

CLASS 12

MATHEMATICS

EXTRA QUESTIONS

Class 12 Mathematics Chapter 4 Determinants – Extra Questions with Answers

Determinants underpin whether a matrix can be inverted, and these questions work through calculating $|A|$, recognising singular matrices, and finding inverses via the adjoint.

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Determinants underpin whether a matrix can be inverted, and these questions work through calculating $|A|$, recognising singular matrices, and finding inverses via the adjoint.

How to Approach the HOTS Questions in This Chapter

HOTS questions here often ask you to prove a determinant identity using row/column operations rather than direct expansion, or combine determinants with solving a system of equations via Cramer's rule — practice simplifying a determinant using properties before expanding, since direct expansion of a complex determinant is usually much slower.

Very Short Answer Questions (1 mark)

Q1. Find $|A|$ for $A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$.

Ans: $|A| = 2(4) - 3(1) = 8 - 3 = 5$.

Q2. What does it mean for a matrix to be singular?

Ans: Its determinant equals zero, so it has no inverse.

Q3. What is the formula for the inverse of a matrix using adjoint?

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

Q4. If $|A| = 0$ for a 3×3 matrix in $AX = B$, can we conclude there is no solution?

Ans: No, it could have no solution or infinitely many; further check via $(\text{adj } A)B$ is needed.

Q5. State one property relating $|A|$ and $|A'|$.

Ans: $|A'| = |A|$ (determinant is unchanged by transpose).

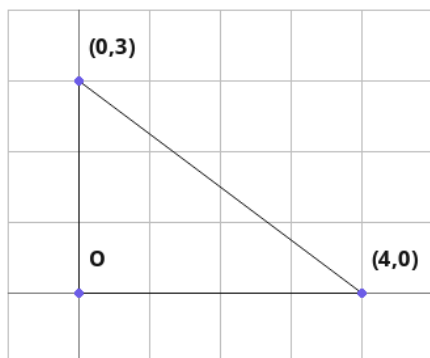
Short Answer Questions (2–3 marks)

Q6. Find the cofactor A_{12} of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$.

Ans: Delete row 1, col 2: $\begin{bmatrix} 4 & 6 \\ 7 & 9 \end{bmatrix}$, minor $= 4(9) - 6(7) = 36 - 42 = -6$. Cofactor $A_{12} = (-1)^{1+2}(-6) = 6$.

Q7. Using determinants, find the area of a triangle with vertices $(0,0)$, $(4,0)$, $(0,3)$.

Ans: Area $= \frac{1}{2}|0(0-3) + 4(3-0) + 0(0-0)| = \frac{1}{2}|12| = 6$ sq units.



Right triangle $(0,0),(4,0),(0,3)$; area = 6 sq units.

Q8. If $|A|=5$ and A is 3×3 , find $|\text{adj}(A)|$.

Ans: $|\text{adj}(A)| = |A|^{n-1} = 5^2 = 25$.

Higher-Order Thinking / Application Questions

Q9. Solve the system $2x+3y=5$ and $x-2y=-3$ using the matrix method, showing all steps including the inverse calculation.

Ans: Write as $AX=B$ where $A=\begin{bmatrix} 2 & 3 \\ 1 & -2 \end{bmatrix}$, $X=\begin{bmatrix} x \\ y \end{bmatrix}$, $B=\begin{bmatrix} 5 \\ -3 \end{bmatrix}$. First, $|A|=2(-2)-3(1)=-4-3=-7$, which is non-zero, so A is invertible and a unique solution exists. Find $\text{adj}(A)$: cofactors are $A_{11}=-2$, $A_{12}=-1$, $A_{21}=-3$, $A_{22}=2$, so the cofactor matrix is $\begin{bmatrix} -2 & -1 \\ -3 & 2 \end{bmatrix}$, and $\text{adj}(A)$ (transpose of cofactor matrix) $=\begin{bmatrix} -2 & -3 \\ -1 & 2 \end{bmatrix}$. Then $A^{-1}=\text{adj}(A)/|A|=(1/-7)\begin{bmatrix} -2 & -3 \\ -1 & 2 \end{bmatrix}=\begin{bmatrix} 2/7 & 3/7 \\ 1/7 & -2/7 \end{bmatrix}$. Now $X=A^{-1}B=\begin{bmatrix} 2/7 & 3/7 \\ 1/7 & -2/7 \end{bmatrix} \times \begin{bmatrix} 5 \\ -3 \end{bmatrix}=\begin{bmatrix} (2/7)(5)+(3/7)(-3) \\ (1/7)(5)+(-2/7)(-3) \end{bmatrix}=\begin{bmatrix} (10-9)/7 \\ (5+6)/7 \end{bmatrix}=\begin{bmatrix} 1/7 \\ 11/7 \end{bmatrix}$. So $x=1/7$, $y=11/7$. Verification: $2(1/7)+3(11/7)=2/7+33/7=35/7=5$ ✓; $(1/7)-2(11/7)=1/7-22/7=-21/7=-3$ ✓.

Q10. Explain, with reasoning, why a system of linear equations $AX=B$ has a unique solution when $|A| \neq 0$, but may have no solution or infinitely many solutions when $|A|=0$.

Ans: When $|A| \neq 0$, matrix A is invertible, meaning A^{-1} exists uniquely (since $A^{-1}=\text{adj}(A)/|A|$ is a well-defined single matrix). We can then multiply both sides of $AX=B$ on the left by A^{-1} to get $A^{-1}AX=A^{-1}B$, i.e., $IX=A^{-1}B$, i.e., $X=A^{-1}B$. Since A^{-1} is unique, this gives exactly one value of X — a unique solution. However, when $|A|=0$, A has no inverse, so we cannot isolate X this way at all. Geometrically, $|A|=0$ means the equations represented by the rows of A are linearly dependent (e.g., two planes/lines that are parallel or coincide rather than intersecting at a single point). If the equations are consistent (compatible), i.e. $(\text{adj } A)B=0$ (a zero matrix), the system reduces to fewer independent equations than unknowns, giving infinitely many solutions (like two coincident lines). If the equations are inconsistent, i.e. $(\text{adj } A)B \neq 0$, the equations contradict each other (like two parallel, non-intersecting lines), giving no solution at all. This is why checking $(\text{adj } A)B$ is the standard test to distinguish between these two $|A|=0$ cases.

Class 12 Mathematics Chapter 4 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the [Class 12 Mathematics Chapter 4 Solutions](#) and [Class 12 Mathematics Chapter 4 Revision Notes](#).

See also: [Chapter 1](#) | [Chapter 2](#) | [Chapter 3](#) | [Chapter 4](#)

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