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Determinants — CBSE Class 12 Mathematics Chapter Test

FREE CHAPTER TEST · CLASS XII · MATHEMATICS (041) · PATTERN OF THE CBSE SAMPLE QUESTION PAPER 2026-27

TIME ALLOWED	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
1½ hours	40	19 (A 10 · B 3 · C 2 · D 2 · E 2)	

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 19 questions. All questions are compulsory.
2. This question paper is divided into five sections: A, B, C, D and E.
3. In Section A, Questions 1 to 8 are multiple choice questions (MCQs) and Questions 9 and 10 are assertion-reason based questions of 1 mark each.
4. In Section B, Q11–13 are very short answer (VSA) type questions, carrying 2 marks each.
5. In Section C, Q14–15 are short answer (SA) type questions, carrying 3 marks each.
6. In Section D, Q16–17 are long answer (LA) type questions, carrying 5 marks each.
7. In Section E, Q18–19 are case study based questions, carrying 4 marks each, with sub-parts of the values of 1, 1 and 2 marks.
8. There is no overall choice. However, an internal choice has been provided in 1 question of Section B, 1 question of Section C, 1 question of Section D and in the 2-mark sub-part of each question of Section E.
9. Use of calculators is not allowed. log x denotes the natural logarithm of x.
10. This chapter test follows the section structure, question types and marks per question of the CBSE Class XII Mathematics (041) Sample Question Paper 2026-27, released on 21 September 2026 at cbseacademic.nic.in, at half the length of the 80-mark board paper: 40 marks in 1½ hours.
11. The answer key and the marking scheme are at the end of this booklet. Attempt the paper in 1½ hours before you look at them.

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Chapter: Determinants · **Topics:** Determinant of a square matrix · Minors and cofactors · Area of a triangle · Adjoint and inverse of a matrix · Consistency and solution of linear equations by the matrix method

SECTION A

This section comprises 10 questions of 1 mark each: 8 multiple choice questions (MCQs) and 2 assertion-reason based questions.

1. The value of $\begin{vmatrix} 2 & -3 \\ 4 & 5 \end{vmatrix}$ is 1

(A) -22 (B) -2

(C) 2 (D) 22

2. If A is a square matrix of order 3 and $|A| = 4$, then $|\text{adj } A|$ is 1

(A) 4 (B) 16

(C) 64 (D) 8

3. The area of the triangle with vertices (1, 0), (6, 0) and (4, 3) is 1

(A) $\frac{15}{2}$ sq units (B) 15 sq units

(C) 5 sq units (D) 12 sq units

4. If A is a square matrix of order 3 and $|A| = 5$, then $|2A|$ equals 1

(A) 10 (B) 80

(C) 40 (D) 20

5. The cofactor of the element in the first row and second column of $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{vmatrix}$ is 1

(A) -2 (B) 2

(C) 6 (D) -6

6. If $\begin{vmatrix} x & 3 \\ 12 & x \end{vmatrix} = \begin{vmatrix} 4 & 3 \\ 12 & 4 \end{vmatrix}$, then x equals 1

(A) ± 4 (B) 4 only

(C) -4 only (D) 0

7. The system of equations $x + 2y = 3$ and $2x + 4y = 7$ has 1

(A) a unique solution (B) infinitely many solutions

(C) exactly two solutions (D) no solution

8. If A is an invertible matrix of order 3 and $|A| = 3$, then $|A^{-1}|$ is 1

(A) 3 (B) 9

(C) $\frac{1}{3}$ (D) $\frac{1}{9}$

9. **Assertion (A):** If A is a singular square matrix of order 3, then adj A is also singular. 1

Reason (R): For a square matrix A of order n, $|\text{adj } A| = |A|^{n-1}$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

10. **Assertion (A):** The points (1, 1), (2, 3) and (3, 5) form a triangle of area 1 square unit. 1

Reason (R): Three points are collinear if the area of the triangle formed by them is zero.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

SECTION B

This section comprises 3 very short answer (VSA) type questions of 2 marks each.

