Determinants

Question 1.

Find the adjoint of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

(a) $\begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}$

Answer:

(b) $\begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$

Question 2.

Find the adjoint of the matrix A, where $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 0 \\ 2 & 4 & 3 \end{bmatrix}$

(a) $\begin{bmatrix} 15 & 6 & 1 \\ 0 & 3 & 0 \\ 10 & 0 & 5 \end{bmatrix}$ (b) $\begin{bmatrix} 15 & 6 & -15 \\ 0 & -3 & 0 \\ -10 & 0 & 5 \end{bmatrix}$

(c) $\begin{bmatrix} 15 & -1 & 5 \\ 0 & 3 & 1 \\ 10 & 1 & 5 \end{bmatrix}$ (d) None of these

Answer:

(b) $\begin{bmatrix} 15 & 6 & -15 \\ 0 & -3 & 0 \\ -10 & 0 & 5 \end{bmatrix}$

Question 3.

Find x, if $\begin{bmatrix} 1 & 2 & x \\ 1 & 1 & 1 \\ 2 & 1 & -1 \end{bmatrix}$ is singular

(a) 1
(b) 2
(c) 3
(d) 4

Answer:
(d) 4

Question 4.

Find the value of x for which the matrix $A = \begin{bmatrix} 3-x & 2 & 2 \\ 2 & 4-x & 1 \\ -2 & -4 & -1-x \end{bmatrix}$ is singular.

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

Answer:
(c) 0, 3

Question 5.

If $\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & -5 \end{bmatrix}$ is a singular matrix, then x is

(a) $\frac{13}{25}$ (b) $-\frac{25}{13}$

(c) $\frac{5}{13}$ (d) $\frac{25}{13}$

Answer:
(b) $-\frac{25}{13}$

Question 6.
The area of a triangle with vertices (-3, 0), (3, 0) and (0, k) is 9 sq. units. The value of k will be
(a) 9
(b) 3
(c) -9
(d) 6
Answer:
(b) 3

Question 7.
The number of distinct real roots of $\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0$ in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is
(a) 0
(b) 2
(c) 1
(d) 3
Answer:
(c) 1

Question 8.
Let $f(t) = \begin{vmatrix} \cos t & t & 1 \\ 2\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$, then $\lim\limits_{t \to 0} \frac{f(t)}{t^2}$ is equal to
(a) 0
(b) -1
(c) 2
(d) 3
Answer:
(a) 0

Question 9.

The maximum value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1+\cos\theta & 1 & 1 \end{vmatrix}$ is (θ is real number)

(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$

(c) $\sqrt{2}$ (d) $\frac{2\sqrt{3}}{4}$

Answer:
(a) $\frac{1}{2}$

Question 10.

The value of the determinant $\begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$ is

(a) $9x^2 (x + y)$
(b) $9y^2 (x + y)$
(c) $3y^2 (x + y)$
(d) $7x^2 (x + y)$
Answer:
(b) $9y^2 (x + y)$

Question 11.

For what value of x, matrix $\begin{bmatrix} 6-x & 4 \\ 3-x & 1 \end{bmatrix}$ is a singularmatrix?

(a) 1
(b) 2
(c) -1
(d) -2
Answer:
(b) 2

Question 12.
Compute $(AB)^{-1}$, If

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \text{ and } B^{-1} = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 3 & -1 \\ 1 & 0 & 2 \end{bmatrix}$$

(a) $\frac{1}{19}\begin{bmatrix} 16 & 12 & 1 \\ 21 & 11 & -7 \\ 10 & -2 & 3 \end{bmatrix}$
(b) $\frac{1}{19}\begin{bmatrix} 16 & 12 & 10 \\ 21 & 11 & -2 \\ 1 & -7 & 3 \end{bmatrix}$

(c) $\frac{1}{19}\begin{bmatrix} 16 & 12 & 1 \\ -21 & -11 & 7 \\ 10 & -2 & 3 \end{bmatrix}$
(d) $\frac{1}{19}\begin{bmatrix} 16 & -21 & 1 \\ 21 & 11 & 7 \\ 10 & -2 & 3 \end{bmatrix}$

Answer:
(a) $\frac{1}{19}\begin{bmatrix} 16 & 12 & 1 \\ 21 & 11 & -7 \\ 10 & -2 & 3 \end{bmatrix}$

Question 13.

