

DETERMINANTS

1 MARK QUESTIONS

- The inverse of matrix $A = \begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$ is
 (A) $\frac{1}{6} \begin{bmatrix} -4 & 2 \\ -1 & -1 \end{bmatrix}$ (B) $\begin{bmatrix} \frac{1}{3} & \frac{1}{6} \\ \frac{2}{3} & -\frac{1}{6} \end{bmatrix}$
 (C) $\begin{bmatrix} \frac{1}{6} & \frac{1}{6} \\ -\frac{1}{3} & \frac{2}{3} \end{bmatrix}$ (D) $\begin{bmatrix} -\frac{2}{3} & \frac{1}{6} \\ -\frac{1}{3} & -\frac{1}{6} \end{bmatrix}$ [March, 2025]
- If $\begin{vmatrix} 2x & 5 \\ 4 & x \end{vmatrix} = \begin{vmatrix} 3 & 5 \\ 4 & 6 \end{vmatrix}$, then the value of x is
 (A) 1.5 (B) 6
 (C) 3 (D) ± 3 [March, 2025]
- The value of $\Delta = \begin{vmatrix} 42 & 2 & 5 \\ 79 & 7 & 9 \\ 29 & 5 & 3 \end{vmatrix}$ is :
 (A) 0 (B) 1
 (C) -3 (D) -15 [March, 2024]
- The value of $\Delta = \begin{vmatrix} 42 & 2 & 5 \\ 79 & 7 & 9 \\ 29 & 5 & 3 \end{vmatrix}$ is :
 (A) 0 (B) 1
 (C) -3 (D) -15 [March, 2024]
- A and B are square matrices each of order 3 such that $|A| = -1$ and $|B| = 3$. What is the value of $3AB$?
 (a) -9 (b) -18
 (c) -27 (d) -81 [March, 2023]
- If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then the value of x is:
 (A) -1 (B) 0
 (C) 1 (D) 3 [March, 2023]
- If A is an invertible matrix, then which of the following is not true?
 (A) $|A^{-1}| = |A|^{-1}$ (B) $(A^2)^{-1} = (A^{-1})^2$
 (C) $(A')^{-1} = (A^{-1})'$ (D) $|A| \neq 0$ [July, 2025]
- The system of linear equations $2x + ky = 7$, $3x + 2y = 7$ will be consistent, if :
 (A) $k = \frac{4}{3}$ (B) $k \neq \frac{4}{3}$

(C) $k = \frac{3}{4}$

(D) $k \neq \frac{3}{4}$

[July, 2025]

9. Assertion (A) : Minor of element a_{13} in the

matrix $\begin{bmatrix} 0 & 2 & 6 \\ 1 & 2 & -1 \\ 2 & 1 & 3 \end{bmatrix}$ is $\begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix}$.

Reason (R) : Minor of an element a_{ij} of a matrix is the determinant obtained by deleting its j^{th} row and i^{th} column in which the element lies.

[July, 2024]

10. If $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$, then the value of x is
 (A) 1 (B) 0.5
 (C) -0.5 (D) 2 [July, 2024]

11. Assertion (A) : If A is a square matrix of order 3 such that $|\text{adj } A| = 144$, then the value of $|A|$ is ± 12 .

Reason (R) : If A is an invertible matrix of order n , then $|\text{adj } A| = |A|^{n-1}$.

[July, 2023]

12. If $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is adjoint of a 3×3 matrix A and $|A| = 4$, then α is equal to
 (A) 4 (B) 8
 (C) 11 (D) 256 [SQP, 2025-26]

13. A and B are square matrices of order 3. The determinants of A and B are 5 and 4 respectively, then the determinant of the matrix $4A^2B$ is
 (A) 64 (B) 400
 (C) 1600 (D) 6400 [SQP, 2025-26]

14. Assertion (A): Let A be a 2×2 matrix, then $\text{adj}(\text{adj } A) = A$
 Reason (R): $|\text{adj } A| = |A|$ [SQP, 2025-26]

15. For a 3×3 matrix if $\text{adj } A = 2A^{-1}$, find $|3AA^T|$
 (A) 108 (B) 12
 (C) 54 (D) 8 [SQP, 2024-25]

16. If A is a square matrix of order 3 and $|A| = -2$, then $|\text{adj}(A)|$ is equal to
 (a) -8 (b) -2
 (c) 0 (d) 4 [SQP, 2021-22]

17. In a 3×3 matrix A, value of $a_{12}c_{13} + a_{22}c_{23} + a_{32}c_{33}$, where c_{ij} is the cofactor of a_{ij} is
 (a) 0 (b) -1
 (c) 1 (d) $|A|$
 [SQP, 2021-22]

18. If two square matrices A and B are such that $|AB| = 12$ and $|B| = -4$, then value of $|A|$ is:
 (a) 8 (b) -8
 (c) -3 (d) 16
 [SQP, 2021-22]

2 MARKS QUESTIONS

19. Using Cramer's rule, solve the following system of equations :
 $2x_1 + 3x_2 = 5$
 $11x_1 - 5x_2 = 6$
 [2M, March, 2024]

20. Solve the following system of linear equations using Cramer's method:
 $2x + y = 17, 3x + 5y = 6$
 [2M, March, 2023]

21. Determine the integral value(s) of x for which the matrix A is singular :
 $A = \begin{bmatrix} x+1 & -3 & 4 \\ -5 & x+2 & 2 \\ 4 & 1 & x-6 \end{bmatrix}$
 [2M, March, 2023]

22. There are two real value(s) of x, for which the value of the determinant $\Delta = \begin{vmatrix} 1 & -2 & 5 \\ 2 & x & -1 \\ 0 & 4 & 2x \end{vmatrix}$ is 86. Find the value(s) of x.
 [2M, SQP, 2022-23]

