

MISSION NDA MATHEMATICS

COMPLETE TOPICWISE QUESTIONS

DETERMINANT

1. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & (x+1)x \\ 3x(x-1) & x(x-1)(x-2) & (x+1)x(x-1) \end{vmatrix}$, then $f(500)$ is equal to
 (a) 0 (b) 1
 (c) 500 (d) -500
2. Let $f(\theta) = \begin{vmatrix} \cos^2 \theta & \cos \theta \sin \theta & -\sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta & \cos \theta \\ \sin \theta & -\cos \theta & 0 \end{vmatrix}$, then $f\left(\frac{\pi}{6}\right) = ?$
 (a) 1 (b) 0
 (c) -1 (d) 2
3. Let α_1, α_2 and β_1, β_2 be the roots of $ax^2 + bx + c = 0$ and $px^2 + qx + r = 0$, respectively. If the system of equations $a_1y + a_2z = 0$ and $\beta_1y + \beta_2z = 0$ has a non-trivial solution, then
 (a) $\frac{b^2}{q^2} = \frac{ac}{pr}$ (b) $\frac{c^2}{r^2} = \frac{ab}{pq}$
 (c) $\frac{a^2}{p^2} = \frac{bc}{qr}$ (d) none of these
4. A root of the equation $\begin{vmatrix} 3-x & -6 & 3 \\ -6 & 3-x & 3 \\ 3 & 3 & -6-x \end{vmatrix} = 0$ is
 (a) 6 (b) 3
 (c) 0 (d) none of these
5. If $l_1^2 + m_1^2 + n_1^2 = 1$, etc., and $l_1l_2 + m_1m_2 + n_1n_2 = 0$, etc., and $\Delta = \begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix}$, then
 (a) $|\Delta| = 3$ (b) $|\Delta| = 2$
 (c) $|\Delta| = 1$ (d) $\Delta = 0$
6. The value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$, ω being a cube root of unity, is
 (a) 0 (b) 1
 (c) ω^2 (d) ω
7. The value of the determinant $\begin{vmatrix} 1 & \sin 3\theta & \sin^3 \theta \\ 2\cos \theta & \sin 6\theta & \sin^3 2\theta \\ 4\cos^2 \theta - 1 & \sin 9\theta & \sin^3 3\theta \end{vmatrix}$ is
 (a) -1 (b) 0
 (c) 1 (d) 2



8.
$$\begin{vmatrix} b^2 - ab & b - c & bc - ac \\ ab - a^2 & a - b & b^2 - ab \\ bc - ac & c - a & ab - a^2 \end{vmatrix} = ?$$

(a) abc

(b) $a + b + c$

(c) 0

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

9. If $a \neq b \neq c$, one value of x which satisfies the equation

$$\begin{vmatrix} 0 & x - a & x - b \\ x + a & 0 & x - c \\ x + b & x + c & 0 \end{vmatrix} = 0$$
 is given by

(a) $x = a$

(b) $x = b$

(c) $x = c$

(d) $x = 0$

10. If a, b, c are non-zero real numbers, then $\begin{vmatrix} bc & ca & ab \\ ca & ab & bc \\ ab & bc & ca \end{vmatrix}$

vanishes for

(a) $\frac{1}{a} - \frac{1}{b} - \frac{1}{c} = 0$

(b) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$

(c) $\frac{1}{b} + \frac{1}{c} - \frac{1}{a} = 0$

(d) $\frac{1}{b} - \frac{1}{c} - \frac{1}{a} = 0$

11. If $A + B + C = \pi$, then the value of

$$\begin{vmatrix} \sin(A+B+C) & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ \cos(A+B) & -\tan A & 0 \end{vmatrix}$$
 is equal to

(a) 0

(b) 1

(c) $2 \sin B \tan A \cos C$

(d) none of these

12.
$$\begin{vmatrix} x & p & q \\ p & x & q \\ p & q & x \end{vmatrix} = ?$$

(a) $(x+p)(x+q)(x-p-q)$

(b) $(x-p)(x-q)(x+p+q)$

(c) $(x-p)(x-q)(x-p-q)$

(d) $(x+p)(x+q)(x+p+q)$

13. The determinant $\begin{vmatrix} a & b & a\alpha + b \\ b & c & b\alpha + c \\ a\alpha + b & b\alpha + c & 0 \end{vmatrix} = 0$ if

(a) a, b, c are in A.P.

