

Determinants

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. If A and B are invertible square matrices of the same order, then which of the following is not correct?

- (a) $\text{adj } A = |A| \cdot A^{-1}$ (b) $\det(A)^{-1} = [\det(A)]^{-1}$
(c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A + B)^{-1} = B^{-1} + A^{-1}$

2. If $|A| = |kA|$, where A is a square matrix of order 2, then sum of all possible values of k is:

- (a) 1 (b) -1 (c) 2 (d) 0

3. If A is a square matrix of order 3 and $|A| = 5$, then $|\text{adj } A| =$

- (a) 5 (b) 25 (c) 125 (d) 1/5

4. If A is a square matrix of order 3, $|A^T| = -3$, then $|AA^T| =$

- (a) 9 (b) -9 (c) 3 (d) -3

5. If A, B are non-singular square matrices of the same order, then $(AB^{-1})^{-1} =$

- (a) $A^{-1}B$ (b) $A^{-1}B^{-1}$ (c) BA^{-1} (d) AB

6. If $A = \begin{vmatrix} a & 2 \\ 2 & a \end{vmatrix}$ and $|A|^3 = 125$, then a is

- (a) ± 3 (b) 5 (c) ± 2 (d) 4

7. If $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$, then the possible value(s) or 'x' is/are

- (a) 3 (b) $\sqrt{3}$ (c) $-\sqrt{3}$ (d) $\sqrt{3}, -\sqrt{3}$

8. Three points P(2x, x + 3), Q(0, x) and R(x + 3, x + 6) are collinear, then x is equal to:

- (a) 0 (b) 2 (c) 3 (d) 1

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- (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.

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(d) Assertion (A) is false but reason (R) is true.

9. **Assertion (A):** The system of equations $2x - y = -2$; $3x + 4y = 3$ has unique solution and $x = -5/11$ and $y = 12/11$.

Reason (R): The system of equations $AX = B$ has a unique solution, if $|A| \neq 0$.

10. **Assertion (A):** Minor of an element of a determinant of order n ($n \geq 2$) is a determinant of order n .

Reason (R): If A is an invertible matrix of order 2, then $\det(A^{-1})$ is equal to $1/|A|$.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. If area of triangle is 35 sq units with vertices $(2, -6)$, $(5, 4)$ and $(k, 4)$. Then find the value of k .

12. Let $A = \begin{bmatrix} x+y & y \\ 2x & x-y \end{bmatrix}$, $B = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ and $C = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$. If $AB = C$, then find A^2 .

13. Using Cofactors of elements of second row, evaluate $\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$

14. If points $(2, 0)$, $(0, 5)$ and (x, y) are collinear, then show that $\frac{x}{2} + \frac{y}{5} = 1$.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, show that $A^2 - 5A + 7I = O$. Hence find A^{-1} .

16. Show that $A = \begin{bmatrix} -8 & 5 \\ 2 & 4 \end{bmatrix}$ satisfies the equation $x^2 + 4x - 42 = O$. Hence find A^{-1} .

17. If A, B are square matrices of the same order, then prove that $\text{adj}(AB) = (\text{adj } B)(\text{adj } A)$.

SECTION – D

Questions 18 carry 5 marks.

18. The cost of 4 kg onion, 3 kg wheat and 2 kg rice is Rs 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is Rs 90. The cost of 6 kg onion 2 kg wheat and 3 kg rice is Rs 70. Find cost of each item per kg by matrix method.

OR

Solve the system of equations:

$$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4,$$

$$\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1 \text{ and}$$

$$\frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2$$

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SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. Gautam buys 5 pens, 3 bags and 1 instrument box and pays a sum of ₹ 160 from Stationery Shop. From the same shop, Vikram buys 2 pens, 1 bag and 3 instrument boxes and pays a sum of ₹ 190. Also, Ankur buys 1 pen, 2 bags and 4 instrument boxes and pays a sum of ₹ 250.



Based on the above information, answer the following questions:

- Convert the given above situation into a matrix equation of the form $AX = B$.
- Find $|A|$.
- Find A^{-1} .

OR

Determine $P = A^2 - 5A$.

20. The Palace of Peace and Reconciliation, also known as the Pyramid of peace and Accord is a 62-metre high Pyramid in Mursultan, the capital of Kazakhstan, that serves as a non-denominational national spiritual centre and an event venue. It is designed by Foster and Partners with a stained glass apex. It has 25 smaller equilateral triangles as shown in the figure.



- If the vertices of one triangle are $(0, 0)$, $(3, \sqrt{3})$ and $(3, -\sqrt{3})$ then find the area.
- Find the area of face of the Pyramid.
- Find the length of an altitude of a smaller equilateral triangle.

OR

Using determinants, find the equation of the line joining the points A (1, 2) and B (3, 6).