3 MARKS QUESTIONS

23. Find the inverse (if it exists) of the matrix $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$.
 [3M, July, 2025]

24. Find the inverse of the matrix
 $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$
 [3M, July, 2024]

5 MARKS QUESTIONS

25. Find the inverse of the matrix $A = \begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$ and hence show that $AA^{-1} = I$.
 [5M, March, 2023]

26. Using matrix method, solve the following system of equations for x, y and z :
 $x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2$
 [5M, March, 2023]

27. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1} and hence solve the following system of linear equations:
 $2x - 3y + 5z = 11, 3x + 2y - 4z = -5, x + y - 2z = -3$
 [5M, March, 2025]

28. Rohini wants to give a rectangular plot of land for a school in her village. When she was asked to mention the dimensions of the plot, she told that if its length is decreased by 50 m and breadth is increased by 50 m, then its area does not alter, but if its length is decreased by 10 m and breadth is decreased by 20 m, then its area will decrease by 5300 sq m.

Based on the above information, answer the following questions :

- (i) Assuming x m and y m as the length and breadth of the plot respectively, write the system of linear equations in x and y.
 (ii) Write the system of linear equations obtained in (i) in the matrix equation $AX = B$.
 (iii) Determine A^{-1} .

OR

Determine the area of the plot.

[5M, July, 2024]

29. The purchase officer of a pharmaceutical company informs the production manager that during the month, following supply of three chemicals i.e., Aspirin (A), Caffeine (C) and Decongestant (D) used in the production of three types of pain-killing tablet will be 16 kg, 10 kg and 16 kg respectively. According to the specification, each strip of 10 tablets of Paingo requires 2 gm of A, 3 gm of C and 1 gm of D. The requirements for other tablets are:

X-prene	4gm of A	1gm of C	3gm of D
Relaxo	1gm of A	2gm of C	3gm of D

Taking suitable variables form the system of linear equations and use matrix method to find the number of strips of each type so that the raw materials are consumed entirely.

[5M,SQP, 2025-26]

30. Given the following equations for two related markets A and B, find the equilibrium conditions for each market and the price for each by Cramer's rule:

$$x_d(A) = 82 - 3p_A + p_B,$$

$$x_s(A) = -5 + 15p_A,$$

$$x_d(B) = 92 + 2p_A - 4p_B,$$

$$x_s(B) = -6 + 32p_B$$

where x_d and x_s denotes the quantity demanded and quantity supplied respectively and p_A and p_B represents the price for each in the two markets.

[5M,SQP, 2025-26]

31. An owl was sitting at $(0, k)$; $k > 0$. Then it starts flying along the path whose equation is given by $y = ax^2 + bx + c$, where $a \in \mathbb{R} - \{0\}$, $b, c \in \mathbb{R}$. It passes through the points $(1,2)$, $(2,1)$ and $(4,5)$. Using Cramer's Rule, find the values of a, b, c and hence k .

[5M,SQP, 2024-25]

32. A toy rocket is fired, from a platform, vertically into the air, its height above the ground after t seconds is given by $s(t) = at^2 + bt + c$, where $a, b, c \in \mathbb{R}$, $a \neq 0$ and $s(t)$ is

measured in metres. After 10 second, the rocket is 16 m above the ground; after 20 seconds, 22 m; after 30 seconds, 25 m.

- (i) Write down a system of three linear equations in terms of a, b , and c .
(ii) Hence find the values of a, b , and c , using matrix method.

[5M,SQP, 2024-25]

33. The management committee of a Welfare Club decided to award some of its members (say x) for sincerity, some (say y) for helping others selflessly and some others (say z) for effective management. The sum of all the awardees is 12. Three times the sum of all awardees for helping others selflessly and effective management added to two times the number of awardees for sincerity is 33. If the sum of the number of awardees for sincerity and effective management is twice the number of awardees for helping others, use matrix method to find the number of awardees of each category.

[5M,SQP, 2023-24]

34. The equilibrium conditions for three competitive markets are described as given below, where p_1, p_2 and p_3 are the equilibrium price for each market respectively.

$$p_1 + 2p_2 + 3p_3 = 85,$$

$$3p_1 + 2p_2 + 2p_3 = 105,$$

$$2p_1 + 3p_2 + 2p_3 = 110$$

Using matrix method, find the values of respective equilibrium prices.

[5M,SQP, 2022-23]

CASE-BASED QUESTIONS

35. On her birthday, Prema decides to donate some money to children of an orphanage home.



If there are 8 children less, everyone gets < 10 more. However, if there are 16 children more, everyone gets < 10 less.

Let the number of children in the orphanage home be x and the amount to be donated to each child be $< y$.

Based on the above information, answer the following questions :

- (i) Write the system of linear equations in x and y formed of the given situation.
- (ii) Write the system of linear equations, obtained in (i) above, in matrix form $AX = B$.
- (iii) (a) Find the inverse of matrix A .

OR

- (b) Determine the values of x and y .

[4M, March, 2024]

36. 10 students were selected from a school on the basis of values for giving awards and were divided into three groups. The first group comprises hard workers, the second group has honest and law abiding students, and the third group contains vigilant and obedient students. Double the number of students of the first group added to the number in the second group gives 13, while the combined strength of the first and the second group is four times that of the third group. Assume that x , y and z denote the number of students in first, second and third group respectively.

Based on the above information, answer the following questions :

- (a) Write the system of linear equations that can be formulated from the above described situation. 1
- (b) Write the coefficient matrix, say A . 1
- (c) (i) Write the matrix of cofactors of every element of matrix A . 2

OR

- (c) (ii) Determine the number of students of each group.

[4M, July, 2023]