If $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ then $\frac{A^2 - 3I}{2} =$

(a) A^{-1}
(b) $2A$
(c) $2A^{-1}$
(d) $\frac{3}{2}A^{-1}$

Answer:
(a) A^{-1}

Question 14.

If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ **and** $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$, **then find** $(AB)^{-1}$.

(a) $\frac{1}{11}\begin{bmatrix} 14 & 5 \\ 5 & 1 \end{bmatrix}$ (b) $\frac{1}{11}\begin{bmatrix} 14 & -5 \\ -5 & 1 \end{bmatrix}$

(c) $\frac{1}{11}\begin{bmatrix} 1 & 5 \\ 5 & 14 \end{bmatrix}$ (d) $\frac{1}{11}\begin{bmatrix} 1 & -5 \\ -5 & 14 \end{bmatrix}$

Answer:
(a) $\frac{1}{11}\begin{bmatrix} 14 & 5 \\ 5 & 1 \end{bmatrix}$

Question 15.

If $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$, **then find** A^{-1}.

(a) $\frac{1}{17}\begin{bmatrix} 2 & 3 \\ -3 & 4 \end{bmatrix}$ (b) $\frac{1}{17}\begin{bmatrix} 4 & 3 \\ -3 & 2 \end{bmatrix}$

(c) $\frac{-1}{17}\begin{bmatrix} 4 & 3 \\ -3 & 2 \end{bmatrix}$ (d) $\frac{1}{17}\begin{bmatrix} 4 & 3 \\ -3 & -2 \end{bmatrix}$

Answer:
(b) $\frac{1}{17}\begin{bmatrix} 4 & 3 \\ -3 & 2 \end{bmatrix}$

Question 16.
If the points (3, -2), (x, 2), (8, 8) are collinear, then find the value of x.
(a) 2
(b) 3
(c) 4
(d) 5
Answer:
(d) 5

Question 17.
Using determinants, find the equation of the line joining the points (1, 2) and (3, 6).

(a) y = 2x
(b) x = 3y
(c) y = x
(d) 4x – y = 5
Answer:
(a) y = 2x

Question 18.
Find the minor of the element of second row and third column in the following determinant

$$\begin{bmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{bmatrix}$$

(a) 13
(b) 4
(c) 5
(d) 0
Answer:
(a) 13

Question 19.
If $\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$, then write the minor of the element a_{23}.
(a) 7
(b) -7
(c) 4
(d) 8
Answer:
(a) 7

Question 20.
If a, b, c are the roots of the equation $x^3 – 3x^2 + 3x + 7 = 0$, then the value of

$$\begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix}$$ is

(a) 9
(b) 27
(c) 81
(d) 0
Answer:
(d) 0

Question 21.

If $\begin{vmatrix} 1+a^2x & \left(1+b^2\right)x & \left(1+c^2\right)x \\ \left(1+a^2\right)x & 1+b^2x & \left(1+c^2\right)x \\ \left(1+a^2\right)x & \left(1+B^2\right)x & 1+c^2x \end{vmatrix}$, then f(x) is apolynomial of degree

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

Answer:
(a) 2

Question 22.

$\begin{vmatrix} a^2 & 2ab & b^2 \\ b^2 & a^2 & 2ab \\ 2ab & b^2 & a^2 \end{vmatrix}$ is equal to

(a) $a^3 - b^3$
(b) $a^3 + b^3$
(c) $(a^3 - b^3)^2$
(d) $(a^3 + b^3)^2$

Answer:
(d) $(a^3 + b^3)^2$

Question 23.

If α, β, γ are in A.P., then $\begin{vmatrix} x-3 & x-4 & x-\alpha \\ x-2 & x-3 & x-\beta \\ x-1 & x-2 & x-\gamma \end{vmatrix} =$

(a) 0
(b) $(x - 2)(x - 3)(x - 4)$
(c) $(x - \alpha)(x - \beta)(x - \gamma)$
(d) $\alpha\beta\gamma\,(\alpha - \beta)(\beta - \gamma)^2$

Answer:
(a) 0

Question 24.

