



Attempt all questions before checking the answer key. Use [a, b; c, d] for row-wise matrix notation. Show minors/cofactors where needed.

A. Very short answers - 1 mark each

1. Evaluate the determinant of $[3, 2; 1, 4]$.
2. What does a zero determinant imply about invertibility of a square matrix?
3. Find the cofactor of entry a_{12} in $[2, 3; 4, 5]$.
4. Evaluate the determinant of a 3×3 identity matrix.
5. State the relation between A , $\text{adj } A$ and $|A|$.

B. Short answers / practice - 2 marks each

6. Find x if the determinant of $[x, 2; 3, 6]$ is zero.
7. Find the determinant of $[1, 2, 0; 0, 3, 4; 0, 0, 5]$.
8. Find the area of the triangle with vertices $(0, 0)$, $(4, 0)$, $(1, 3)$ using determinants.
9. Find $\text{adj } A$ for $A = [2, 1; 3, 2]$.
10. Find the inverse of $[3, 1; 2, 1]$, if it exists.
11. Evaluate $|2, 3; 4, 5|$.
12. Find determinant of diagonal matrix $\text{diag}(2, 3, 4)$.
13. Is a matrix with a zero row invertible?
14. Find k if $|1, k; 2, 6| = 0$.
15. Find area of triangle $(0, 0), (3, 0), (0, 4)$.
16. Find inverse of $[1, 0; 2, 1]$.
17. Solve $x + y = 7$, $x - y = 1$ by matrices.
18. Find minor of a_{22} in $[3, 1; 2, 4]$.
19. Find determinant of $[1, 2; 2, 4]$.
20. Can a non-zero square matrix have determinant zero?

C. Short answers - 3 marks each

21. Evaluate the determinant of $[2, -1, 3; 1, 0, 2; 3, 1, 1]$ by expansion.
22. Use determinants to find k when $(1, 2)$, $(3, 6)$, $(k, 10)$ are collinear.

23. Solve $2x + y = 5$ and $x - y = 1$ using the inverse-matrix method.

24. For $A = [1, 2; 2, 4]$, discuss consistency of $AX = B$ for $B = [3; 6]$ and $B = [3; 7]$.

25. Find the values of λ for which $[\lambda, 1; 4, \lambda]$ is non-singular; find its inverse in terms of λ .

D. Long answers - 5 marks each

26. Find all cofactors and the adjoint of $A = [1, 1, 1; 1, 2, 3; 1, 3, 6]$. Verify $A(\text{adj } A) = |A|I$ and hence find A^{-1} .

27. Solve $x + y + z = 6$, $2x - y + 3z = 9$ and $x + 2y - z = 2$ by the inverse-matrix method. Verify the solution.

28. Find k if the area of the triangle with vertices $(k, 0)$, $(0, 4)$, $(2, 1)$ is 6 square units. Explain the need for an absolute value and find all possible k .

29. Discuss the number of solutions of $x + y = 2$ and $2x + ky = 4$ as k varies. Use determinants for the non-singular case and direct consistency analysis for the singular case.

30. Three items cost ₹10, ₹20 and ₹30 each. Their total quantity is 12, total cost ₹240, and the second item's quantity is twice the first's. Form a matrix equation, solve it using an inverse and verify all three conditions.

ANSWER KEY - Numerical / short answers

- 1) 10. 2) Not invertible. 3) -4. 4) 1. 5) $x=1$. 6) $x=1$. 7) 15. 8) 6 square units. 9) $[2, -1; -3, 2]$. 10) $[1, -1; -2, 3]$. 11) -2. 12) 24. 13) No. 14) 3. 15) 6. 16) $[1, 0; -2, 1]$. 17) $x=4, y=3$. 18) 3. 19) 0. 20) Yes; for example $[1, 2; 2, 4]$. 21) -6. 22) $k=5$. 23) $x=2, y=1$. 24) First: infinitely many; second: no solution. 25) $\lambda \neq \pm 2$; inverse $= [\lambda, -1; -4, \lambda] / (\lambda^2 - 4)$. 26) Cofactor matrix = adjoint = inverse $= [3, -3, 1; -3, 5, -2; 1, -2, 1]$; determinant 1. 27) $x=1, y=2, z=3$. 28) $k=20/3$ or $-4/3$. 29) $k \neq 2$: $x=2, y=0$; $k=2$: infinitely many with $x+y=2$. 30) Quantities 3, 6, 3.