11. Find the values of k if the area of the triangle with vertices (k, 0), (6, 0) and (0, 3) is 6 square units. 2

12. (a) Find adj A for $A = \begin{bmatrix} 3 & -2 \\ 5 & 4 \end{bmatrix}$, and verify that A(adj A) = |A| I. 2

OR

(b) Using determinants, find the equation of the line joining the points (2, 3) and (4, 7).

13. Find the minors and cofactors of the elements of the second row of $\begin{vmatrix} 2 & -1 & 3 \\ 1 & 0 & 4 \\ -2 & 5 & 1 \end{vmatrix}$. 2

SECTION C

This section comprises 2 short answer (SA) type questions of 3 marks each.

14. (a) Find the inverse of $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ using its adjoint. 3

OR

(b) If $A = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$.

15. Examine the consistency of the system of equations $2x - y = 3$, $6x - 3y = 10$. 3

SECTION D

This section comprises 2 long answer (LA) type questions of 5 marks each.

16. 5

(a) Find the product AB, where $A = \begin{bmatrix} 0 & 2 & 2 \\ 3 & -3 & 0 \\ 3 & 1 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 2 & 1 & -1 \end{bmatrix}$. Use it to solve the system $x + y + z = 6$, $x - y + z = 2$, $2x + y - z = 1$.

OR

(b) 2 kg onions, 3 kg wheat and 1 kg rice cost ₹ 240; 1 kg onions, 2 kg wheat and 3 kg rice cost ₹ 290; 3 kg onions, 1 kg wheat and 2 kg rice cost ₹ 250. Using matrices, find the cost of each item per kg.

17. 5

If $A = \begin{bmatrix} 2 & -1 & 1 \\ 1 & 1 & -1 \\ 1 & -2 & 3 \end{bmatrix}$, find A^{-1}. Hence solve the system $2x - y + z = 2$, $x + y - z = 4$, $x - 2y + 3z = -3$.

SECTION E

This section comprises 2 case study based questions of 4 marks each, with sub-parts of 1, 1 and 2 marks.

18. A farmer's field is a triangle with corners at A(1, 2), B(7, 4) and C(3, 8), the coordinates being in units of 10 m. M is the midpoint of AC, where a well is to be dug.

(i) Write the area of triangle ABC as a determinant. [1]

(ii) Find the area of the field (in square units). [1]

(iii) Find the area of triangle ABM, and compare it with the area of the field. [2]

OR

(iii) A path runs straight from A through B. Using determinants, check whether the points A(1, 2), P(4, 3) and Q(10, 5) lie on the same line. [2]

19. A person invests a total of ₹ 30,000 in three schemes giving simple interest of 5 %, 6 % and 8 % per annum. The total interest in one year is ₹ 1,860, and the amount in the 5 % scheme is ₹ 2,000 more than the amount in the 8 % scheme. Let the amounts be x, y and z rupees.

(i) Write the system of equations in matrix form AX = B. [1]

(ii) Find |A|, and state whether the system has a unique solution. [1]

(iii) Solve the system using A^{-1}. [2]

OR

(iii) If the total interest were ₹ 1,900 instead (all else the same), find the amount invested in the 6 % scheme. [2]

END OF THE QUESTION PAPER

ANSWER KEY — SECTION A

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
(D)	(B)	(A)	(C)	(B)	(A)	(D)	(C)	(A)	(D)

MARKING SCHEME AND WORKED SOLUTIONS

Marks for each step are shown in brackets, as in the CBSE marking scheme. Any correct alternative method earns full marks.

Q1. Answer (D). $2 \times 5 - (-3) \times 4 = 10 + 12 = 22$.

Q2. Answer (B). $|\text{adj } A| = |A|^{n-1} = 4^2 = 16$.

Q3. Answer (A). $\frac{1}{2}|1(0-3) + 6(3-0) + 4(0-0)| = \frac{1}{2}|-3 + 18| = 15/2$.

Q4. Answer (C). $|kA| = k^n|A| = 2^3 \times 5 = 40$.

Q5. Answer (B). Minor $M_{12} = 4 \times 10 - 6 \times 7 = -2$; cofactor $A_{12} = (-1)^{1+2}M_{12} = 2$.

