| = k^n|A|$.
- Always state consistency before solving.

## Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 12 Mathematics Part I textbook, prescribed in the CBSE 2026-27 syllabus.

Can I download these notes as a PDF?

Yes. Use the free PDF link at the top of this page – no signup needed.

How do you find the inverse of a matrix?

Find |A|; if non-zero, compute the adjoint (transpose of cofactor matrix) and use $A^{-1}$ = adj A / |A|.

When does a system of linear equations have a unique solution?

When the coefficient matrix A is non-singular, i.e. $|A| \neq 0$.

## Conclusion

Determinants is one of the most reliable scoring chapters. Practise the matrix method and save the free PDF.

More Notes: Class 12 Maths Chapter 3: Matrices notes | Class 12 Maths Chapter 5: Continuity

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE maths educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 12 Maths textbook, Mathematics Part I (NCERT reprint 2026-27, rationalised syllabus), and the CBSE syllabus for the 2026-27 session. Last checked on 26 November 2026.