$\begin{vmatrix} 1 & a^2+bc & a^3 \\ 1 & b^2+ca & b^3 \\ 1 & c^2+ab & c^3 \end{vmatrix}$

(a) $-(a - b)(b - c)(c - a)(a^2 + b^2 + c^2)$

(b) (a – b)(b – c)(c – a)
(c) $(a^2 + b^2 + c^2)$
(d) $(a – b)(b – c)(c – a)(a^2 + b^2 + c^2)$
Answer:
(a) $-(a – b)(b – c)(c – a)(a^2 + b^2 + c^2)$

Question 25.
Evaluate the determinant $\Delta = \begin{vmatrix} \log_3 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix}$
(a) $\frac{15}{2}$
(b) 12
(c) $\frac{14}{3}$
(d) 6
Answer:
(a) $\frac{15}{2}$

Question 26.
$\begin{vmatrix} x & -7 \\ x & 5x+1 \end{vmatrix}$
(a) $3x^2 + 4$
(b) x(5x + 8)
(c) $3x + 4x^2$
(d) x(3x + 4)
Answer:
(b) x(5x + 8)

Question 27.
$\begin{vmatrix} \cos 15^\circ & \sin 15^\circ \\ \sin 75^\circ & \cos 75^\circ \end{vmatrix}$
(a) 0
(b) 5
(c) 3
(d) 7
Answer:
(a) 0

Question 28.

If $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = k(a+b+c)^3$, then k is

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

Answer:
(b) 1

Question 29.

If $abc \neq 0$ and $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 0$, then $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=$

(a) 1
(b) 2
(c) −1
(d) −3

Answer:
(c) -1

Question 30.

Find a 2 × 2 matrix B such that $B = \begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$

(a) $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$
(b) $\begin{bmatrix} 4 & 2 \\ 1 & 1 \end{bmatrix}$
(c) $\begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$
(d) $\begin{bmatrix} 1 & -2 \\ -1 & 4 \end{bmatrix}$

Answer:
(a) $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$

Question 31.
If for the non-singular matrix A, $A^2 = I$, then find A^{-1}.
(a) A
(b) I
(c) O

(d) None of these
Answer:
(a) A

Question 32.
If the equation a(y + z) = x, b(z + x) = y, c(x + y) = z have non-trivial solutions then the value of $\frac{1}{1+a}+\frac{1}{1+b}+\frac{1}{1+c}$ is
(a) 1
(b) 2
(c) -1
(d) -2
Answer:
(b) 2

Question 33.
A non-trivial solution of the system of equations x + λy + 2z = 0, 2x + λz = 0, 2λx – 2y + 3z = 0 is given by x : y : z =
(a) 1 : 2 : -2
(b) 1 : -2 : 2
(c) 2 : 1 : 2
(d) 2 : 1 : -2
Answer:
(d) 2 : 1 : -2

Question 34.
If 4x + 3y + 6z = 25, x + 5y + 7z = 13, 2x + 9y + z = 1, then z = ________
(a) 1
(b) 3
(c) -2
(d) 2
Answer:
(d) 2

Question 35.
If the equations 2x + 3y + z = 0, 3x + y – 2z = 0 and ax + 2y – bz = 0 has non-trivial solution, then
(a) a – b = 2
(b) a + b + 1 = 0
(c) a + b = 3
(d) a – b – 8 = 0
Answer:
(a) a – b = 2

Question 36.
Solve the following system of equations $x - y + z = 4$, $x - 2y + 2z = 9$ and $2x + y + 3z = 1$.
(a) $x = -4, y = -3, z = 2$
(b) $x = -1, y = -3, z = 2$
(c) $x = 2, y = 4, z = 6$
(d) $x = 3, y = 6, z = 9$
Answer:
(b) $x = -1, y = -3, z = 2$

Question 37.
If the system of equations $x + ky - z = 0$, $3x - ky - z = 0$ & $x - 3y + z = 0$ has non-zero solution, then k is equal to
(a) -1
(b) 0
(c) 1
(d) 2
Answer:
(c) 1

Question 38.
If the system of equations $2x + 3y + 5 = 0$, $x + ky + 5 = 0$, $kx - 12y - 14 = 0$ has non-trivial solution, then the value of k is
(a) $-2, \frac{12}{5}$
(b) $-1, \frac{1}{5}$
(c) $-6, \frac{17}{5}$
(d) $6, -\frac{12}{5}$
Answer:
(c) $-6, \frac{17}{5}$