Q6. Answer (A). $x^2 - 36 = 16 - 36 = -20$, so $x^2 = 16$ and $x = \pm 4$.

Q7. Answer (D). $|A| = 4 - 4 = 0$ and $(\text{adj } A)B = [[4, -2], [-2, 1]][[3], [7]] = [[-2], [1]] \neq O$: inconsistent.

Q8. Answer (C). $|A^{-1}| = 1/|A| = 1/3$.

Q9. Answer (A). $|\text{adj } A| = |A|^2 = 0$. R gives exactly why. Answer (A).

Q10. Answer (D). $\frac{1}{2}|1(3-5) + 2(5-1) + 3(1-3)| = \frac{1}{2}|-2 + 8 - 6| = 0$: the points are collinear, so A is false. R is true. Answer (D).

Q11. (2 marks) Answer: k = 2 or 10.
Area = $\frac{1}{2}|k(0-3) + 6(3-0) + 0(0-0)| = \frac{1}{2}|18 - 3k|$. [1]
$\frac{1}{2}|18 - 3k| = 6$ gives $18 - 3k = \pm 12$, so k = 2 or k = 10. [1]

Q12. (2 marks) Answer: (a) [[4, 2], [−5, 3]]; (b) y = 2x − 1.
(a) adj A = [[4, 2], [−5, 3]]. [1] A(adj A) = [[12 + 10, 6 − 6], [20 − 20, 10 + 12]] = [[22, 0], [0, 22]] = 22I, and |A| = 12 + 10 = 22. [1]
OR (b) The point (x, y) lies on the line when |x y 1; 2 3 1; 4 7 1| = 0. [1] x(3 − 7) − y(2 − 4) + 1(14 − 12) = 0, i.e. −4x + 2y + 2 = 0, or y = 2x − 1. [1]

Q13. (2 marks) Answer: M: −16, 8, 8; A: 16, 8, −8.
$M_{21} = (-1)(1) - (3)(5) = -16$, $M_{22} = (2)(1) - (3)(-2) = 8$, $M_{23} = (2)(5) - (-1)(-2) = 8$. [1]
$A_{21} = (-1)^3M_{21} = 16$, $A_{22} = (-1)^4M_{22} = 8$, $A_{23} = (-1)^5M_{23} = -8$. [1]

Q14. (3 marks) Answer: (a) [[1/2, 0, −1/2], [1/2, −1, 1/2], [−1/2, 1, 1/2]]; (b) verified.
(a) $|A| = 2(0-1) - 1(1-0) + 1(1-0) = -2 \neq 0$, so A^{-1} exists. [1] Cofactors give adj A = [[−1, 0, 1], [−1, 2, −1], [1, −2, −1]]. [1] $A^{-1} = (1/|A|)\ \text{adj } A = (-1/2)[[-1, 0, 1], [-1, 2, -1], [1, -2, -1]] = [[1/2, 0, -1/2], [1/2, -1, 1/2], [-1/2, 1, 1/2]]$. [1]
OR (b) AB = [[3 + 1, 6 + 3], [2 + 1, 4 + 3]] = [[4, 9], [3, 7]]; |AB| = 28 − 27 = 1; $(AB)^{-1} = [[7, -9], [-3, 4]]$. [1] $A^{-1} = [[1, -1], [-2, 3]]$ (|A| = 1), $B^{-1} = [[3, -2], [-1, 1]]$ (|B| = 1). [1] $B^{-1}A^{-1} = [[3, -2], [-1, 1]][[1, -1], [-2, 3]] = [[3 + 4, -3 - 6], [-1 - 2, 1 + 3]] = [[7, -9], [-3, 4]] = (AB)^{-1}$. [1]

Q15. (3 marks) Answer: inconsistent.
In matrix form AX = B with A = [[2, −1], [6, −3]], B = [[3], [10]]; |A| = −6 + 6 = 0, so we look at (adj A)B. [1]
adj A = [[−3, 1], [−6, 2]]; (adj A)B = [[−9 + 10], [−18 + 20]] = [[1], [2]] ≠ O. [1½]
So the system is inconsistent (no solution). [½]