(b) a, b, c are in G.P. or $(x - \alpha)$ is a factor of $ax^2 + 2bx + c = 0$

(c) a, b, c are in H.P.

(d) α is a root of the equation $ax^2 + 2bx + c = 0$

14. $f(x) = \begin{vmatrix} 2\cos x & 1 & 0 \\ 1 & 2\cos x & 1 \\ 0 & 1 & 2\cos x \end{vmatrix}$, then $f\left(\frac{\pi}{3}\right)$ is equal to

(a) -5

(b) -4

(c) -3

(d) -1

15. For a +ve value of x, y, z , the numerical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is

equal to

(a) 1

(b) 0

(c) $\log x + \log y + \log z$

(d) -1



16. The value of the determinant $\begin{vmatrix} ka & k^2 + a^2 & 1 \\ kb & k^2 + b^2 & 1 \\ kc & k^2 + c^2 & 1 \end{vmatrix}$ is
- (a) $kabc(a^2 + b^2 + c^2)$ (b) $k(a+b)(b+c)(c+a)$
(c) $k(a-b)(b-c)(c-a)$ (d) $k(a+b-c)(b+c-a)(c+a-b)$
17. If $D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2 + n + 1 & n^2 + n \\ 2k-1 & n^2 & n^2 + n + 1 \end{vmatrix}$ and $\sum_{k=1}^n D_k = 56$, then n equals
- (a) 4 (b) 6
(c) 7 (d) none of these
18. $\begin{vmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{vmatrix}^2$ is equal to
- (a) $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ (b) $\begin{vmatrix} b^2 + c^2 & ab & ac \\ ba & c^2 + a^2 & bc \\ ca & bc & a^2 + b^2 \end{vmatrix}$
(c) $\begin{vmatrix} a+b & 0 & c \\ b+c & b & 0 \\ c+a & a & b \end{vmatrix}$ (d) $\begin{vmatrix} b+c & ab & ac \\ c+a & ca & cb \\ a+b & ba & bc \end{vmatrix}$
19. If $a + b + c = 0$, then $\Delta = \begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$ when
- (a) $x = -1$ (b) $x = \pm \sqrt{\frac{3}{2}(a^2 + b^2 + c^2)}$
(c) $x = abc$ (d) none of these
20. The number of distinct real solutions 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
21. If $\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = 0$, then $x = ?$
- (a) 1, 9 (b) -1, 9
(c) -1, -9 (d) 1, -9
22. The determinant $\begin{vmatrix} xp+y & x & y \\ yp+z & y & z \\ 0 & xp+y & yp+z \end{vmatrix} = 0$ if
- (a) x, y, z are in A.P. (b) x, y, z are in G.P.
(c) x, y, z are in H.P. (d) xy, yz, zx are in A.P.
23. The value of $\Delta = \begin{vmatrix} {}^{10}C_4 & {}^{10}C_5 & {}^{11}C_m \\ {}^{11}C_6 & {}^{11}C_7 & {}^{12}C_{m+2} \\ {}^{12}C_8 & {}^{12}C_9 & {}^{13}C_{m+4} \end{vmatrix}$ is equal to zero, where m is
- (a) 6 (b) 4
(c) 5 (d) none of these



24. Let $f(x) = \begin{vmatrix} 1 + \sin^2 x & \cos^2 x & 4\sin 2x \\ \sin^2 x & 1 + \cos^2 x & 4\sin 2x \\ \sin^2 x & \cos^2 x & 1 + 4\sin 2x \end{vmatrix}$, then the maximum value of $f(x)$ is

(a) 0 (b) 1
(c) 6 (d) -1

25. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$, then the value of the

determinant $\begin{vmatrix} \alpha & \beta & \gamma \\ 1 & 1 & 1 \\ \beta & \gamma & \alpha \end{vmatrix}$ is