Question 39.
If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then the value of x is
(a) 3
(b) ±3
(c) ±6
(d) 6
Answer:
(c) ±6

Question 40.
$$\begin{vmatrix} (b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab \end{vmatrix} =$$
(a) $(a - b)(b - c)(c - a)(a^2 + b^2 + c^2)$
(b) $-(a - b)(b - c)(c - a)$
(c) $(a - b)(b - c)(c - a)(a + b + c)(a^2 + b^2 + c^2)$
(d) 0
Answer:
(c) $(a - b)(b - c)(c - a)(a + b + c)(a^2 + b^2 + c^2)$

Question 41.
Find the area of the triangle with vertices P(4, 5), Q(4, -2) and R(-6, 2).
(a) 21 sq. units
(b) 35 sq. units
(c) 30 sq. units
(d) 40 sq. units
Answer:
(b) 35 sq. units

Question 42.
If the points (a_1, b_1), (a_2, b_2) and$(a_1 + a_2, b_1 + b_2)$ are collinear, then
(a) $a_1b_2 = a_2b_1$
(b) $a_1 + a_2 = b_1 + b_2$
(c) $a_2b_2 = a_1b_1$
(d) $a_1 + b_1 = a_2 + b_2$
Answer:
(a) $a_1b_2 = a_2b_1$

Question 43.
If the points (2, -3), (k, -1) and (0, 4) are collinear, then find the value of 4k.
(a) 4
(b) 7/140
(c) 47
(d) 40/7
Answer:
(d) 40/7

Question 44.
Find the area of the triangle whose vertices are (-2, 6), (3, -6) and (1, 5).

(a) 30 sq. units
(b) 35 sq. units
(c) 40 sq. units
(d) 15.5 sq. units
Answer:
(d) 15.5 sq. units

Question 45.
$$\begin{vmatrix} 2xy & x^2 & y^2 \\ x^2 & y^2 & 2xy \\ y^2 & 2xy & x^2 \end{vmatrix} =$$
(a) $(x^3 + y^3)^2$
(b) $(x^2 + y^2)^3$
(c) $-(x^2 + y^2)^3$
(d) $-(x^3 + y^3)^2$
Answer:
(d) $-(x^3 + y^3)^2$

Question 46.
The value of $\begin{vmatrix} \cos(\alpha+\beta) & -\sin(\alpha+\beta) & \cos 2\beta \\ \sin\alpha & \cos\alpha & \sin\beta \\ -\cos\alpha & \sin\alpha & \cos\beta \end{vmatrix}$ is independent of
(a) α
(b) β
(c) α, β
(d) none of these
Answer:
(a) α

Question 47.
Let $\Delta = \begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix}$, then the value of Δ is
(a) (x – y) (y – z) (z – x)
(b) xyz
(c) $(x^2 + y^2 + z^2)^2$
(d) xyz (x – y) (y – z) (z – x)
Answer:
(d) xyz (x – y) (y – z) (z – x)

Question 48.

The value of the determinant $\begin{vmatrix} \alpha & \beta & \gamma \\ \alpha^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\alpha & \alpha+\beta \end{vmatrix} =$

(a) $(\alpha + \beta)(\beta + \gamma)(\gamma + \alpha)$
(b) $(\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)(\alpha + \beta + \gamma)$
(c) $(\alpha + \beta + \gamma)^2 (\alpha - \beta - \gamma)^2$
(d) $\alpha\beta\gamma (\alpha + \beta + \gamma)$
Answer:
(b) $(\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)(\alpha + \beta + \gamma)$

Question 49.

Using properties of determinants, $\begin{vmatrix} 1 & a & a^2-bc \\ 1 & b & b^2-ca \\ 1 & c & c^2-ab \end{vmatrix} =$

(a) 0
(b) 1
(c) 2
(d) 3
Answer:
(a) 0

Question 50.

Find the minor of 6 and cofactor of 4 respectively in the determinant $\Delta = \begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$

(a) 6, 6
(b) 6, -6
(c) -6, -6
(d) -6, 6
Answer:
(d) -6, 6