Q16. (5 marks) Answer: (a) AB = 6I; x = 1, y = 2, z = 3; (b) ₹ 30, ₹ 40, ₹ 60.
(a) AB = [[0 + 2 + 4, 0 − 2 + 2, 0 + 2 − 2], [3 − 3 + 0, 3 + 3 + 0, 3 − 3 + 0], [3 + 1 − 4, 3 − 1 − 2, 3 + 1 + 2]] = 6I. [2] So B^{-1} = A/6. [1] The system is BX = C with C = [[6], [2], [1]], so X = B^{-1}C = (1/6)[[0 + 4 + 2], [18 − 6 + 0], [18 + 2 − 2]] = (1/6)[[6], [12], [18]]. [1] x = 1, y = 2, z = 3. [1]
OR (b) Let the costs per kg be o, w and r: 2o + 3w + r = 240, o + 2w + 3r = 290, 3o + w + 2r = 250. [1] |A| = 2(4 − 3) − 3(2 − 9) + 1(1 − 6) = 18 ≠ 0. [1] adj A = [[1, −5, 7], [7, 1, −5], [−5, 7, 1]], and X = (1/18)(adj A)B = (1/18)[[240 − 1450 + 1750], [1680 + 290 − 1250], [−1200 + 2030 + 250]] = (1/18)[[540], [720], [1080]]. [2] Onion ₹ 30, wheat ₹ 40, rice ₹ 60 per kg. [1]

Q17. (5 marks) Answer: A^{-1} = (1/3)[[1, 1, 0], [−4, 5, 3], [−3, 3, 3]]; x = 2, y = 1, z = −1.
|A| = 2(3 − 2) + 1(3 + 1) + 1(−2 − 1) = 2 + 4 − 3 = 3. [1]
adj A = [[1, 1, 0], [−4, 5, 3], [−3, 3, 3]], so A^{-1} = (1/3)[[1, 1, 0], [−4, 5, 3], [−3, 3, 3]]. [2]
X = A^{-1}B = (1/3)[[2 + 4 + 0], [−8 + 20 − 9], [−6 + 12 − 9]] = (1/3)[[6], [3], [−3]]. [1]
x = 2, y = 1, z = −1. [1]

Q18. (4 marks) Answer: (ii) 16; (iii) 8 (half), or collinear.
(i) Area = ½ |1 2 1; 7 4 1; 3 8 1| (in absolute value). [1]
(ii) ½|1(4 − 8) − 2(7 − 3) + 1(56 − 12)| = ½|−4 − 8 + 44| = 16 square units. [1]
(iii)(a) M = (2, 5). Area ABM = ½|1(4 − 5) + 7(5 − 2) + 2(2 − 4)| = ½|−1 + 21 − 4| = 8 square units. [1] It is half the area of the field (a median divides a triangle into two equal areas). [1]
OR (iii)(b) ½|1(3 − 5) + 4(5 − 2) + 10(2 − 3)| = ½|−2 + 12 − 10| = 0. [1] So A, P and Q are collinear. [1]

Q19. (4 marks) Answer: (ii) 1; (iii) ₹ 10,000, ₹ 12,000, ₹ 8,000; or ₹ 4,000.
(i) x + y + z = 30000, 5x + 6y + 8z = 186000 (multiplying the interest equation by 100), x − z = 2000: A = [[1, 1, 1], [5, 6, 8], [1, 0, −1]], B = [[30000], [186000], [2000]]. [1]
(ii) |A| = 1(−6 − 0) − 1(−5 − 8) + 1(0 − 6) = 1 ≠ 0: unique solution. [1]
(iii)(a) adj A = [[−6, 1, 2], [13, −2, −3], [−6, 1, 1]], A^{-1} = adj A. [1] X = A^{-1}B gives x = 10000, y = 12000, z = 8000 (₹ 10,000 at 5 %, ₹ 12,000 at 6 %, ₹ 8,000 at 8 %). [1]
OR (iii)(b) Now B = [[30000], [190000], [2000]]; y = 13(30000) − 2(190000) − 3(2000) [1] = 390000 − 380000 − 6000 = ₹ 4,000. [1]

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