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

26. The value of the determinant $\begin{vmatrix} {}^5C_0 & {}^5C_3 & 1 \\ {}^5C_1 & {}^5C_4 & 1 \\ {}^5C_2 & {}^5C_5 & 1 \end{vmatrix}$ is

- (a) 0 (b) $-(6!)$
(c) 80 (d) none of these

27. The value of the determinant $\begin{vmatrix} a+pd & a+qd & a+rd \\ p & q & r \\ d & d & d \end{vmatrix}$ is equal to

- (a) 0 (b) -1
(c) 1 (d) $p + q + r$

28. The value of $\Delta = \begin{vmatrix} {}^5C_0 & {}^5C_3 & 14 \\ {}^5C_1 & {}^5C_4 & 1 \\ {}^5C_2 & {}^5C_5 & 1 \end{vmatrix}$ is

- (a) 0 (b) -576
(c) 80 (d) none of these

29. If $f(x), g(x)$ and $h(x)$ are three polynomials of degree 2 and $\Delta(x) = \begin{vmatrix} f(x) & g(x) & h(x) \\ f'(x) & g'(x) & h'(x) \\ f''(x) & g''(x) & h''(x) \end{vmatrix}$

then $\Delta(x)$ is a polynomial of degree

- (a) 2 (b) 3
(c) 0 (d) at most 3

30. The value of $\begin{vmatrix} 2 & \omega & \omega^2 \\ 1 & 1 + \omega^2 & \omega \\ \omega^2 & 1 & 1 + \omega \end{vmatrix}$, where ω is the complex cube root of unity, is

- (a) 1 (b) ω
(c) ω^2 (d) none of these

31. Let $f(x) = \begin{vmatrix} \cos x & -x & 1 \\ 2\sin x & -x^2 & 2x \\ \tan x & -x & 1 \end{vmatrix}$, find $\lim_{x \rightarrow 0} \frac{f'(x)}{x}$.

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



32. If a, b, c are in A.P., then the determinant $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix}$ in its simplified form is

- (a) $x^3 + 3ax + 7c$
 (b) 0
 (c) 15
 (d) $10x^2 + 5x + 2c$

33. If $\Delta(x) = \begin{vmatrix} x & 1+x^2 & x^3 \\ \log(1+x^2) & e^x & \sin x \\ \cos x & \tan x & \sin^2 x \end{vmatrix}$, then

- (a) $\Delta(x)$ is divisible by x
 (b) $\Delta(x) = 0$
 (c) $\Delta'(x) = 0$
 (d) none of these

34. If $\Delta(n) = \begin{vmatrix} x^n & \sin x & \cos x \\ n! & \sin \frac{n\pi}{2} & \cos \frac{n\pi}{2} \\ \alpha & \alpha^2 & \alpha^3 \end{vmatrix}$, then the value of $\frac{d^n}{dx^n} [\Delta(x)]$ at $x = 0$ is

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

35. If $\begin{vmatrix} 3x^2 - 2x + 3 & x^2 - 5 & 3x - 2 \\ x & 2 - 3x & x + 1 \\ x^2 + 2x & 7 + 2x^2 & 3x - x^2 + 1 \end{vmatrix} = ax^5 + bx^4 + cx^3 + dx^3 + ex + f$, then f is equal to

- (a) -12
 (b) -15
 (c) 15
 (d) 12

36. A root of the equation $\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0$ is

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

37. If $2s = a + b + c$, then the value of

- $\begin{vmatrix} a^2 & (s-a)^2 & (s-a)^2 \\ (s-b)^2 & b^2 & (s-b)^2 \\ (s-c)^2 & (s-c)^2 & c^2 \end{vmatrix}$ is
 (a) $\sqrt{s(s-a)(s-b)(s-c)}$
 (b) $2s^2(s-a)(s-b)(s-c)$
 (c) $2s^3(s-a)(s-b)(s-c)$
 (d) none of these

38. If α, β, γ are the roots of $px^3 + qx^2 + r = 0$, then the value of the determinant $\begin{vmatrix} \alpha\beta & \beta\gamma & \gamma\alpha \\ \beta\gamma & \gamma\alpha & \alpha\beta \\ \gamma\alpha & \alpha\beta & \beta\gamma \end{vmatrix}$

- is
 (a) p
 (b) q
 (c) 0
 (d) r

39. If $f(x) = \begin{vmatrix} 1 & 2x & 3x^2 \\ 3 & a & 27 \\ 1 & 3 & 9 \end{vmatrix}$ and $\int_0^3 f(x)dx = 0$, then a is equal to

- (a) 3
 (b) 6
 (c) 9
 (d) any real number



40. Let $\begin{vmatrix} 1+x & x & x^2 \\ x & 1+x & x^2 \\ x^2 & x & 1+x \end{vmatrix} = ax^5 + bx^4 + cx^3 + dx^2 + \lambda x + \mu$
be an identity in x , where a, b, c, d, λ, μ are independent of x . Then the value of λ is
(a) 3 (b) 2
(c) 4 (d) none of these

41. If $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = \lambda a^2 b^2 c^2$, then the value of λ is
(a) 1 (b) 2
(c) 4 (d) 3

42. The value of the determinant $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+a & 1 \\ 1 & 1 & 1+a \end{vmatrix}$ is
(a) $a^3 \left(1 - \frac{2}{a}\right)$ (b) $a^3 \left(1 + \frac{3}{a}\right)$
(c) $a^3 \left(1 - \frac{3}{a}\right)$ (d) $a^3 \left(1 + \frac{2}{a}\right)$

43. If $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix} = 64$, then $a = ?$
(a) 2 (b) 3
(c) 4 (d) 6

44. For positive numbers x, y, z , the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_z x & 2 & \log_y z \\ \log_z x & \log_z y & 4 \end{vmatrix}$ equals
(a) 0 (b) 3
(c) $\log x \log y \log z$ (d) none of these

45. If a, b, c are the sides of a triangle and

$$\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+1)^2 & (b+1)^2 & (c+1)^2 \\ (a-1)^2 & (b-1)^2 & (c-1)^2 \end{vmatrix} = 0, \text{ then}$$

- (a) $\triangle ABC$ is an equilateral triangle
(b) $\triangle ABC$ is a right-angled isosceles triangle
(c) $\triangle ABC$ is an isosceles triangle
(d) none of these

46. If $D_r = \begin{vmatrix} 2^{r-1} & 2 \cdot 3^{r-1} & 4 \cdot 5^{r-1} \\ \alpha & \beta & \gamma \\ 2^{n-1} & 3^{n-1} & 5^{n-1} \end{vmatrix}$, then the value of $\sum_{r=1}^n D_r$ is
(a) 0 (b) $\alpha\beta\gamma$
(c) $\alpha + \beta + \gamma$ (d) $\alpha \cdot 2^n + \beta \cdot 3^n + \gamma \cdot 4^n$



47. If a, b, c are non-zero distinct numbers, then the system of equations $ax + by + cz = 0, cx + ay + bz = 0$ and $bx + cy + ax = 0$ has a non-trivial solution provided
- (a) $a + b + c = 0$ (b) $a + b + c \neq 0$
 (c) $a + b + c = 1$ (d) $a + b + c - 1$
48. If $f(x) = \begin{vmatrix} x^3 & \cos^2 x & 2x^4 \\ \tan^5 x & 1 & \sec 2x \\ \sin^3 x & x^4 & 5 \end{vmatrix}$, then $\int_{-\pi/2}^{\pi/2} f(x) dx = ?$
- (a) 2 (b) -2
 (c) 0 (d) none of these
49. If $f(x) = \begin{vmatrix} \cos(x+x^2) & \sin(x+x^2) & -\cos(x+x^2) \\ \sin(x-x^2) & \cos(x-x^2) & \sin(x-x^2) \\ \sin(2x) & 0 & \sin(2x^2) \end{vmatrix}$, find $f'(0)$.
- (a) 2 (b) 4
 (c) 7 (d) 1
50. The equations $ax + y = 4, 4x + ay = 8$ and $2x + y = 2a$ are consistent for
- (a) no value of a (b) one value of a
 (c) two values of a (d) three values of a
51. If $f(x) = \begin{vmatrix} \sec^2 x & 1 & 1 \\ \cos^2 x & \cos^2 x & \operatorname{cosec}^2 x \\ 1 & \cos^2 x & \cot^2 x \end{vmatrix}$, then $f(x) = ?$
- (a) $\cos^4 x$ (b) $\sin^4 x$
 (c) 0 (d) $\sin^2 x \cos^2 x$
52. If $S_r = \begin{vmatrix} 2r & x & n(n+1) \\ 6r^2 - 1 & y & n^2(2n+3) \\ 4r^3 - 2nr & z & n^3(n+1) \end{vmatrix}$, then the value of $\sum_{r=1}^n S_r$ is independent of
- (a) x only (b) y only
 (c) x, y, z, n (d) n only
53. If the system of equations $ax + y + z = 0, x + by + z = 0$ and $x + y + cz = 0$ ($a, b, c \neq 1$) has a non-trivial solution, then the value of $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is
- (a) -1 (b) 0
 (c) 1 (d) none of these
54. The system of equations $3x + ky = 2, kx + ky = 4$ is inconsistent for
- (a) no value of k (b) one value of k
 (c) two values of k (d) none of these



55. If x, y, z are in A.P., then the value of the $\det A$, where $A = \begin{bmatrix} 4 & 5 & 6 & x \\ 5 & 6 & 7 & y \\ 6 & 7 & 8 & z \\ x & y & z & 0 \end{bmatrix}$ is

- (a) 0
(b) 1
(c) 2
(d) none of these

56. If $\sin 2x + 1 = 0$, then $\begin{vmatrix} 0 & \cos x & -\sin x \\ \sin x & 0 & \cos x \\ \cos x & \sin x & 0 \end{vmatrix}^2$ equals

- (a) 1
(b) 2
(c) 3
(d) none of these

57. Let λ and α be real. Let S denote the set of all values of λ for which the system of linear equations

$$\begin{aligned} \lambda x + (\sin \alpha)y + (\cos \alpha)z &= 0 \\ x + (\cos \alpha)y + (\sin \alpha)z &= 0 \\ -x + (\sin \alpha)y - (\cos \alpha)z &= 0 \end{aligned}$$

has a non-trivial solution, then S contains

- (a) $(-1, 1)$
(b) $[-\sqrt{2}, \sqrt{2}]$
(c) $[1, \sqrt{2}]$
(d) $(-2, 2)$

58. If the system of equations $2x + ay + 6z = 8$, $x + 2y + bz = 5$ and $x + y + 3z = 4$ has a unique solution, then

- (a) $a \neq 2, b \neq 3$
(b) $a \neq 3, b \neq 2$
(c) $a \neq 2, b = 3$
(d) $a = 2, b \neq 2$

59. The value of $\begin{vmatrix} x & x^2 - yz & 1 \\ y & y^2 - zx & 1 \\ z & z^2 - xy & 1 \end{vmatrix}$ is

- (a) 1
(b) -1
(c) 0
(d) $-xyz$

60. The repeated factor of the determinant

$$\begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix}$$
 is

- (a) $x - y$
(b) $y - z$
(c) $z - x$
(d) none of these

61. The system of equations $x \sin \theta - \sqrt{3}y = 0$ and $x \cos \theta + y = 0$ has an infinite number of solutions, for θ equal to

- (a) $\pi/3$
(b) $2\pi/3$
(c) $5\pi/3$
(d) $4\pi/3$



62. If $p + q + r = 0 = a + b + c$, then the value of the determinant $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix}$ is
- (a) 0
(b) $pa + qb + rc$
(c) 1
(d) none of these

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
a	a	a	c	c	a	b	c	d	b
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
a	b	b	d	b	c	c	b	b	c
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
d	b	c	c	b	d	a	b	c	d
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
c	b	a	b	b	c	c	c	d	a
Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50
c	b	c	b	c	a	a	c	a	c
Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60
a	c	c	b	a	d	b	a	c	c
Q61	Q62								
d	a								

